



 ORIGINAL

Via Federal Express

December 21, 2015



Ms. Kimberly Martone, Director
Office of Health Care Access
410 Capitol Avenue
MS# 13HCA
Hartford, CT 06134-0308

RE: St. Vincent's Medical Center
Project Title: Acquisition of a SPECT/CT Camera to Replace Existing SPECT Camera

Dear Ms. Martone:

On behalf of St. Vincent's Medical Center I am pleased to submit an original and 4 copies of our application for the acquisition of a SPECT/CT camera to replace our existing SPECT camera. In addition, electronic copies in an Adobe PDF have also been provided on CD-ROM.

I look forward to working with you and your staff on this important project. Thank you for your time and attention.

Very truly yours,

Kurt Bassett
Project Manager

Enclosures: 5 Binders, Check for Application Fee \$500

Checklist

Instructions:

1. Please check each box below, as appropriate; and
2. The completed checklist *must* be submitted as the first page of the CON application.
 - Attached is a paginated hard copy of the CON application including a completed affidavit, signed and notarized by the appropriate individuals.
 - (*New*). A completed supplemental application specific to the proposal type, available on OHCA's website under "[OHCA Forms](#)." A list of supplemental forms can be found on page 2.
 - Attached is the CON application filing fee in the form of a check made out to the "Treasurer State of Connecticut" in the amount of \$500.
 - Attached is evidence demonstrating that public notice has been published in a suitable newspaper that relates to the location of the proposal, 3 days in a row, at least 20 days prior to the submission of the CON application to OHCA. (OHCA requests that the Applicant fax a courtesy copy to OHCA (860) 418-7053, at the time of the publication)
 - Attached is a completed Financial Attachment
 - Submission includes one (1) original and four (4) hard copies with each set placed in 3-ring binders.
 - The following have been submitted on a CD
 1. A scanned copy of each submission in its entirety, including all attachments in Adobe (.pdf) format.
 2. An electronic copy of the applicant's responses in MS Word (the applications) and MS Excel (the financial attachment).

For OHCA Use Only:

Docket No.: 32056 Check No.: 1592642
OHCA Verified by: SA Date: 12-20-11

General Information

Main Site	MAIN SITE	MEDICAID PROVIDER ID	TYPE OF FACILITY	MAIN SITE NAME	
	St. Vincent's Medical Center	004041893	Hospital	St. Vincent's Medical Center	
	STREET & NUMBER				
	2800 Main Street				
	TOWN			ZIP CODE	
	Bridgeport			06606	

Project Site	PROJECT SITE	MEDICAID PROVIDER ID	TYPE OF FACILITY	PROJECT SITE NAME	
	St. Vincent's Medical Center	004041893	Hospital	St. Vincent's Medical Center	
	STREET & NUMBER				
	2800 Main Street				
	TOWN			ZIP CODE	
	Bridgeport			06606	

Operator	OPERATING CERTIFICATE NUMBER	TYPE OF FACILITY	LEGAL ENTITY THAT WILL OPERATE OF THE FACILITY (or proposed operator)		
	N/A	Hospital	St. Vincent's Medical Center		
	STREET & NUMBER				
	2800 Main Street				
	TOWN			ZIP CODE	
	Bridgeport			06606	

Chief Executive	NAME		TITLE		
	Stuart Marcus		Chief Executive Officer		
	STREET & NUMBER				
	2800 Main Street				
	TOWN			STATE	ZIP CODE
	Bridgeport			CT	06606
	TELEPHONE		FAX	E-MAIL ADDRESS	
(203) 576-6000		(203) 576-5345	smarcus@stvincents.org		

Title of Attachment:		
Is the applicant an existing facility? If yes, attach a copy of the resolution of partners, corporate directors, or LLC managers, as the case may be, authorizing the project.	YES <input checked="" type="checkbox"/>	SVMC Board Resolution 9.13.15 (SPECT-CT)
NO <input type="checkbox"/>		
Does the Applicant have non-profit status? If yes, attach documentation.	YES <input checked="" type="checkbox"/>	SVMC IRS Tax Exempt Letter
NO <input type="checkbox"/>		

Identify the Applicant's ownership type.	PC <input type="checkbox"/>	Other: _____
	LLC <input type="checkbox"/>	
	Corporation <input checked="" type="checkbox"/>	
Applicant's Fiscal Year (06/30)	Start <u>07/01/2015</u> End <u>6/30/2016</u>	

Contact:

Identify a single person that will act as the contact between OHCA and the Applicant.

Contact Information	NAME:		TITLE:	
	Kurt Bassett		Director of Strategic planning	
	STREET & NUMBER			
	2800 Main Street			
	TOWN		STATE	ZIP CODE
	Bridgeport		Connecticut	06606
	TELEPHONE		FAX	E-MAIL ADDRESS
	(203) 576-6264		(203) 576-5345	Kurt.Bassett@stvincents.org
RELATIONSHIP TO APPLICANT		EMPLOYEE		

Identify the person primarily responsible for preparation of the application (optional):

Prepared by	NAME		TITLE	
	Kurt Bassett		Director of Strategic planning	
	STREET & NUMBER			
	2800 Main Street			
	TOWN		STATE	ZIP CODE
	Bridgeport		Connecticut	06606
	TELEPHONE		FAX	E-MAIL ADDRESS
	(203) 576-6264		(203) 576-5345	Kurt bassett@stvincents.org
RELATIONSHIP TO APPLICANT		EMPLOYEE		

Affidavit

Applicant: St. Vincent's Medical Center

Project Title: Acquisition of a SPECT/CT camera to replace existing SPECT camera

I, Dr. Stuart Marcus, CEO
(Name) (Position – CEO or CFO)

of St. Vincent's Medical Center being duly sworn, depose and state that the said facility complies with the appropriate and applicable criteria as set forth in the Sections 19a-630, 19a-637, 19a-638, 19a-639, 19a-486 and/or 4-181 of the Connecticut General Statutes.

Signature [Handwritten Signature] Date 12/15/15

Subscribed and sworn to before me on December 15, 2015

[Handwritten Signature]

Notary Public/Commissioner of Superior Court

My commission expires: May 31, 2016

Executive Summary

The purpose of the Executive Summary is to give the reviewer a conceptual understanding of the proposal. In the space below, provide a succinct overview of your proposal (this may be done in bullet format). Summarize the key elements of the proposed project. Details should be provided in the appropriate sections of the application that follow.

St. Vincent's Medical Center is proposing to replace its GE Millennium MPR/MPS SPECT Nuclear Medicine Camera with a SPECT/CT Nuclear Medicine Camera, specifically a GE Optima NM/CT 640. St. Vincent's currently provides a large number of patients with SPECT services and from an optimizing patient care perspective, the established patient population will benefit greatly.

The acquisition of the new SPECT/CT will raise the level of our standard care by:

- Providing an anatomical structure to be placed over Nuclear Medicine images
- Providing an increase in image quality to support confident diagnosis
- Increasing the level of accuracy when diagnosing functional abnormalities
- Improving efficiency by reducing exam times
- Increased confidence by referring physician to use SPECT/CT

SPECT/CT is an integral component of St. Vincent's comprehensive cancer care program at the medical center and will be an important addition to our cardiology and gastroenterology services.

Pursuant to Section 19a-639 of the Connecticut General Statutes, the Office of Health Care Access is required to consider specific criteria and principles when reviewing a Certificate of Need application. Text marked with a "§" indicates it is actual text from the statute and may be helpful when responding to prompts.

Project Description

1. Provide a detailed narrative describing the proposal. Explain how the Applicant(s) determined the necessity for the proposal and discuss the benefits for each Applicant separately (if multiple Applicants). Include all key elements, including the parties involved, what the proposal will entail, the equipment/service location(s), the geographic area the proposal will serve, the implementation timeline and why the proposal is needed in the community.

St. Vincent's Medical Center is proposing to replace its SPECT Nuclear Medicine Camera with a SPECT/CT Nuclear Medicine Camera. This proposal will augment services at St. Vincent's Medical Center by allowing referring physicians to gain a deeper understanding of images generated by nuclear medicine and therefore increasing its acceptability.

The existing GE Millennium MPR/MPS is over nine years old and is nearing the end of its useful life. This camera provides little anatomical information in the images, information that is paramount and clinically useful.

By obtaining a SPECT/CT Camera, we are employing a reliable co-registration of anatomical structure information along with a more reliable way to accurately diagnose functional abnormalities. The acquisition of the SPECT/CT will raise the level of our standard care.

In the past three fiscal years, St. Vincent's has provided 3154 patients with SPECT services from Bridgeport and the surrounding towns Fairfield, Monroe, Shelton, Stratford, and Trumbull. This established patient population will benefit from this proposal because of the increased level of confidence by our physicians to provide a more accurate diagnosis. This application is not for a new service, but rather for the provision of SPECT services with a CAT scan component that will enhance the quality of care, an upgrade from our current equipment that is nearing the end of its useful life.

The total capital expenditure for this project will be \$752,349. Once purchased, the implementation will be seamless, as it represents a replacement of current equipment and will be housed in the same department, adjacent to the MRI facilities. The proposed system is "plug and go" and will not require additional electrical, mechanical, or technological upgrades.

2. Provide the history and timeline of the proposal (i.e., When did discussions begin internally or between Applicant(s)? What have the Applicant(s) accomplished so far?).

The current equipment is nearing the end of its useful life, and, as such has had functional deficiencies. Replacement of the current equipment has been under discussion for the past 5 years. The Radiology Department began internal discussions in January 2015, then received capital approval in July 2015, and the plan to replace the existing equipment with a upgraded model was approved by the Medical Center Board of Directors in September 2015.

3. Provide the following information:
 - a. utilizing **OHCA Table 1**, list all services to be added, terminated or modified, their physical location (street address, town and zip code), the population to be served and the existing/proposed days/hours of operation;
 - b. identify in **OHCA Table 2** the service area towns and the reason for their inclusion (e.g., provider availability, increased/decreased patient demand for service, market share);
4. List the health care facility license(s) that will be needed to implement the proposal;
CT DPH License # 0057
5. Submit the following information as attachments to the application:
 - a. a copy of all State of Connecticut, Department of Public Health license(s) currently held by the Applicant(s); - See **"Attachments DPH License"**
 - b. a list of all key professional, administrative, clinical and direct service personnel related to the proposal and attach a copy of their Curriculum Vitae; - See **"Attachments Key Personnel"**
 - c. copies of any scholarly articles, studies or reports that support the need to establish the proposed service, along with a brief explanation regarding the relevance of the selected articles;

The articles chosen relate to the specific advantages of SPECT-CT, the benefits to assisting in proper and timely diagnosis which ultimately leads to improved overall care of the patients. - See **"Attachments Scholarly Articles"**
 - d. letters of support for the proposal; - See **"Attachments Letters of Support"**
 - e. the protocols or the Standard of Practice Guidelines that will be utilized in relation to the proposal. Attach copies of relevant sections and briefly describe how the Applicant proposes to meet the protocols or guidelines. - See **"Attachments Protocols"**

GE will provide SVMC staff with training in advance of installation and protocols and guidelines will be reviewed and adhered to according to protocols.
 - f. copies of agreements (e.g., memorandum of understanding, transfer agreement, operating agreement) related to the proposal. If a final signed version is not available, provide a draft with an estimated date by which the final agreement will be available.

- See **"Attachments Quotation"**

Public Need and Access to Care

§ "Whether the proposed project is consistent with any applicable policies and standards adopted in regulations by the Department of Public Health;" (Conn.Gen.Stat. § 19a-639(a)(1))

6. Describe how the proposed project is consistent with any applicable policies and standards in regulations adopted by the Connecticut Department of Public Health.

This proposal is consistent with Connecticut DPH policies and standards as it will expand access to services not currently available. The new imaging is more advanced, will provide higher quality images and greater population health outcomes by diagnosing diseases quicker and more accurate and providing better imaging for diagnosis and more accurate imaging for surgeons.

§ "The relationship of the proposed project to the statewide health care facilities and services plan;" (Conn.Gen.Stat. § 19a-639(a)(2))

7. Describe how the proposed project aligns with the Connecticut Department of Public Health Statewide Health Care Facilities and Services Plan, available on [OHCA's website](#).

The primary service area of St. Vincent's is the City of Bridgeport, Connecticut's largest and most impoverished and diverse urban center. The Statewide Health Care Facilities and Services Plan notes that "Black non-Hispanics and Hispanics were more likely than White non-Hispanics to have a potentially preventable hospitalization, avoidable ED visit or to visit the ED more than ten times within a year." The introduction of the SPECT/CT camera into the specific service area will allow this underserved minority population access to clinical testing that can prevent long-term hospitalization as well as avoid potential ED visits by providing more accurate diagnosis.

§ "Whether there is a clear public need for the health care facility or services proposed by the applicant;" (Conn.Gen.Stat. § 19a-639(a)(3))

8. With respect to the proposal, provide evidence and documentation to support clear public need:

- a. identify the target patient population to be served;

The Greater Bridgeport area has a population of 367,064, which has grown over the past decade but at a smaller rate than the state overall. Bridgeport, Connecticut's largest city and the fifth largest city in New England, comprises 45% of the region's population. Fairfield and Stratford each make up less than 20% of the total population of the region.

The target population to be served includes patients referred by their clinicians from the towns in St. Vincent's immediate service area. This service area includes the city of Bridgeport and the surrounding towns of Fairfield, Easton, Monroe, Trumbull, Shelton and Stratford. The proposed equipment will serve oncology, cardiology, gastroenterology, as well as other patients needing diagnostics for conditions such as thyroid disorders, brain disorders and other inflammations and infections.

- b. discuss how the target patient population is currently being served;

The target patient population is currently being served on the Medical Center's existing equipment. This purchase merely represents an equipment upgrade to replace a machine that is nearing the end of its useful life with a new machine with better imaging and more accurate diagnostics.

- c. document the need for the equipment and/or service in the community;

The proposed purpose of the SPECT/CT camera will fill a demonstrated need, as there is no other camera with similar capabilities accessible to patients in the service area.

Quantitative data reported in the Greater Bridgeport Community Health Assessment indicates that the top two causes of death in each of the city/towns in the region are heart disease and cancer. Data shows that the leading causes of emergency department (ED) admissions are heart disease and digestive disease. The SPECT/CT camera will be useful to serve patients with oncology, cardiology and gastrointestinal clinical diagnostic needs.

Cancer is the second leading cause of death in the Greater Bridgeport region. Of all the Greater Bridgeport communities, rates of cancer incidence and mortality are highest in Monroe. Monroe's mortality rate is 204 per 100,000 population, above both state (176.9 per 100,000 population) and national (181 per 100,000 population) rates. Connecticut as a whole has the second highest incidence of breast cancer in the country, second only to Rhode Island. According to the 2014 Community Profile of Breast Cancer by the Susan G. Komen organization, the greater Bridgeport area, has a higher incidence of breast cancer, higher late stage diagnosis, and a higher mortality rate than the State of Connecticut incidence rates.

The proposed equipment purchase will serve not only patients with healthcare needs related to heart disease, cancer, and digestive diseases, but will prove effective in providing accurate anatomic localization and characterization to improve surgical outcomes.

- d. explain why the location of the facility or service was chosen;

St. Vincent's is proposing locating the equipment in the Radiology Department at the Medical Center. This location is the current location of the equipment being replaced, therefore its placement will create a seamless transition for patients and staff.

- e. provide incidence, prevalence or other demographic data that demonstrates community need;

As noted in question C, quantitative data reported in the Greater Bridgeport Community Health Assessment indicates that the top two causes of death in each of the city/towns in the region are heart disease and cancer. Data shows that the leading causes of emergency department (ED) admissions are heart disease and digestive disease. The SPECT/CT camera will be useful to serve patients with both cardio and gastrointestinal clinical diagnostic needs as well as other patients needing diagnostics for conditions such as thyroid disorders, brain disorders and other inflammations and infections.

- f. discuss how low income persons, racial and ethnic minorities, disabled persons and other underserved groups will benefit from this proposal;

St. Vincent's is dedicated to providing healthy living at every stage of life and enhance life by addressing the unique needs of patients, families and our community. Our outreach programs and partnerships are designed to enhance public health and quality of life in the greater Bridgeport area and improve access to health services for members of the community we serve regardless of ability to pay.

The patient demographic at St. Vincent's closely mirrors that of the city it calls home. Bridgeport's population is 39.6% White, 34.6% Black or African American, 0.5% American Indian and Alaska Native, 3.4% Asian, 0.1% Native Hawaiian and Other Pacific Islander, 17.5% some other race, and 4.3% two or more races (U.S. Census 2010). Approximately 38.2% of Bridgeport's population is Hispanic or Latino (of any race) (U.S. Census 2010). As the U.S. Census 2010 data shows, Bridgeport has a significantly higher percentage of Black or African Americans and Hispanics or Latinos of any race than the State of Connecticut.

According to the 2011 American Community Survey, the Greater Bridgeport region has the widest gap between rich and poor of all 516 metropolitan and micropolitan areas included in the survey. The towns of Fairfield, Trumbull, and Monroe are affluent with median incomes substantially higher than national and state averages. Stratford, which has a long history as an industrial town, can be categorized as blue collar and middle class. Bridgeport has a higher poverty rate and a lower median income than both state and national averages; it is among one of the poorest cities in the country. Although Fairfield County has a reputation for affluence, it is clear that many of the area's residents fall well outside this category, and look to St. Vincent's as a safety net.

Bridgeport also has a high rate of unemployment. In July 2015, the Connecticut Department of Labor reported that the unemployment rate in Bridgeport is 8.5%, compared to 5.6% statewide, 4.8% in Fairfield, and 4.6% in Trumbull, Bridgeport's closest neighboring communities (Connecticut Labor Market Information 2015). Bridgeport residents who are employed often earn only a minimum wage, which is not a living wage in this geographic area.

Over one quarter of Bridgeport's population is foreign-born and nearly one half speaks a language other than English at home, a proportion far higher than other towns in the region and the state as a whole. According to the U.S. Census, the most commonly spoken non-English language in the city is Spanish, with over 30% of the population reporting speaking Spanish at home.

- g. list any changes to the clinical services offered by the Applicant(s) and explain why the change was necessary;

There will be no changes to clinical services due to the installation of the GE Optima NM/CT 640.

- h. explain how access to care will be affected;

The purchase and installation of the GE Optima NM/CT will increase access to a more accurate diagnostic solution than is currently available in the service area.

- i. discuss any alternative proposals that were considered.

As the current equipment is nearing the end of its useful life, a discussion to simply replace the GE Millennium MPR/MPS was entertained. However, the organization decided to upgrade the equipment instead, with the SPECT/CT which has better imaging, more accurate anatomical localization, faster diagnosis and lower dose scans.

§ "Whether the applicant has satisfactorily demonstrated how the proposal will improve quality, accessibility and cost effectiveness of health care delivery in the region, including, but not limited to, (A) provision of or any change in the access to services for Medicaid recipients and indigent persons, and (B) the impact upon the cost effectiveness of providing access to services provided under the Medicaid program;"
(Conn.Gen.Stat. § 19a-639(a)(5))

- 9. Describe how the proposal will:

- a. improve the quality of health care in the region;

The purchase and installation of the GE Optima NM/CT 640 will improve health care in the region by offering a combination of metabolic information with precise anatomical location and attenuation correction. This state of the art system is not available at any other health care facility in St. Vincent's service area.

- b. improve accessibility of health care in the region; and

St. Vincent's does not turn away any patient for inability to pay and is also located on the public bus route. Therefore, housing this equipment at the Medical Center will increase access to high quality care for patients who are medically underserved, providing precise anatomical localization to aid in diagnosis and treatment.

- c. improve the cost effectiveness of health care delivery in the region.

Diagnostic imaging performed on the GE Optima NM/CT 640 will have the same cost to patient as imaging on the existing equipment. Installation of new equipment may reduce wait time, travel and out of network costs for those patients who previously had to seek this increased level of diagnostic services outside of the service area.

- 10. How will this proposal help improve the coordination of patient care (explain in detail regardless of whether your answer is in the negative or affirmative)?

The installation of this equipment will reduce the need for additional exams and multiple test locations thereby improving the on-site care coordination. Will provide better, more accurate imaging to avoid additional scan and will also aid in surgery.

- 11. Describe how this proposal will impact access to care for Medicaid recipients and indigent persons.

St. Vincent's does not turn away any patient for inability to pay and the medical center is located on the transit bus route. Therefore, housing this equipment at the Medical Center will increase access to high quality care for patients who are medically underserved, providing precise anatomical localization to aid in diagnosis and treatment.

§ "Whether an applicant, who has failed to provide or reduced access to services by Medicaid recipients or indigent persons, has demonstrated good cause for doing so, which shall not be demonstrated solely on the basis of differences in reimbursement rates between Medicaid and other health care payers;" (Conn.Gen.Stat. § 19a-639(a)(10))

12. If the proposal fails to provide or reduces access to services by Medicaid recipients or indigent persons, provide explanation of good cause for doing so.

Not Applicable.

§ "Whether the applicant has satisfactorily demonstrated that any consolidation resulting from the proposal will not adversely affect health care costs or accessibility to care." (Conn.Gen.Stat. § 19a-639(a)(12))

13. Will the proposal adversely affect patient health care costs in any way? Quantify and provide the rationale for any changes in price structure that will result from this proposal, including, but not limited to, the addition of any imposed facility fees.

The cost to patient is not affected by this proposal. Patients will be provided a more accurate diagnostic reading at the current cost of service.

Financial Information

§ "Whether the applicant has satisfactorily demonstrated how the proposal will impact the financial strength of the health care system in the state or that the proposal is financially feasible for the application," (Conn.Gen.Stat. § 19a-639(a)(4))

14. Describe the impact of this proposal on the financial strength of the state's health care system or demonstrate that the proposal is financially feasible for the applicant.

SVMC has the capital available to purchase and install the equipment. Once the equipment is purchased and installed it will not result in any additional expenses to the organization.

15. Provide a final version of all capital expenditure/costs for the proposal using OHCA Table 3.

16. List all funding or financing sources for the proposal and the dollar amount of each. Provide applicable details such as interest rate; term; monthly payment; pledges and funds received to date; letter of interest or approval from a lending institution.

The Project will be fully funded through capital dollars, no fundraising or debt will be incurred.

17. Include as an attachment:

- a. audited financial statements for the most recently completed fiscal year. If audited financial statements do not exist, provide other financial documentation (e.g., unaudited balance sheet, statement of operations, tax return, or other set of books.). Connecticut hospitals required to submit annual audited financial statements may reference that filing, if current;
- b. a complete **Financial Worksheet A (not-for-profit entity) or B (for-profit entity)**, available on OHCA's website under "[OHCA Forms](#)," providing a summary of revenue, expense, and volume statistics, "without the CON project," "incremental to the CON project," and "with the CON project." Note: the actual results reported in the Financial Worksheet must match the audited financial statement that was submitted or referenced.

18. Complete [OHCA Table 4](#) utilizing the information reported in the attached Financial Worksheet.

19. Explain all assumptions used in developing the financial projections reported in the Financial Worksheet.

Assumptions for final projections were based on current and historical volumes for the medical center. Projections and estimates were made aligning the project with the current financial strategic plan for the hospital and its affiliates.

20. Explain any projected incremental losses from operations resulting from the implementation of the CON proposal.

There is no incremental loss from operations for the implementation of this proposal since this is replacing an existing camera and service with a new upgraded version.

21. Indicate the minimum number of units required to show an incremental gain from operations for each projected fiscal year.

There is no incremental increase currently projected from this proposal. Subsequently any increase in volume could lead to potential incremental gain, although there is no determination whether there is any per scan margin.

Utilization

*§ "The applicant's past and proposed provision of health care services to relevant patient populations and payer mix, including, but not limited to, access to services by Medicaid recipients and indigent persons;"
(Conn.Gen.Stat. § 19a-639(a)(6))*

21. Complete [OHCA Table 5](#) and [OHCA Table 6](#) for the past three fiscal years ("FY"), current fiscal year ("CFY") and first three projected FYs of the proposal, for each of the Applicant's existing and/or proposed services. Report the units by service, service type or service level.

22. Provide a detailed explanation of all assumptions used in the derivation/ calculation of the projected service volume; explain any increases and/or decreases in volume reported in OHCA Tables 4 and 5.

There are no expected increases or decreases to the volumes of scans projected. FY16 estimates are based on current projection trends which have been declining. It is anticipated that the decline will level off with the acquisition of the new SPECT-CT camera based on the quality of the imaging.

23. Provide the current and projected patient population mix (number and percentage of patients by payer) for the proposal using **OHCA Table 7** and provide all assumptions. **Note: payer mix should be calculated from patient volumes, not patient revenues.**

§ "Whether the applicant has satisfactorily identified the population to be served by the proposed project and satisfactorily demonstrated that the identified population has a need for the proposed services;"
(Conn.Gen.Stat. § 19a-639(a)(7))

24. Describe the population (as identified in question 8(a)) by gender, age groups or persons with a specific condition or disorder and provide evidence (i.e., incidence, prevalence or other demographic data) that demonstrates a need for the proposed service or proposal. **Please note: if population estimates or other demographic data are submitted, provide only publicly available and verifiable information (e.g., U.S. Census Bureau, Department of Public Health, CT State Data Center) and document the source.**

The patient demographic at St. Vincent's closely mirrors that of the City it calls home. Bridgeport's population is 39.6% White, 34.6% Black or African American, 0.5% American Indian and Alaska Native, 3.4% Asian, 0.1% Native Hawaiian and Other Pacific Islander, 17.5% some other race, and 4.3% two or more races (U.S. Census 2010). Approximately 38.2% of Bridgeport's population is Hispanic or Latino (of any race) (U.S. Census 2010). As the U.S. Census 2010 data shows, Bridgeport has a significantly higher percentage of Black or African Americans and Hispanics or Latinos of any race than the State of Connecticut.

According to the 2011 American Community Survey, the Greater Bridgeport region has the widest gap between rich and poor of all 516 metropolitan and micropolitan areas included in the survey. The towns of Fairfield, Trumbull, and Monroe are affluent with median incomes substantially higher than national and state averages. Stratford, which has a long history as an industrial town, can be categorized as blue collar and middle class. Bridgeport has a higher poverty rate and a lower median income than both state and national averages; it is among one of the poorest cities in the country. Although Fairfield County has a reputation for affluence, it is clear that many of the area's residents fall well outside this category, and look to St. Vincent's as a safety net.

Bridgeport also has a high rate of unemployment. In July 2015, the Connecticut Department of Labor reported that the unemployment rate in Bridgeport is 8.5%, compared to 5.6% statewide, 4.8% in Fairfield, and 4.6% in Trumbull, Bridgeport's closest neighboring communities (Connecticut Labor Market Information 2015). Bridgeport residents who are employed often earn only a minimum wage, which is not a living wage in this geographic area.

Over one quarter of Bridgeport's population is foreign-born and nearly one half speaks a language other than English at home, a proportion far higher than other towns in the region

and the state as a whole. According to the U.S. Census, the most commonly spoken non-English language in the city is Spanish, with over 30% of the population reporting speaking Spanish at home.

Quantitative data reported in the Greater Bridgeport Community Health Assessment indicates that the top two causes of death in each of the city/towns in the region are heart disease and cancer. Data shows that the leading causes of emergency department (ED) admissions are heart disease and digestive disease. The SPECT/CT camera will be useful to serve patients with oncology, cardiology and gastrointestinal clinical diagnostic needs.

Cancer is the second leading cause of death in the Greater Bridgeport region. Of all the Greater Bridgeport communities, rates of cancer incidence and mortality are highest in Monroe. Monroe's mortality rate is 204 per 100,000 population, above both state (176.9 per 100,000 population) and national (181 per 100,000 population) rates. Connecticut as a whole has the second highest incidence of breast cancer in the country, second only to Rhode Island. According to the 2014 Community Profile of Breast Cancer by the Susan G. Komen organization, the greater Bridgeport area has a higher incidence of breast cancer, higher late stage diagnosis, and a higher mortality rate than the State of Connecticut incidence rates.

The proposed equipment purchase will serve not only patients with healthcare needs related to heart disease, cancer, and digestive diseases, but will prove effective in providing accurate anatomic localization and characterization to improve surgical outcomes, as well as providing diagnosis for thyroid disorders, brain disorders and other inflammations and infections.

25. Using [OHCA Table 8](#), provide a breakdown of utilization by town for the most recently completed FY. Utilization may be reported as number of persons, visits, scans or other unit appropriate for the information being reported.

§ "The utilization of existing health care facilities and health care services in the service area of the applicant;" (Conn.Gen.Stat. § 19a-639(a)(8))

26. Using [OHCA Table 9](#), identify all existing providers in the service area and, as available, list the services provided, population served, facility ID (see table footnote), address, hours/days of operation and current utilization of the facility. Include providers in the towns served or proposed to be served by the Applicant, as well as providers in towns contiguous to the service area.

There are currently no providers of SPECT-CT services in our service area.

27. Describe the effect of the proposal on these existing providers.

There are no existing providers of this specific diagnostic service in the service area.

28. Describe the existing referral patterns in the area served by the proposal.

Patients are referred for a SPECT-CT exam by their primary care provider or specialist based on clinical need. Oncologists, Cardiologists, ED physicians and primary care practitioners will request imaging to help diagnose and treat their patients. The new equipment will proving a much needed resource to the physicians within our service area.

29. Explain how current referral patterns will be affected by the proposal.

Referral patterns will not change with the installation of the new equipment.

§ *“Whether the applicant has satisfactorily demonstrated that the proposed project shall not result in an unnecessary duplication of existing or approved health care services or facilities;” (Conn. Gen. Stat. § 19a-639(a)(9))*

30. If applicable, explain why approval of the proposal will not result in an unnecessary duplication of services.

The purchase and installation of the GE Optima NM/CT 640 will improve health care in the region by offering a combination of metabolic information with precise anatomical location and attenuation correction. This state of the art system is not available at any other health care facility in St. Vincent’s service area.

§ *“Whether the applicant has satisfactorily demonstrated that the proposal will not negatively impact the diversity of health care providers and patient choice in the geographic region. . .” (Conn. Gen. Stat. § 19a-639(a)(11))*

31. How will the proposal impact the diversity of health care providers and patient choice or reduce competition in the geographic region?

The proposal will not have a significant impact on diversity of provider or reduce competition in the region.

Tables

**TABLE 1
APPLICANT'S SERVICES AND SERVICE LOCATIONS**

Service	Street Address, Town	Population Served	Days/Hours of Operation	New Service or Proposed Termination
SPECT	2800 Main St. Bridgeport CT	367,064	Mon. – Fri. 7:00 – 5:00 Sat., Sun. and evenings on call	SPECT-CT

[\[back to question\]](#)

**TABLE 2
SERVICE AREA TOWNS**

List the official name of town* and provide the reason for inclusion.

Town*	Reason for Inclusion
Bridgeport	Primary Service Area
Monroe	Primary Service Area
Trumbull	Primary Service Area
Stratford	Primary Service Area
Shelton	Primary Service Area
Fairfield	Primary Service Area
Easton	Primary Service Area

* Village or place names are not acceptable.

[\[back to question\]](#)

**TABLE 3
TOTAL PROPOSAL CAPITAL EXPENDITURE**

Purchase/Lease	Cost
Equipment (Medical, Non-medical, Imaging)	\$547,797
Land/Building Purchase*	\$0
Construction/Renovation**	\$204,552
Other (specify)	\$0
Total Capital Expenditure (TCE)	\$752,349
Lease (Medical, Non-medical, Imaging)***	\$0
Total Capital Cost (TCC)	\$0
Total Project Cost (TCE+TCC)	\$752,349

* If the proposal involves a land/building purchase, attach a real estate property appraisal including the amount; the useful life of the building; and a schedule of depreciation.

** If the proposal involves construction/renovations, attach a description of the proposed building work, including the gross square feet; existing and proposed floor plans; commencement date for the construction/ renovation; completion date of the construction/renovation; and commencement of operations date.

*** If the proposal involves a capital or operating equipment lease and/or purchase, attach a vendor quote or invoice; schedule of depreciation; useful life of the equipment; and anticipated residual value at the end of the lease or loan term.

[\[back to question\]](#)

**TABLE 4
PROJECTED INCREMENTAL REVENUES AND EXPENSES**

	FY 2017*	FY 2018*	FY 2019*
Revenue from Operations	\$0	\$0	\$0
Total Operating Expenses	0	0	0
Gain/Loss from Operations	\$0	\$0	\$0

* Fill in years using those reported in the Financial Worksheet attached.

NOTE: No projected incremental volumes, revenues or expense.

[\[back to question\]](#)

**TABLE 5
HISTORICAL UTILIZATION BY SERVICE**

Service**	Actual Volume (Last 3 Completed FYs)			CFY Volume*
	FY 2013	FY 2014	FY 2015	FY 2016
Nuclear Medicine	1154	1090	910	900
Total	1154	1090	910	900

- * For periods greater than 6 months, report annualized volume, identifying the number of actual months covered and the method of annualizing. For periods less than 6 months, report actual volume and identify the period covered.
- ** Identify each service type and level adding lines as necessary. Provide the number of visits or discharges as appropriate for each service type and level listed.
- *** Fill in years. If the time period reported is not *identical* to the fiscal year reported in Table 4 of the application, provide the date range using the mm/dd format as a footnote to the table.

[\[back to question\]](#)

**TABLE 6
PROJECTED UTILIZATION BY SERVICE**

Service*	Projected Volume		
	FY 2017	FY 2018	FY 2019
Nuclear Medicine	900	900	900
Total	900	900	900

- * Identify each service type by location and add lines as necessary. Provide the number of visits/discharges as appropriate for each service listed.
- ** If the first year of the proposal is only a partial year, provide the first partial year and then the first three full FYs. Add columns as necessary. If the time period reported is not *identical* to the fiscal year reported in Table 4 of the application, provide the date range using the mm/dd format as a footnote to the table.

[\[back to question\]](#)

**TABLE 7
 APPLICANT'S CURRENT & PROJECTED PAYER MIX**

Payer	Current FY 2016**		Projected					
			FY 2017**		FY 2018**		FY 2019**	
	Discharges	%	Discharges	%	Discharges	%	Discharges	%
Medicare*			405	45%	405	45%	405	45%
Medicaid*			207	23%	207	23%	207	23%
CHAMPUS & TriCare			0	0%	0	0%	0	0%
Total Government			612	68%	612	68%	612	68%
Commercial Insurers			243	27%	243	27%	243	27%
Uninsured			40	4.5%	40	4.5%	40	4.5%
Workers Compensation			5	0.5%	5	0.5%	5	0.5%
Total Non- Government			288	32%	288	32%	288	32%
Total Payer Mix			900	100%	900	100%	900	100%

* Includes managed care activity.

** Fill in years. Ensure the period covered by this table corresponds to the period covered in the projections provided. New programs may leave the "current" column blank.

[\[back to question\]](#)

**TABLE 8
UTILIZATION BY TOWN**

Town	Utilization FY 2015
Bridgeport	0
Monroe	0
Trumbull	0
Stratford	0
Shelton	0
Fairfield	0
Easton	0

* List inpatient/outpatient/ED volumes separately, if applicable

** Fill in year if the time period reported is not *identical* to the fiscal year reported on pg. 2 of the application; provide the date range using the mm/dd format as a footnote to the table.

NOTE: Chart is not applicable as the hospital does not currently own or operate a SPECT-CT camera.

[\[back to question\]](#)

**TABLE 9
SERVICES AND SERVICE LOCATIONS OF EXISTING PROVIDERS**

Service or Program Name	Population Served	Facility ID*	Facility's Provider Name, Street Address and Town	Hours/Days of Operation	Current Utilization
None	N/A	N/A	N/A	N/A	N/A

* Provide the Medicare, Connecticut Department of Social Services (DSS), or National Provider Identifier (NPI) facility identifier and label column with the identifier used.

[\[back to question\]](#)



**Supplemental CON Application Form
Acquisition of Equipment
Conn. Gen. Stat. § 19a-638(a)(10),(11)**

Applicant: St. Vincent's Medical Center

Project Name: SVMC – SPECT-CT15

Affidavit

Applicant: St. Vincent's Medical Center

Project Title: Acquisition of a SPECT/CT camera to replace existing SPECT camera

I, Dr. Stuart Marcus, CEO
(Name) (Position – CEO or CFO)

of St. Vincent's Medical Center being duly sworn, depose and state that the said facility complies with the appropriate and applicable criteria as set forth in the Sections 19a-630, 19a-637, 19a-638, 19a-639, 19a-486 and/or 4-181 of the Connecticut General Statutes.

[Signature] 12/15/15
Signature Date

Subscribed and sworn to before me on DECEMBER 15, 2015

[Signature]

Notary Public/Commissioner of Superior Court

My commission expires: May 31, 2016

1. Project Description: Acquisition of Equipment

- a. Provide the manufacturer, model and number of slices/tesla strength of the proposed scanner (as appropriate to each piece of equipment).

GE Optima NM/CT 640 – 4 slice

- b. List each of the Applicant's sites and the imaging modalities currently offered by location.

St. Vincent's Medical Center – 2800 Main St. Bridgeport
X-Ray, SPECT, Ultrasound, CT, MRI, PET, Nuclear Medicine, Mammography

Bridgeport Urgent Care – 4600 Main St. Bridgeport – X-Ray

Fairfield Urgent Care – 1055 Post. Rd Fairfield – X-Ray

Milford Urgent Care – 199 Cherry St. Milford – X-Ray

Monroe Urgent Care – 401 Monroe Tpke Monroe – X-Ray

Shelton Urgent Care – 20 Trap Falls Rd. Shelton – X-Ray

Stratford Urgent Care – 3272 Main St. Stratford – X-Ray

2. Clear Public Need

- a. Complete **Table A** for each piece of equipment of the type proposed currently operated by the Applicant at each of the Applicant's sites.

Not Applicable, currently no SPECT-CT.

TABLE A
EXISTING EQUIPMENT OPERATED BY THE APPLICANT

Provider Name/Address	Service*	Days/Hours of Operation **	Utilization***
None	N/A	N/A	N/A

*Include equipment strength (e.g. slices, tesla strength), whether the unit is open or closed (for MRI)

**Days of the week unit is operational, and start and end time for each day

***Number of scans/exams performed on each unit for the most recent 12-month period (identify period).

- b. Provide the rationale for locating the proposed equipment at the proposed site;

St. Vincent's is locating the equipment in the Radiology Department at the hospital. This location is the current location of the equipment being replaced, therefore its placement will create a seamless transition for patients and staff.

3. Actual and Projected Volume

- a. Complete the following tables for the past three fiscal years ("FY"), current fiscal year ("CFY"), and first three projected FYs of the proposal, for each of the Applicant's existing and proposed pieces of equipment (of the type proposed, at the proposed location only). In **Table B**, report the units of service by piece of equipment, and in **Table C**, report the units of service by type of exam (e.g. if specializing in orthopedic, neurosurgery, or if there are scans that can be performed on the proposed scanner that the Applicant is unable to perform on its existing scanners).

TABLE B
HISTORICAL, CURRENT, AND PROJECTED VOLUME, BY EQUIPMENT UNIT

Equipment***	Actual Volume (Last 3 Completed FYs)			CFY Volume*	Projected Volume (First 3 Full Operational FYs)**		
	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
SPECT-CT					900	900	900
Total					900	900	900

*For periods greater than 6 months, report annualized volume, identifying the number of actual months covered and the method of annualizing. For periods less than six months, report actual volume and identify the period covered.

**If the first year of the proposal is only a partial year, provide the first partial year and then the first three full FYs. Add columns as necessary.

***Identify each scanner separately and add lines as necessary. Also break out inpatient/outpatient/ED volumes if applicable.

****Fill in years. In a footnote, identify the period covered by the Applicant's FY (e.g., July 1-June 30, calendar year, etc.).

TABLE C
HISTORICAL, CURRENT, AND PROJECTED VOLUME, BY TYPE OF SCAN/EXAM

Service***	Actual Volume (Last 3 Completed FYs)			CFY Volume*	Projected Volume (First 3 Full Operational FYs)**		
	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Oncology					280	285	280
Cardiology					100	105	105
GI					270	265	270
Orthopedics					225	225	225
Chronic Illness					25	20	20
Total					900	900	900

*For periods greater than 6 months, report annualized volume, identifying the number of actual months covered and the method of annualizing. For periods less than six months, report actual volume and identify the period covered.

**If the first year of the proposal is only a partial year, provide the first partial year and then the first three full FYs. Add columns as necessary.

***Identify each type of scan/exam (e.g., orthopedic, neurosurgery or if there are scans/exams that can be performed on the proposed piece of equipment that the Applicant is unable to perform on its existing equipment) and add lines as necessary.

****Fill in years. In a footnote, identify the period covered by the Applicant's FY (e.g., July 1-June 30, calendar year, etc.).

- b. Provide a detailed explanation of all assumptions used in the derivation/ calculation of the projected volume by scanner and scan type.

There are no projected increases or decreases to the volumes of scans projected. FY17-FY19 estimates are based on current projection trends and utilizations, which have been declining. It is estimated that the decline will level off with the acquisition of the new SPECT-CT camera based on the quality of the imaging.

- c. Explain any increases and/or decreases in the volume reported in the tables above.

There is no projected increase or decrease in volumes.

- d. Provide a breakdown, by town, of the volumes provided in **Table C** for the most recently completed FY.

NOTE: No current SPECT –CT Volume

TABLE D
UTILIZATION BY TOWN

Equipment*	Town	Utilization FY 2015
SPECT-CT	Bridgeport	0
SPECT-CT	Monroe	0
SPECT-CT	Trumbull	0
SPECT-CT	Stratford	0
SPECT-CT	Shelton	0
SPECT-CT	Fairfield	0
SPECT-CT	Easton	0

*Identify each scanner separately and add lines as necessary. Also, break out inpatient/outpatient/ED volumes if applicable and include equipment strength (e.g., slices, tesla strength), whether the unit is open or closed (for MRI).

**Fill in year

St. Vincent's Medical Center
Attachments

SVMC SPECT-CT15

Attachments

Public Notice

Order Confirmation

<u>Ad Order Number</u> 0002122611	<u>Customer</u> JSR ADVERTISING	<u>Payor Customer</u> JSR ADVERTISING
<u>Sales Rep.</u> dsettani	<u>Customer Account</u> 229729	<u>Payor Account</u> 229729
<u>Order Taker</u> dsettani	<u>Customer Address</u> 132 GLENARDEN DRIVE FAIRFIELD CT 06824 USA	<u>Payor Address</u> 132 GLENARDEN DRIVE FAIRFIELD CT 06824 USA
<u>Ordered By</u> mr ryan	<u>Customer Phone</u> 203-445-8631	<u>Payor Phone</u> 203-445-8631
<u>Order Source</u> E-mail		
<u>PO Number</u> SEPC/CT CAMERA	<u>Customer Fax</u> 204-445-8633	<u>Customer EMail</u> jryan@jsradvertising.com

Ad Content Proof

St. Vincent's Medical Center is filing an application for a Certificate of Need under section 19a-638(a)(9) of the Connecticut General Statutes for the acquisition and operation of a SPECT/CT camera system to be located on the main hospital campus at 2800 Main Street, Bridgeport, CT. The estimated capital expenditure for the project is \$752,349.

<u>Tear Sheets</u>	<u>Proofs</u>	<u>Affidavits</u>	<u>Special Pricing</u>	<u>Promo Type</u>
3	0	1	None	

Order Notes:

Invoice Text:

<u>Blind Box</u>	<u>Materials</u>	<u>Payment Method</u>		
<u>Net Amount</u>	<u>Tax Amount</u>	<u>Total Amount</u>	<u>Payment Amt</u>	<u>Amount Due</u>
\$251.60	\$0.00	\$251.60	\$0.00	\$251.60

<u>Ad Number</u>	<u>Ad Type</u>	<u>Ad Size</u>	<u>Pick Up Number</u>
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<u>External Ad #</u>	<u>Ad Released</u>	<u>Ad Attributes</u>	
	No		
<u>Color</u>	<u>Production Method</u>	<u>Production Notes</u>	
<NONE>	AdBooker		

<u>Product</u>	<u>Placement/Class</u>	<u># Inserts</u>	<u>Cost</u>
<u>Run Dates</u>			
<u>Sort Text</u>			
<u>Run Schedule Invoice Text</u>			
Connecticut Post::	Public Notices	3	\$210.60
11/4/2015, 11/5/2015, 11/6/2015			
STVINCENTSMEDICALCENTERISFILINGANAPPLICATIONFORACERTIFICATEOFNEEDUNDER:			
St. Vincent's Medical Center is filing an application for a Cert			
Connpost.com::	Public Notices	3	\$10.00
11/4/2015, 11/5/2015, 11/6/2015			
STVINCENTSMEDICALCENTERISFILINGANAPPLICATIONFORACERTIFICATEOFNEEDUNDER:			
St. Vincent's Medical Center is filing an application for a Cert			

OFFICE SPACE



FAIRFIELD OFFICE SPACE
SINGLE Room, furn'd.
 \$450/m, utils. included
Large Room 10x20 \$775/m, utils. included! And: Desk space, \$350/m. (1 person).
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FAIRFIELD - Suite w/1 office avail. at \$450/m. Incl. comfortable waiting rm, priv. parking lot & utilities. Loc. 2 blocks from train station and one block from Post Office. Area is made up of various business, shops, restaurants and beaches. For details or appointment, call 203-254-3340



GREENWICH - Greenwich Avenue. Furnished suites, w/reception, conference room & lounge area.
 203-661-3343.
 EOG, Inc. - Since 1874

VEHICLES FOR SALE

AUDI A4, 2005, 1.8T, 6 speed, 84k miles, sunroof, exc cond. \$6,800.
 *Call 203-313-2622.

BMW 528i, 80,500 mi. 2000, Silver Long range remote starter, leather heated seats, m/roof, all power.
 *Asking \$5,900. Call 203-249-9797.

PUBLIC NOTICES

St. Vincent's Medical Center is filing an application for a Certificate of Need under section 18a-63b(a)(9) of the Connecticut General Statutes for the acquisition and operation of a SPECT/CT camera system to be located on the main hospital campus at 2800 Main Street, Bridgeport, CT. The estimated capital expenditure for the project is \$752,348.

CITY OF SHELTON RFP BID# 36-40
 Pick Up Truck with Utility Body

Sealed Bids (IN DUPLICATE) will be received at the Office of the Purchasing Agent, 64 Hill Street, Shelton, CT 06484 by 11:00 A.M. local time on Wednesday, November 25, 2015 and publicly opened and read aloud at 3:00 P.M. on such date in room 104 City Hall Shelton, CT.

RFP BID# 36-40
 Pick Up Truck with Utility Body

City of Shelton is an Equal Opportunity Employer

If this project is state funded and is 50,000 dollars or more, state set a sides-4a-60, 4a-60a, 4a-60g, 46a-38b, 46a-68f will apply

Gene Sullivan
 Purchasing Agent
 (203) 924-1555 x 1305
 g.sullivan@cityofshelton.org
 November 3, 2015

VEHICLES FOR SALE

2001 Buick Century Ltd 50,000 mi, 2nd owner (1st owner elderly lady I knew), tan with tan leather interior. Reliable, excellent condition, V-6, 25 MPG. 18" XCR wheels with high performance tires, also OEM 16" Alloy wheels with winter tires (great in the snow); Upgraded Pioneer Stereo system and speakers: \$4900, or \$4500 without the 18" wheels/tires. Call 203-727-0015 for more details (leave a message and I'll call you back)

BUICK LESABRE 2002 White, good condition. 160k mi. \$1800 firm (203)912-7060

BUICK LESABRE '00 4-dr sedan. Good cond. New parts. (Needs engine). \$250 obo (203)746-5444

CHEVROLET CORVETTE Convertible, 1994 Very good condition, 300hp. Loaded. 46,350 hvy. mi. CD/cassette, air/bags. White w/black top/black leather int. \$9,500.00 (646)295-8432

CHEVY BLAZER 2001 4DR 4WD Full power. Very good condition. 96k mi. \$2400. (203)247-9289

CHEVY PICKUP 3500 Series, 1995 2WD, 156k mi, Runs & looks great! Asking \$2300. Call Rick, (203)297-7835 or (203)746-9381

CHEVY MALIBU LS, 2009. 69k mi, 1 owner, exc cond, PS, air, remote start, OnStar & phone adaptable. \$8,000. Call 203-261-7874

CHEVY TRAILBLAZER LS '02 98k mi. Orig. owner, good cond., service records. \$5900 obo. (203)344-1725

CHRYSLER PT CRUISER 2003 Auto, Silver w/black int, good shape, inside & out. 118k mi. Garaged. New tires & shocks. Car in New Fairfield. \$3650.00 (914)323-8683

DODGE VAN 2500 99' Runs great. \$1800/obo. Pls Call 203.912.2263

DODGE PICK-UP, '05. Quad Cab, 4x4 4.7, 84k mi, runs exc, looks good. \$9500/obo. Rob 203-746-6598



DONATE YOUR CAR to the SPCA and receive the maximum tax deduction and quick, free pick up.
 Call 203-445-9978

FORD ESCAPE, 2006, AWD, 118k miles, clean carfax, exc cond. \$4,995. Call 203-377-1111.

LIQUOR PERMITS

LIQUOR PERMIT

Notice of Application

This is to give notice that I,

LEONARD GORDON
 50 EASTERN PARKWAY
 MILFORD, CT 06460-5001

Have filed a request placarded 10/22/2015 with the Department of Consumer Protection for permission to move my PACKAGE STORE LIQUOR business now located

at
 143 TUNXIS HILL RD
 FAIRFIELD, CT 06825-4857
 To



Shop Smart.

Dollars spent at local businesses have a strong impact on our community.

Help local businesses create jobs for residents

FOR SALE

rim for Jeep \$100. text 203-375-8560

60/16 Michelin 327

10 FOR \$10 NEWPLS CALL

DUAL KITCHEN & BATH NEW 203-375-8560

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ick flexible over \$

about 50 pieces each. avail 11/13.

7, large, top faces w/bottom 203-268-8917

size "m". 203-

doll carriages, 1 assortment of. 203-268-5432

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ident. With bow 259-3883.

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50 used non-men's battery 13-913-2197

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hedge trimmer, 69 Ron

Center Stack. 3 9-9110

idic Sneakers, 1. \$50. Call 203-

re used, \$40. 3622

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WHITE LAMINATE COMPUTER table, pull out keyboard tray & wheels. Good cond. 203-521-7058

WHITE PAINTED GLIDER & otoman set. Blue/Green cushions. Pet/Smoke free home \$40. 203-371-5396

WHITE ROSE COFFEE TIN and old Maxwell coffee can have both!!! \$15. 203-803-3966

WICKER CHAIRS, inside chairs, natural brown w/matching upholstered back & seat w/cushions, light blue, \$95 EO. 203-377-7097

WICKER CNEST, Brass Trim. 20"x20"x36". \$50. 203-259-3883.

WINE CABINET. Beautiful distressed green. Holds 15 bottles/storage. Exc cond. \$150. 203-386-8911

WINE CABINET. Beautiful distressed green. Holds 15 bottles/storage. Ex cond. \$160. 203-386-8911

WOMEN'S WATCH, COACH w/ black strap. Like new. \$50. 203-209-2146

WOMEN'S JACKET, genuine sheared beaver/genuine black leather, reversible, size 10/12, gently worn, orig \$500, asking \$200. 203-254-7739/203-395-6671 iv msg

WOODEN EAGLE, Hand-carved hand painted one of a kind, great wall display, \$275. 203-258-2670

WOODEN EAGLE, Hand-carved hand painted one of a kind, great wall display, \$275. 203-258-2670

WORK GRASS TRIMMER/EDGER, 18V unit. Comes with 1 extra spool of line, 3 batteries & charger. \$35.00 203-736-3559

YANKEE CANDLES 100+ MANY SCENTS \$3.00 EACH PARTLY BURNED 203-268-8875

YANKEE CANDLES 100+ MANY SCENTS \$3.00 EACH PARTLY BURNED 203-268-8875

YANKEE CANDLES 100+ MANY SCENTS \$3.00 EACH PARTLY BURNED 203-268-8875

YARN, 250 SKEINS of acrylic yarn, \$125 or best offer. 203-261-5947

PROBATE NOTICES

STATE OF CT TRUMBULL PROBATE DISTRICT

NOTICE TO CREDITORS

ESTATE OF CHESTER A. KREWSON, III of Trumbull (15-00539)

The Hon. T.R. Rowe, Judge of the Court of Probate, District of Trumbull Probate District, by decree dated October 29, 2015, ordered that all claims must be presented to the fiduciary at the address below. Failure to promptly present any such claim may result in the loss of rights to recover on such claim.

Gena Salerno, Asst. Clerk

The fiduciary is:

Dorothy L. Krewson, 257 Broadway Road, Trumbull, CT 06811

STATE OF CT STRATFORD PROBATE DISTRICT

TAG / ESTATE / CRAFT FLEA MARKET SALES

BRIDGEPORT MISC TAG SALE! 474 East Washington Av, Apostolic Mission Church. Sat Nov 7, 9a-4pm.

FAIRFIELD LWV Tag Sale Senior Center, 100 Mona Terrace Saturday, 11/07, 9AM-3PM. Furn., housewares, tableware, motorcycle jacket, helmet, toys, jewelry, sports gear, jewelry, & more. Cash only. NO EARLY BIRDS.

GIANT HOLIDAY BAZAAR Sat, 11/7, 8:30-9:30. Early Bird Special w/coffee & muffins (\$10 donation) 9:30-4pm-all day shopping! Grace Baptist Church, 17 West Av, Norwalk. Lots of vendors!! (cash only)

MONROE 40 Glen Hollow Dr. Fri & Sat 11/6-7, 10-4pm. MOVING SALE. Entire contents of home, LR, DR, & Kitch sets; HH, china, collectibles, art, keyboard, stereo equip, patio set, grill, Craftsman radial arm & table saw, office furn & much more.

SHELTON TAG SALE! Sat, 11/7, 9-3. 23 North Princeton Dr. HH items, designer clothes, shoes & boots, Christmas, golf, pictures, oriental rug and much more! RV/Stone

STRATFORD MULTI Family Tag Sale. 130 Matthew Dr. Sat 11/7; 9-3. HH, rugs, clothes, collect., & more.

STRATFORD, Longaberger Baskets & Boyds Bears. Pottery, Lenox. Sat. Nov. 7, Noon-4PM. St. Joseph's Church, 1300 Stratford Rd, (Lords-hip) Stfd.

TAG / ESTATE / CRAFT FLEA MARKET SALES

STRATFORD 3FAM tag sale! 120 Swanson Av. 11/6-7-8, 10-3. Patio furn, tools, hb, toys, collectables.

TRUMBULL ESTATE SALE! 43 Clark Road, Sat only, 11/7, 10-5pm. Furn to include: LR, DR, entertainment center, TVs, treadmill, craft supplies, china, Hummels, jewelry, records, tons of tools, plus full garage!! Everything MUST go! SALE CONDUCTED BY THE GOOD BUY GIRLS & SON (Photos on Craig's List)

TRUMBULL - 167 Lounsbury Rd. (Edison to Leonard to Lounsbury, at end of cul-de-sac) Everything must go! HH items, children's jammies, clothing, glassware, DR set, toys, books, crochet blankets & more! Sat only, 9-4pm.

PUBLIC NOTICES

REQUEST FOR PROPOSALS The WorkPlace is seeking qualified providers to oversee the Southwestern Connecticut American Job Centers. Interested providers should review the RFQ at www.workplace.org/news.php

PUBLIC NOTICES

CITY OF BRIDGEPORT ZONING BOARD OF APPEALS PUBLIC HEARING

Tuesday, November 10, 2015 at 6:00pm

A public hearing will be held in the City Hall Common Council Chambers, 45 Lyon Terrace, Bridgeport, CT relative to the following:

C-1 (#4) 168 Union Ave. & 119 Carroll Ave. - Petition of 119 Carroll Avenue, LLC - Seeking to change a nonconforming manufacturing facility to a warehouse use for furniture and household goods of Sec. 4-12-3c, as well as outdoor trailer storage and also seeking to waive the landscaping and site coverage requirements of Sec. 5-1-3 in an R-C zone and coastal area.

D-1 (#3) 645 Pine St. - Petition of 645 Pine Street, LLC - Appealing of Sec. 14-10 of the Zoning Regulations of the City of Bridgeport and Sec. 8-7 of the CT General Statutes, whereby is alleged that the Zoning Enforcement Officer erred in his issuance of an Order to Comply regarding the erection of an on-premises roof sign without a special permit for the building housing the advertised use in an I-L zone.

#1 48 Fifth St. - Petition of Loida and Kenneth Gant - Seeking variances of the 2,700 sq. ft. of property per residential unit; 8' of the 10' side setback requirement and 7' of the 20' rear setback requirement of Sec. 5-1-3, and also seeking a variance of all three (3) required on-site parking spaces of Sec. 11-1-2 and a variance of the maximum projection allowed of Sec. 4-3-2a(i) to permit the conversion of a single-family dwelling into a two-family dwelling on a nonconforming lot in an R-C zone.

#2 1661-1673 Main St. - Petition of Friends of Liberation Programs, Inc. - Seeking variances of the maximum site coverage and minimum landscaping requirements of Sec. 6-1-3; the building siting and window requirements of Sec. 6-1-4 and waive six (6) of the required off-street parking spaces to permit the establishment of a primary medical care facility and a counseling and clinic facility in the existing commercial building in an OR zone.

#3 1725 Barnum Ave. - Petition of Mary Avramopoulos, et al - Seeking a change of the type of liquor permit of Sec. 12-10c to permit the establishment of a café with a consumer bar and the issuance of a café liquor permit in the previously liquor licensed full service restaurant in an DR zone.

#4 921 Hancock Ave. - Petition of Kevin Johnson - Seeking a variance of the prohibition of enlarging a nonconforming accessory structure of Sec. 4-12-4a and also seeking a variance of the maximum height requirement of 15' of an accessory structure of Sec. 5-1-3 to permit the construction of a 2nd floor addition and exterior stairway to the existing 2-car garage in an R-C zone.

#5 261 River St. - Petition of Bridgeport Islamic Community Center, Incorporated - Seeking a use variance of Sec. 7-1-2, and also seeking variances of the minimum landscaping and maximum site coverage of Sec. 7-1-3; the interior landscaping; the perimeter landscaping and minimum parking setbacks required of Sec. 11-1-13 and seeking to waive 76 of the required 108 parking spaces of Sec. 11-1-2 to permit the establishment of a religious institution and community center in an I-L zone.

PUBLIC NOTICES

TRUMBULL INLAND WETLANDS AND WATERCOURSES COMMISSION NOTICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN THAT the Inland Wetlands and Watercourses Commission of the Town of Trumbull will hold a Public Hearing on Tuesday, November 10, 2015 at 7:00 p.m., at the Trumbull Town Hall 5866 Main Street, Trumbull, CT on the following application(s):

Application 15-23, Saint Joseph High School Inc. - Permit approval to construct a wetlands nature trail & boardwalk to be used for educational and passive recreational purposes. Project includes removal & deposition of material and construction within the wetlands and the regulated area at 2320 Huntington Turnpike.

A copy of the application and maps are on file for public inspection in the Town Engineer's Office, Town Hall, Trumbull, Connecticut.

Dated at Trumbull, Connecticut this 28th day of October, 2015. Richard H. Girouard, Sr., Chairman Inland Wetlands and Watercourses Commission of the Town of Trumbull

St. Vincent's Medical Center is filing an application for a Certificate of Need under section 18a-638(a)(9) of the Connecticut General Statutes for the acquisition and operation of a SPECT/CT camera system to be located on the main hospital campus at 2800 Main Street, Bridgeport, CT. The estimated capital expenditure for the project is \$752,349.

ATTENTION: Donna Marie Morris formerly of Broad Street, Bridgeport, CT. I have important news for you. Please contact me, Attorney Harold Rosnick, 203 334-0191.



LEGAL NOTICE FORECLOSURE AUCTION SALE Docket No. FBT CV 13 6038527 S Case Name: SECRETARY OF HOUSING & URBAN DEVELOPMENT v. WINKLER, LINDA, ET AL Property Address: 20 CHATFIELD DRIVE, TRUMBULL, CT Property Type: Residential SINGLE FAMILY Date of Sale: NOVEMBER 7, 2015 Committee Name: ROBERT T. ROSATI, Committee Phone Number: (203) 377 6187 See Foreclosure Sales at www.jud.ct.gov for more detailed information

State of Connecticut Court of Probate, District of New Haven Regional Children's Probate Court. NOTICE TO John James, whose last known residence was in the town of Bridgeport, CT. Pursuant to an order of Hon. Beverly K. Strat-Kafalos, Judge of

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gas. req'd. \$1000/m. (203)728-7115

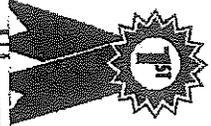
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1K+ 1B+ DR. Full cabler. 2p. parking.
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or 203-722-1538

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& Bunnell school Dist. For appoin-
(203)258-1303 (pre-qual only)

PROBATE NOTICES
STATE OF CT
SHELTON PROBATE DISTRICT
NOTICE TO CREDITORS
ESTATE OF STANLEY F.
JANCZEWSKI, deceased
(15-00355)

STRATFORD LARGE 1BR condo.
The Plaintiff has named as the De-
fendant, The Widow, Heirs
and/or Creditors, of the Estate of
Marta Wiatrzyk, and all unknown
persons, claiming or who may
claim, any rights, title interest or
estate in or lien or encumbrance
upon the property described in
this Complaint, adverse to the
Plaintiff, whether such claim or
possible claim can be vested or
contingent, if not (ivng, as a party
defendant), in the Complaint,
which it is bringing to the Court.
The Court seeks a foreclosure
sure of its common law rights upon
premises 187 Apartment 347,
Building B, Apartment 347,
Bridgeport, Connecticut 06810.

The Hon. Fred J. Anthony, Judge
of the Court of Probate, District
of Shelton Probate District, by
Commissioner Community Bank
N.A. D/B/A Weichert National
Bank, Habit: for Humany, of
coastal Fairfield County and Hab-
itat for Humany William Street
Condominium Association, Inc.,
as parties defendant. The Court
has granted the Plaintiff's motion
for summary judgment by its said
Fairfield County, the widow and
Heirs of Daniel Martinez in the
complaint which it is bringing to
the above named court seeking a
foreclosure of its mortgage upon
premises known as 247A William
Street, Bridgeport, CT. This com-
plaint is returnable to court on
November 24, 2015 and will be
pending therein after that date.
The plaintiff has represented to
said Court, by means of an affida-
vit annexed to said Complaint,
that despite all reasonable efforts
to ascertain such information it
has been unable to determine the
residence of the said Widow and
Heirs of Daniel Martinez. Now,
therefore, it is hereby ordered that
notice of the institution of this ac-
tion be given to said widow and
Heirs of Daniel Martinez by some
proper officer causing a true and
attested copy of the Order of Co-
rrected Post, once a week for
two successive weeks, commencing
on or before October 31, 2015
and that return of service be
made to the court.

Now, therefore, it is hereby OR-
DERED that notice of the institu-
tion of this action be given to the
Widow, Heirs and/or Creditors
of the Estate of Marta Wiatrzyk
and all unknown persons, claim-
ing or who may claim, any rights,
title, interest or estate in or lien or
encumbrance upon the property
described in this Complaint, ad-
verse to the Plaintiff, whether
such claim or possible claim can
be vested or contingent, by some
proper officer causing a true and
attested copy of this Order of Co-
rrected Post, once a week for 2
successive weeks, commencing
on or before 11/25/15, and that re-
turn of such services be made to
the Court.

THIS IS A TRUE COPY OF THE
ORIGINAL ORDER OF NOTICE IN
MY HANDS FOR SERVICE OF
PUBLICATION
STATE: JOHN M. MCNICHOLOS,
ATTORNEY AT LAW
By the Court, Robert A. Wilcock, II
Assistant Clerk
10/27/2015

St. Vincent's Medical Center is fil-
ing an application for a Certificate
of Need under section 19a-
638(e)(9) of the Connecticut Gen-
eral Statutes for the acquisition,
and operation of a SPEC/CT
camera system to be located on
Main Street, Bridgeport, CT. The
estimated capital expenditure for
the project is \$782,385.

Friday, November 6, 2015 | Connecticut Post | C7

Attachments
Board Resolution

The following resolution was approved by the Board of Directors of St. Vincent's Medical Center on September 30, 2015:

RESOLVED, that the Board of Directors of St. Vincent's Medical Center hereby authorizes and approves the purchase by the Medical Center of a nuclear single photon emission computed tomography-computed tomography (SPECT-CT) scanner for a purchase price of up to \$643,000, or such greater amount as may be approved by the President and Chief Executive Officer, and further authorizes management to take such steps as may be necessary in connection with the purchase of such scanner, including but not limited to the submission of a certificate of need application to the Department of Public Health Office of Health Care Access.

Attachments
Non-Profit Status

Internal Revenue Service

Department of the Treasury

Washington, DC 20224

St. Vincent's Medical Center
2800 Main Street
Bridgeport, Connecticut 06606

Person to Contact: *Paul*

Telephone Number:

Refer Reply to:
OF:EO:R:5

Date:

JAN 25 1985

Legend:

- A = St. Vincent's Health Services Corporation
- B = St. Vincent's Foundation, Inc.
- C = St. Vincent's Development, Inc.
- R = Roman Catholic Church
- S = Mr. John Sanders
- T = Connecticut

Dear Sisters:

This is in reply to a letter dated August 30, 1984, from S your legal representative, in which S requested certain rulings, in your behalf, relative to a proposed reorganization of your hospital.

The information presented shows that you are a facility operated in connection with the R church. As such, you are a charitable organization recognized to be exempt from federal income tax under section 501(c)(3) of the Internal Revenue Code. You are also a public charity of the type described in sections 509(a)(1) and 170(b)(1)(A)(iii) of the Code.

You propose to restructure your organization in order to:

- (a) increase your organizational flexibility through the segregation of some of the various activities of your facility into separate organizations;
- (b) centralize in a new parent organization management oversight and coordination responsibilities of the many functions of a hospital;
- (c) enable you to separate those activities which are more effectively carried on outside of the hospital setting leaving the full development of acute care unencumbered by ancillary activities;
- (d) permit you to keep your regulated activities separate from unregulated activities and to minimize unregulated activities and to minimize the exposure of your assets to creditors by limiting liability for legal claims; and
- (e) to engage in certain profit-making endeavors without risking the loss of exemption.

St. Vincent's Medical Center

In accordance with your plan of reorganization you have caused to be established three new entities: A, B, and C.

A, the "Parent" organization was incorporated July 18, 1984, as a nonstock corporation under the laws of the state of T. A's principal purpose is to benefit, carry out the purposes of, and uphold, promote and further the welfare, programs and activities of your organization as well as those of B and C. It will be operated by a board of directors consisting of not less than three nor more than fifteen persons. At all times, at least two of the directors of the Hospital will be directors of A. A has applied for a listing in the official directory of R. It is anticipated that A will be operated as a public charity under section 509(a)(3) as a supporting organization to you.

C was also incorporated on July 18, 1984, under the nonstock corporation laws of the state of T. Its purpose is to engage in promote, or support activities relating to human health and well-being, and to engage in businesses or activities in furtherance and support of A and the other affiliates of A. A will be its sole member. As in the case of A, C has also applied for a listing in the official directory of R. It is anticipated that C will be operated as a public charity under section 509(a)(2).

B was also incorporated on July 18, 1984, under the nonstock corporation laws of the state of T. Its principal purpose is to solicit and to hold funds and properties for the benefit of A and its affiliate organizations, including your organization. A will be its sole member. As in the case of A and C, B has also applied for a listing in the official directory of R. It is anticipated that B will be operated as a public charity under sections 509(a)(1) and 170(b)(1)(A)(vi) of the Code.

Upon receiving favorable rulings from this office with respect to, the reorganization, the following actions will be taken:

1. You will amend your articles of incorporation and bylaws to show, among other things, that A will become your sole member.
2. Approximately \$200,000 of your funds will be transferred to A to fund its initial activities and to provide initial capital for B and C.
3. Transfers of assets, including cash, will take place among the affiliate organizations on the basis of the need of a member for funds or, if necessary, to properly allocate programs among the related entities.

Section 501(c)(3) of the Code provides for the exemption of organizations that are organized and operated exclusively for religious, charitable, scientific, literary, or educational purposes.

St. Vincent's Medical Center

Section 1.501(c)(3)-1(d)(2) of the Income Tax Regulations provides that the term "charitable" is used in section 501(c)(3) of the Code in its generally accepted legal sense and is not to be construed as limited by the separate enumeration in section 501(c)(3) of other tax exempt purposes which may fall within the broad outlines of charity as developed by judicial decisions.

In the general law of charity, the promotion of health has traditionally been considered a charitable purpose. See Restatement (Second) of Trusts, section 372 (1959).

Section 509(a) of the Code provides that a section 501(c)(3) organization shall be a private foundation unless it is described in sections 509(a)(1) through 509(a)(4).

Section 509(a)(1) refers to organizations which are described in section 170(b)(1)(A) other than in clauses (vii) and (viii).

Section 170(b)(1)(A)(vi) of the Code refers to certain organizations, including charitable organizations described in section 501(c)(3) of the Code which normally receive a substantial part of their support from governmental organizations or from direct or indirect contributions from the general public.

In determining whether an organization is described in section 170(b)(1)(A)(vi) of the Code, section 1.170A-9(e)(6)(ii) of the regulations provides that one or more "unusual grants" may be excluded from both the numerator and the denominator of the applicable support fraction. The regulations set forth certain factors to be considered in making this determination.

Section 509(a)(3) of the Code describes an organization that is organized and operated exclusively to support one or more specified 509(a)(1) or (2) organizations which have a degree of control or supervision over the supporting organization.

Section 511 of the Code imposes a tax on the unrelated business taxable income of certain tax exempt organizations, including charitable organizations described in section 501(c)(3) of the Code.

Section 512(a)(1) of the Code defines the term "unrelated business taxable income", with certain modifications, as the "gross income derived by any organization from any unrelated trade or business...regularly carried on by it, less allowable deductions directly connected with the carrying on of such trade or business.

Section 513(a) of the Code defines the term "unrelated trade or business" as "any trade or business the conduct of which is not substantially related (aside from the need of such organization for income or funds or the use it makes of the profits derived) to the exercise or performance by such organization of its charitable, educational, or other

St. Vincent's Medical Center

purpose or function constituting the basis for its exemption under section 501...."

Section 170(a)(1) of the Code provides, in general, subject to certain limitations, for the allowance of a deduction for charitable contributions to corporations, trusts, funds or foundations that are organized and operated exclusively for charitable, scientific or educational purposes.

Based on the information presented, and with the understanding that your affiliates, A, B, and C are included in the official directory of R, we rule as follows:

1. The proposed reorganization will have no adverse effect on your tax exempt status under section 501(c)(3) of the Code.
2. After the reorganization, it would appear that A, B, and C will be entitled to recognition of exemption from federal income tax under section 501(c)(3) of the Code.
3. Contributions to A, B, and C will be deductible by donors under section 170(a)(1) of the Code.
4. Your status as a public charity under sections 509(a)(1) and 170(b)(1)(A)(iii) of the Code will not be adversely affected by the reorganization.
5. After the reorganization, and on condition that it meets the applicable support tests, it would appear that B will be entitled to classification as a public charity under sections 509(a)(1) and 170(b)(1)(A)(vi) of the Code. Furthermore, transfers of funds by you to B may be treated as "unusual grants" within the meaning of section 1.170A-9(e)(b)(ii) of the regulations.
6. After the reorganization, it would appear that C will be entitled to classification as a public charity described in section 509(a)(3) of the Code if it meets the applicable support tests.
7. After the reorganization it would appear that A will be a public charity described in section 509(a)(3) of the Code.
8. The reorganization, including the transfer of funds and the sharing of assets, facilities and services by and among your exempt affiliates, will not result in an unrelated trade or business subjecting you or any of your exempt affiliates to the unrelated business income tax provided by section 511(a).
9. The transfer of funds among the affiliate groups, including the transfer of \$200,000 by you to A and the transfer by A to B and C of funds to provide initial capital, will have no

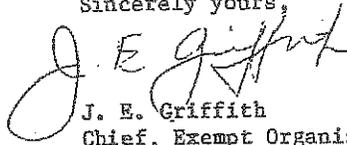
St. Vincent's Medical Center

adverse effect on the tax exempt status or the public charity status of any of the organizations.

This ruling is directed only to the organization that requested it. Section 6110(j)(3) of the Code provides that it may not be used or cited as a precedent.

We are notifying your key District Director of this action.

Sincerely yours,



J. E. Griffith
Chief, Exempt Organizations
Rulings Branch

Attachments

DPH License

STATE OF CONNECTICUT

Department of Public Health

LICENSE

License No. 0057

General Hospital

In accordance with the provisions of the General Statutes of Connecticut Section 19a-493:

St. Vincent's Medical Center of Bridgeport, CT d/b/a St. Vincent's Medical Center is hereby licensed to maintain and operate a General Hospital.

St. Vincent's Medical Center is located at 2200 Main Street, Bridgeport, CT 06606-4201.

The maximum number of beds shall not exceed at any time:

47 Bassinets

473 General Hospital Beds

This license expires September 30, 2017 and may be revoked for cause at any time.
Dated at Hartford, Connecticut, October 1, 2015. RENEWAL.

Satellites:

Family Health Center, 760-762 Lindley Street, Bridgeport, CT

The St. Vincent's Center for Wound Healing, 115 Technology Drive, Trumbull, CT

St. Vincent's Behavioral Health Center-Westport, 47 Long Lots Road, Westport, CT

St. Vincent's Outpatient Behavioral Health-Bridgeport, 2400 Main Street, Bridgeport, CT

St. Vincent's Outpatient Behavioral Health-Norwalk, 1 Lois Street, Norwalk, CT

St. Vincent's Center for Wound Healing-Stratford, 3272 Main Street, Stratford, CT



Jewel Mullen

Jewel Mullen, MD, MPH, MPA
Commissioner

Attachments
Key Personnel

St. Vincent's Medical Center

SPECT-CT 2015

Key professional, administrative, clinical and direct service personnel related to the proposal

- **Stuart Marcus, President/CEO**
- **Dale Danowski, SVP/COO/CNO**
- **Ruben Kier, Chairman Radiology**
- **Thomas Olsavsky, Chief Nuclear Medicine Radiologist**
- **Sean Mathews, RSO**
- **Curtis Mccloggan, Radiology Director**
- **LaTishia Greene-Jackson, Radiology Manager**
- **Hiral Shah, Nuclear Medicine Technologist**
- **Parnel Mortimer, Nuclear Medicine Technologist**

March 25, 2015

CURRICULUM VITAE

Name: Stuart G. Marcus, MD, MBA
Address: St. Vincent's Medical Center
2800 Main Street
Bridgeport, CT 06606
Telephone: (203) 576-6235
Facsimile: (203) 581-6587
E-mail: smarcus@stvincents.org
Birth date, place: February 21, 1961, Brooklyn, N.Y.

Education:

Degree Programs:

1983 B.A., Rutgers College/Rutgers University, New Brunswick, N.J.
1987 M.D., Duke University School of Medicine, Durham, N.C.
2015 M.B.A., University of Massachusetts, Worcester, MA

Other:

2000 Certificate; Health Care Management Course,
NYU Wagner School of Public Service, N.Y., N.Y.
2012 Certificate, Formation for Catholic Healthcare Ministry Leadership
Aquinas Institute of Theology/Ascension Health, St. Louis, MO
2014 Certificate, Leadership Academy, Ascension Health, St. Louis, MO

Postdoctoral Training:

Internships and Residencies:

1987-1988 Intern, General Surgery, NYU School of Medicine, N.Y., N.Y.
1988-1989 Junior Resident, General Surgery, NYU School of Medicine, N.Y., N.Y.
1992-1994 Senior Resident, General Surgery, NYU School of Medicine, N.Y., N.Y.
1994-1995 Chief Resident, General Surgery, NYU School of Medicine, N.Y., N.Y.

Research Fellowships:

1989-1992 Clinical Associate/Research Fellow, National Cancer Institute, Bethesda, MD.

Licensure and Certification:

1988 National Board of Medical Examiners
1988 Medical License, State of New York
1996 Diplomat, American Board of Surgery
2005 Re-certified
2006 Medical License, State of Connecticut

Academic Appointments:

1987 - 1994 Teaching Assistant in Surgery, NYU School of Medicine, N.Y.,N.Y.
1994 - 1995 Clinical Instructor in Surgery, NYU School of Medicine, N.Y.,N.Y.
1995 - 1996 Instructor in Surgery, NYU School of Medicine, N.Y.,N.Y.
1996 - 2005 Assistant Professor of Surgery, NYU School of Medicine, N.Y.,N.Y.
2005 - Clinical Associate Professor of Surgery, NYU School of Medicine, N.Y.,N.Y.
2012 - Professor of Surgery, Quinnipiac University School of Medicine, Hamden, CT

Hospital Appointments:

1990 - 1992 House Officer, Reston Hospital Center, Reston VA.
1995 - 1998 Clinical Assistant Attending Surgeon, Bellevue Hospital Center, N.Y., N.Y.
1995 - 2006 Attending Surgeon, Tisch Hospital, N.Y., N.Y.
1995 - 2006 Attending Surgeon, Manhattan V.A. Hospital, N.Y., N.Y.
1998 - 2006 Attending Surgeon, Bellevue Hospital Center
1998 - 2003 Associate Director of Surgery, Bellevue Hospital Center
2004 - 2006 Co-Director, NYUCI Outpatient Oncology Services, Bellevue Hospital Center
2004 - 2005 Associate Program Director, General Surgery Residency Training Program, NYU School of Medicine
2005 - 2006 Program Director, General Surgery Residency Training Program, NYU School of Medicine
2006 - Active Staff, Department of Surgery, St. Vincent's Medical Center, Bridgeport, CT
2006 - 2009 Vice President, Cancer Services; Chairman of Oncology, St. Vincent's Medical Center, Bridgeport, CT
2008 - 2009 Interim Chief Medical Officer, St. Vincent's Medical Center, Bridgeport, CT
2009 - 2012 Senior Vice President, Chief Medical Officer, Chairman of Oncology, St. Vincent's Medical Center, Bridgeport, CT
2012 - 2014 President, St. Vincent's Medical Center, Bridgeport, CT
2013 - 2014 Executive Vice President, St. Vincent's Health System, Bridgeport, CT
2014 - President/CEO, St. Vincent's Health System, Bridgeport, CT
2015 - President, St. Vincent's MultiSpecialty Group, Bridgeport, CT

Awards and Honors:

1983 Phi Beta Kappa Honor Society
1983 B.A., High Honors, Rutgers College
1984 Class of 1962 Public Service Award, Rutgers College
1986 James Ewing Student Research Fellowship, Society of Surgical Oncology
1986 Alpha Omega Alpha Honor Medical Society
2002 Attending of the Year, Department of Surgery, NYU School of Medicine
2003 Honoree, Coaches vs. Cancer Classic, Sponsored by TIAA-CREF and Commission of Independent Colleges and Universities, Madison Square Garden, NY. NY
2014 Regional Health Care Impact Award, Bridgeport Regional Business Council, Bridgeport, CT

Committee Assignments:

NYU School of Medicine, N.Y., N.Y.

1995 - 2000 Medical Student Advisory College Program
1998 - 2000 Task Force on Curriculum Policy 2001, Cross Site Evaluation Committee
1998 - 2000 Task Force on Curriculum Policy 2001, Clinical Curriculum Committee
1998 - 2001,
2004 - 2006 House Staff Committee, Department of Surgery
Chairman
2001 - 2003 Faculty Council
2001 - 2003 Oversight Committee, NYU Cancer Institute
2001 - 2004 Quality Audit Committee, NYU Cancer Institute, Chairman
2002 - 2006 Clinical Research Oversight Committee, NYU School of Medicine
2004 - 2006 Graduate Medical Education Committee

Bellevue Hospital Center, N.Y., N.Y.

1995 - 2006 Clinical Service Line, Department of Surgery
1998 - 2003 Chair
1995 - 1999 Bioethics Committee
1995 - 2001,
2004 - 2006 House Staff Affairs Committee
1998 - 2001 Peer Review Committee
1998 - 2001 Medical Records Committee
1998 - 2006 Cancer Committee
2001 - 2004 Cancer Liaison Physician, Commission on Cancer, ACS
2003 - 2005 Committee Chair
1998 - 2003 Operating Room / Recovery Room Committee
1998 - 2003 Quality Council
1998 - 2005 Medical Board

St. Vincent's Medical Center, Bridgeport, CT.

2006 - 2012 Oncology Service Line, Chairman
2006 - 2012 Strategic Council Committee
2006 - 2012 Cancer Committee, Liaison Physician
2006 - Medical Executive Committee
2006 - Professional Peer Review Committee
2006 - Quality Council
2012 - President's Council
2012 - St. Vincent's Medical Center Board of Directors
2012 - Performance Improvement Committee
2012 - Planning Committee
2013 - Governance Committee
2013 - Joint Finance Committee, Ex-Officio
2013 - Joint Audit/Corporate Responsibility Committee
2012 - St. Vincent's College Board of Trustees
2014 - St. Vincent's Special Needs Board of Trustees

Professional Societies:

1983 - Phi Beta Kappa Honor Society
1986 - Alpha Omega Alpha Honor Medical Society
1987 - Duke University Medical Center Alumni Association
1987 - 1995 American College of Surgeons, Candidate Group
1995 - 1998 Associate Fellow

1998 -	Fellow
1992 - 1993	American Association of Cancer Research, Associate Member
1995 - 2013	Member
1995 -	Association of Alumni of Bellevue Hospital
1996 - 2006	Medical Society of the State of New York
1996 - 2006	New York County Medical Society
1996 -	Society for Surgery of the Alimentary Tract
2000 - 2005	Publications Committee
2007 -	Public Policy Committee
1996 -	Association for Academic Surgery
1999 - 2001	Membership Committee
1997 -	The Pancreas Club
1997 -	American Hepato-Pancreato-Biliary Association
1999 - 2003	Research and Education Committee
2003 - 2008	Membership Committee
1997 - 2006	New York Surgical Society
1997 -	American Society of Clinical Oncology
2004 -	Society of Surgical Oncology
2008 - 2012	Outcomes Committee
2007 -	American College of Physician Executives
2008 -	Fairfield County Medical Association
2015 -	American Association of Healthcare Executives

Principal Clinical and Hospital Service Responsibilities:

1995 - 2006	Attending Surgeon, General Surgery A & B, Trauma Services, Bellevue Hospital
1995 - 2006	Attending Surgeon, General Surgery Group I, Tisch Hospital
1996 - 2006	Comprehensive Cancer Center, NYU School of Medicine, Member
2003 - 2005	Chair, Cancer Committee, Bellevue Hospital Center
2004 - 2006	Co-Director, NYUCI Outpatient Oncology Services, Bellevue Hospital Center
2006 - 2009	Vice President, Cancer Services; Chairman, Department of Oncology, St. Vincent's Medical Center, Bridgeport, CT
2008 - 2009	Interim Chief Medical Officer, St. Vincent's Medical Center, Bridgeport, CT
2009 - 2012	Chief Medical Officer, Chairman, Department of Oncology, Active Staff, St. Vincent's Medical Center, Bridgeport, CT
2012 - 2014	President, St. Vincent's Medical Center, Bridgeport, CT
2013 - 2014	Executive Vice President, St. Vincent's Health System, Bridgeport, CT
2014 -	President/CEO, St. Vincent's Health System, Bridgeport, CT

Grants / Funding / Sponsorship:

1986	James Ewing Student Research Fellowship, Society of Surgical Oncology: Monoclonal antibody directed therapy for pancreatic cancer.
1987	Professional Oncology Education Grant, Duke University School of Medicine: Monoclonal antibody directed therapy for pancreatic cancer. Direct costs: \$2,000.
1996 - 1998	Departmental funds, S. Arthur Localio Laboratory for General Surgery Research: Angiogenesis and matrix metalloproteinases in tumor biology and inflammatory states.
1996	Departmental funds, Gastrointestinal tumor database: Development and application.
1998	Kaplan Comprehensive Cancer Center/NYU School of Medicine, Pilot grant, Gastric cancer screening in a high risk underserved Asian population, Principal Investigator, Direct costs: \$20,000 / 2 years.
1998	Pharmacia & Upjohn, Industry Support: A phase II study of systemic therapy with

- CPT-11 (Camptosar HCl) and Cisplatin in patients with advanced gastric cancer to be followed by surgical resection and postoperative intraperitoneal therapy. Co-investigator.
- 1999 Merit funding, New York City Council: The Cancer Center at Bellevue Hospital, Capital expenditures: \$1.8 million.
- 2002 NYU School of Medicine Institute for Global and Urban Health/Provincial Bureau of Health of Fujian Province, People's Republic of China, Sino-American Healthcare Exchange Program.
- 2002 FDA: Intraperitoneal Floxuridine in Gastric Carcinoma, Co-investigator. Direct costs: \$442, 953 / 3 years.
- 2003 NIH, Center to Reduce Cancer Health Disparities (CRCHD): An Evaluation and Continuation of a Gastric Cancer Screening Effort in Chinese Immigrants in New York City. Co-investigator, Total Costs \$50,000 / 1 year.

Bibliography:

Original Publications:

1. Mule JJ, **Marcus SG**, Yang JC, Weber JS, and Rosenberg SA. Clinical application of IL-6 in cancer therapy. *Research in Immunology* 1992; 143(7):777-779.
2. **Marcus SG**, Choyke PL, Reiter R, Jaffe GS, Alexander RB, Linehan WM, Rosenberg SA, and Walther MM. Regression of metastatic renal cell carcinoma after cytoreductive nephrectomy. *J Urol* 1993; 150(2 Pt 1):463-466.
3. Marincola FM, Balkissoon J, Schwartzenruber DJ, Hom SS, Concepcion R, **Marcus SG**, Yannelli J, Topalian SL, Parkinson DR, and Rosenberg SA. Hemodynamic effects of the administration of tumor-infiltrating lymphocytes to cancer patients. *J Immunotherapy* 1993; 13(4): 282-288.
4. **Marcus SG**, Merino MJ, Glatstein E, DeLaney TF, Steinberg SM, Rosenberg SA, and Yang JC. Long term outcome in 87 patients with low-grade soft-tissue sarcoma. *Arch Surg* 1993; 128(12):1336-1343.
5. **Marcus SG**, Walsh TJ, Pizzo PA, and Danforth DN Jr. Hepatic abscess in cancer patients: Characterization and management. *Arch Surg* 1993; 128(12):1358-1364.
6. **Marcus SG**, Perry-Lalley D, Mule JJ, Rosenberg SA, and Yang JC. The use of interleukin-6 to generate tumor-infiltrating lymphocytes with enhanced *in vivo* antitumor activity. *J Immunotherapy* 1994;15(2):105-112.
7. **Marcus SG**, Krauss T, Freedberg RS, Culliford AT, Weinreich DJ, and Kronzon I. Pulmonary embolectomy for intravenous uterine leiomyomatosis. *American Heart Journal* 1994; 127(6):1642-1645.
8. **Marcus SG**, Cohen H, and Ranson JHC. Optimal management of the pancreatic remnant after pancreaticoduodenectomy. *Ann Surg* 1995; 221(6):635-645.
9. Schwartz JD, Shamamian P, Grossi EA, Schwartz DS, **Marcus SG**, Steiner F, Jacobs CE, Tayyarah M, Eng K, Colvin SB, Galloway AC. Lexipitant inhibits platelet activating factor enhanced neutrophil functions. *J Surg Res* 1997; 69(2):240-248.
10. **Marcus SG**, Dobryansky M, Shamamian P, Cohen H, Gouge TH, Pachter HL, Eng K. Endoscopic biliary drainage prior to pancreaticoduodenectomy for periampullary malignancies. *J Clin Gastroenterol* 1998; 26(2):125-129.

11. Schwartz JD, Monea S, **Marcus SG**, Patel S, Eng K, Galloway AC, Mignatti P, Shamamian P. Soluble factor(s) released from neutrophils activates endothelial cell matrix metalloproteinase-2. *J Surg Res* 1998; 76(1):79-85.
12. Schwartz JD, Shamamian P, Monea S, Whiting D, **Marcus SG**, Galloway AC, Mignatti P. Activation of tumor cell matrix metalloproteinase-2 by neutrophil proteinases requires expression of membrane-type I matrix metalloproteinase. *Surgery* 1998; 124:232-238.
13. Pocock BJ, Monea S, Schwartz JD, Chuang N, **Marcus SG**, Eng K, Mignatti P, Shamamian P. Membrane type-1 matrix metalloproteinase-dependent tumor invasion is enhanced by neutrophil-derived serine proteinases. *Surgical Forum* 1998; XLIX:419-421.
14. Hochwald SN, Dobryansky M, Rofsky N, Naik KS, Shamamian P, Coppa G, **Marcus SG**. Magnetic resonance cholangiopancreatography (MRCP) accurately predicts the presence or absence of choledocholithiasis. *J Gastrointest Surg* 1998; 2:573-579.
15. Monea S, Roberts B, **Marcus SG**, Shamamian P, Mignatti P. Roles of MT1-MMP in the regulation of cell surface proteolysis. *Ann NY Acad Sci* 1999; 878:703-6.
16. Hochwald SN, Rofsky N, Dobryansky M, Shamamian P, **Marcus SG**. Magnetic resonance imaging (MRI) with magnetic resonance cholangiopancreatography (MRCP) accurately predicts resectability of pancreatic carcinoma. *J Gastrointest Surg* 1999; 3:506-511.
17. Zanetta L, **Marcus SG**, Vasile J, Dobryansky M, Cohen H, Eng K, Shamamian P, Mignatti P. Expression of von Willebrand factor, an endothelial cell marker, is upregulated by angiogenesis factors: a potential method for objective assessment of tumor angiogenesis. *Int J Cancer* 2000; 85:281-288.
18. Shamamian P, Pocock BJ, Schwartz J, Monea S, Chuang N, Whiting D, **Marcus SG**, Galloway AC, Mignatti P. Neutrophil-derived serine proteinases enhance membrane type-1 matrix metalloproteinase-dependent tumor cell invasion. *Surgery* 2000; 126:142-147.
19. Brooks AS, **Marcus SG**, Gradek C, Newman E, Shamamian P, Gouge TH, Pachter HL, Eng K. Decreasing length of stay after pancreaticoduodenectomy. *Arch Surg* 2000; 135:823-830.
20. Patel S, Pachter HL, Yee H, Schwartz JD, **Marcus SG**, Shamamian P. Topical hepatic hypothermia attenuates pulmonary injury after hepatic ischemia. *J Am Coll Surg* 2000; 191:650-656.
21. Muhs BE, Patel S, Yee H, **Marcus S**, Shamamian P. Increased matrix metalloproteinase expression and activation following experimental acute pancreatitis. *J Surg Res* 2001; 101:21-28.
22. Newman E, **Marcus SG**, Potmesil M, Sewak S, Yee H, Sorich J, Hayek M, Muggia F, Hochster H. Neoadjuvant chemotherapy with CPT-11 and Cisplatin downstages locally advanced gastric cancer. *J Gastrointest Surg* 2002; 6:212-223.
23. Muhs BE, Patel S, Yee H, **Marcus S**, Shamamian P. Inhibition of matrix metalloproteinases reduces local and distant organ injury following experimental acute pancreatitis. *J Surg Res* 2003; 109:110-117.
24. **Marcus SG**, Cohen D, Lin K, Wong K, Thompson S, Rothberger A, Potmesil M, Hiotis S, Newman E. Complications of gastrectomy following CPT-11 based neoadjuvant chemotherapy

- for gastric cancer. *J Gastrointest Surg* 2003; 7:1015-1023.
25. Colen KL, **Marcus SG**, Berman R, Newman E, Hiotis SP. Multi-organ resection for locally advanced gastric cancer: Clinical T4 disease does not accurately predict pathologic T4 disease. *J Gastrointest Surg* 2004; 8:897-900.
 26. Miller G, Mueller C, Yim D, Macari M, Liang H, **Marcus SG**, Shamamian P. Perforated duodenal diverticulitis: A report of three cases. *Dig Surg* 2005; 22:198-202.
 27. Klegar EK, **Marcus SG**, Newman E, Hiotis SP. Diagnostic laparoscopy in the evaluation of the viral hepatitis patient with potentially respectable hepatocellular carcinoma. *HPB* 2005; 7:204-207.
 28. Newman E, Potmesil M, Ryan T, **Marcus S**, Hiotis S, Yee H, Norwood B, Wendall M, Muggia F, Hochster H. Neoadjuvant chemotherapy, surgery, and adjuvant chemotherapy in patients with locally advanced gastric or gastroesophageal junction carcinoma: A phase II study. *Semin Oncol* 2005; 32 (suppl 9):S97-S100.
 29. Cho A, Chaudhry A, Minsky-Primus L, Tso A, Perez-Perez G, Diehl D, **Marcus SG**, Gany FM. Follow-up care after a diagnosis of *Helicobacter pylori* infection in an immigrant cohort. *J Clin Gastroenterol* 2006; 40:29-32.
 30. Cho A, Chaudhry A, Minsky-Primus L, Tso A, Perez-Perez G, Diehl D, **Marcus SG**, Gany F. Acceptance of repeat esophago gastroduodenoscopy to detect gastric cancer in a chinese immigrant cohort. *J Clin Gastroenterol* 2006; 40:606-11.
 31. Lim S, Muhs BE, **Marcus SG**, Newman E, Berman RS, Hiotis SP. Results following resection for stage IV gastric cancer; are better outcomes observed in selected patient subgroups. *J Surg Onc* 2007; 95:118-22.
 32. Sabbaghian MS, Rich BS, Rothberger GD, Cohen J, Batash S, Kramer E, Pachter HL, **Marcus SG**, Shamamian P. Evaluation of surgical outcomes and gall bladder characteristics in patients with biliary dyskinesia. *J Gastrointest Surg* 2008; 12:1324-1330.
 33. Wasif, N, Cormier JN, Ko CY, McCahill LE, Edge SB, Wong SL, Anthony T, Kollmorgen D, **Marcus SG**, Bleznak A, Leong SPL. Quality Measurement in Cancer Care Delivery. *Ann Surg Oncol* 2011; 18:611-618.
 34. **Marcus SG**, Reid-Lombardo KM, Halverson AL, Maker V, Demetriou A, Fischer JF, Bentrem D, Rudnicki M, Hiatt JR, Jones D. Staying Alive: Strategies for Accountable Health Care. *J Gastrointest Surg* 2012; 16:927-934.
 35. Reid-Lombardo KM, Glass CG, Marcus SG, Liesinger J, Jones DB and the Public Policy and Advocacy Committee of the SSAT. Workforce Shortage for General Surgeons: Results form the Society for Surgery of the Alimentary Track (SSAT) Surgeon Shortage Survey. *J Gastrointest Surg* 2014; 18:2061-2073.

Book Chapters and Miscellaneous:

1. Shamamian P, **Marcus SG**. *Interstitial Edematous Pancreatitis*. In: Beger HG, Warshaw AL, Sarr MG, et al, eds. The Pancreas: A Clinical Textbook. Oxford: Blackwell Scientific Publications, 1998: 416-422.
2. Muggia F, Newman E, Yee H, **Marcus S**, Potsemil M. Resectable gastric cancer: A target for

- intraperitoneal chemotherapy? Proceedings 4th International Gastric Cancer Congress. Monduzzi Editore, 2001: 83-88.
3. **Marcus SG**, Cushman J, Shamamian P. Remembering September 11: Reflections From Bellevue-NYU, Surgery 2002; 132:502-506.
 4. Bell R, Fernandez Del-Castillo C, **Marcus SG**, Nealon WH, Sarr MG. Update on indications for surgery in chronic pancreatitis: Part I. Contemporary Surgery 2004; 60(4):157-164.
 5. Bell R, Fernandez Del-Castillo C, **Marcus SG**, Nealon WH, Sarr MG. Current approaches to surgery in chronic pancreatitis: Part II. Contemporary Surgery 2004; 60(5): 202-209.
 6. Shamamian P, **Marcus SG**. Enteric *Drainage of Pancreatic Fistulas with Onlay Roux-en-Y Limb*. In: Clavien PA, Sarr M, Fong Y, eds. Atlas of Upper Abdominal Surgery. Springer-Verlag GmbH & Co.KG, 2007; 799-804.

Published Abstracts:

1. **Marcus SG**, Merino MJ, Glatstein E, DeLaney TF, Steinberg SM, Rosenberg SA, and Yang JC. Long term outcome in 87 patients with low grade soft tissue sarcoma. Proceedings of ASCO 1992; 11:1450.
2. **Marcus SG**, Palmer LD, Perry-Lalley D, Mule JJ, Rosenberg SA, and Yang, JC. The use of interleukin-6 to generate tumor-infiltrating lymphocytes with enhanced *in vivo* antitumor activity. Proceedings of the American Association for Cancer Research 1992; 33:322.
3. Hochwald SN, **Marcus SG**, Naik KS, Dobryansky M, Shamamian P, Rofsky N, Coppa G. Magnetic resonance cholangiopancreatography (MRCP) accurately predicts the presence of choledocholithiasis. Gastroenterology 1997; 112(4):A1448.
4. Shamamian P, Grosso M, Guth A, Diflo T, **Marcus SG**, Coppa GF. Treatment of primary intrahepatic stones with a holmium laser. Gastroenterology 1997; 112(4):A1473.
5. Schwartz JD, Monea S, Shamamian P, **Marcus SG**, Whiting D, Galloway AC, Mignatti P. Activation of endothelial or tumor cell progelatinase A (MMP-2) by human polymorphonuclear neutrophils. Molecular Biology of the Cell 1997; 8:435.
6. Monea S, Lehti K, Schwartz J, Shamamian P, **Marcus S**, Galloway AC, Keski-Oja J, Mignatti P. Requirement for plasmin and membrane type 1 matrix metalloproteinase in the cell surface activation of gelatinase A (MMP-2). Molecular Biology of the Cell 1997; 8:434.
7. Schwartz JD, Shamamian P, Whiting D, **Marcus SG**, Monea S, Patel S, Mignatti P, Galloway AC. Activation of endothelial cell pro-gelatinase A by inflammatory cell-derived serine proteinases. Proceedings of the American Association for Cancer Research 1998; 39:82.
8. Zanetta L, **Marcus SG**, Vasile J, Schwartz JD, Cohen H, Eng K, Shamamian P, Mignatti P, Mignatti P. Angiogenesis factors upregulate endothelial cell expression of von Willebrand factor (vWF). Proceedings of the American Association for Cancer Research 1998; 39:40.
9. Hochwald SN, Dobryansky M, Rofsky N, Shamamian P, **Marcus S**. Magnetic resonance imaging (MRI) with magnetic resonance cholangiopancreatography (MRCP) predicts resectability and ductal abnormalities in benign and malignant pancreatic disease. Gastroenterology 1998; 114(4):A1392.

10. Karpoff HM, Sivamurthy N, Oh C, Shamamian P, Gouge TH, Pachter HL, Eng K, **Marcus SG**. Predicting comorbidity in patients with pancreatic fistula following pancreaticoduodenectomy. *Gastroenterology* 1998; 114(4):A1398.
11. Shamamian P, **Marcus S**, Deutsch E, Maldonado T, Liu A, Stewart J, Eng K, Gilvarg C. Carboxypeptidase A activity in pancreatic cancer and acute pancreatitis. *Gastroenterology* 1998; 114(4):A1425.
12. Patel S, Schwartz J, Chaung N, **Marcus S**, Pachter HL, Deutsch E, Galloway AC, Eng K, Mignatti P, Shamamian P. Matrix metalloproteinase (MMP) 2 and 9 activity in experimental acute pancreatitis. *Gastroenterology* 1998; 114(4):A1416.
13. **Marcus SG**, Villanueva G, Shamamian P, Newman E, Ortega J, Lam Y, Garbers S. Increased risk of gastric adenocarcinoma in east asian immigrants. *J Surg Res* 1999; 86:290.
14. **Marcus SG**, Dave J, Kim S, Kim M, Newman E. Improving survival in an underserved minority population with gastric cancer. *Gastroenterology* 2000; 118(4):A6873.
15. Ramsay-Joseph KP, Gilvarg C, **Marcus S**, Shamamian P. Total carboxypeptidase A (T-CPA) activity in pancreatic cancer. *Gastroenterology* 2000; 118(4):A6896.
16. Newman RM, **Marcus SG**. Cystic duct tube placement in patients with choledocholithiasis discovered at time of laparoscopic cholecystectomy. *Gastroenterology* 2000; 118(4):A6888.
17. Potmesil M, Newman E, Yee H, Newcomb EW, **Marcus SG**, Ahmed AN, Muggia FM. Neoadjuvant therapy of gastric adenocarcinoma by CPT-11 (Camptosar) and Cisplatin: Preliminary surgical and histopathologic findings. *Proceedings of ASCO* 2000; 19:1209.
18. **Marcus SG**, Tian H, Lam Y, Wong C, Ortega J, Newman E, Shamamian P, Garbers S, Villanueva G, Yee H. A prospective evaluation of esophagogastroduodenoscopy (EGD) in a population at increased risk for gastric cancer. *Gastroenterology* 2001; 120(5):A488.
19. Newman E, **Marcus SG**, Potmesil M, Hochster H, Yee H, Sewak S, Hayak M, Muggia FM. CPT-11/Cisplatin neoadjuvant therapy downstages locally advanced gastric cancer. *Gastroenterology* 2001; 120(5):A129.
20. Newman E, Marjanovic N, Alexander A, Mustalish D, Shamamian P, **Marcus S**, Melamed J, Scholes J, Delgado Y, Kaufman A, Jacobson D. Molecular staging in colon cancer (CC) with the aid of sentinel lymphnode (SLN) mapping. *Gastroenterology* 2001; 120(5):A472.
21. **Marcus SG**, Burkholder H, Burns P, Goldberg JD, Shivji M, Merali S. Plasma S-Adenosylmethionine level: A methyl donor as a potential aid in the diagnosis and treatment of colorectal cancer. *Gastroenterology* 2003; 124(4suppl1):A817(#M1947)
22. **Marcus SG**, Cohen D, Lin K, Wong K, Thompson S, Rothberger A, Potmesil M, Hiotis S, Newman E. Complications of Gastrectomy following CPT-11 based neoadjuvant chemotherapy for gastric cancer. *Gastroenterology* 2003; 124(4suppl1):A789(#498)
23. Colen KL, Berman R, **Marcus SG**, Newman E, Hiotis SP. Multi-organ resection for locally advanced gastric cancer: Clinical T4 disease does not accurately predict pathologic T4 disease. *Gastroenterology* 2003; 124(4suppl1):A812(#M1922)
24. Newman E, Potmesil M, Ryan T, **Marcus SG**, Yee H, Hochster H, Muggia FM. The effective combination of systemic neoadjuvant chemotherapy, potentially curative surgery, and adjuvant

intraperitoneal (IP) chemotherapy in patients with locally advanced gastric or GE-junction carcinoma. Proceedings of ASCO 2003; 22:1159.

25. Klegar EK, Newman E, Berman RS, **Marcus SG**, Hiotis SP. Comprehensive evaluation of the patient with viral hepatitis and potentially respectable hepatocellular carcinoma should include diagnostic laparoscopy and laparoscopic ultrasonography. HPB 2004; 6(Supp 1):7.
26. Newman E, Chang RY, Potmesil M, Donahue B, Marcus SG, Hiotis SP, Iqbal S, Ryan T, Hochster HS, Muggia FM. Postoperative intraperitoneal (IP) 5'-fluoro-2'-deoxyuridine (FUDR) added to chemoradiation in patients curatively resected (R0) for locally advanced gastric and gastroesophageal junction (GEJ) adenocarcinoma. JCO, 2005 ASCO Annual Meeting Proceedings, 2005; 23:4163.

Scientific Presentations:

Marcus SG, Merino MJ, Glatstein E, DeLaney TF, Steinberg SM, Rosenberg SA, and Yang JC. Longterm outcome in 87 patients with low grade soft tissue sarcoma. American Society of Clinical Oncology. San Diego, CA. May, 1992.

Marcus SG, Palmer LD, Perry-Lalley D, Mule JJ, Rosenberg SA, and Yang, JC. The use of interleukin-6 to generate tumor-infiltrating lymphocytes with enhanced *in vivo* antitumor activity. American Association for Cancer Research. San Diego, CA. May 1992.

Brown DM, **Marcus SG**, Wong A, Luck EE and Yu NY. Release kinetics of cytokines and lymphokines from protein carrier drug delivery systems. Second International Congress on Biological Response Modifiers. San Diego, CA. January 1993.

Marcus SG and Ranson JHC. Optimal management of the pancreatic remnant following pancreaticoduodenectomy. Southern Surgical Association. Palm Beach, FL. December 1994.

Schwartz JD, Shamamian P, **Marcus SG**, Schwartz DS, Steiner F, Jacobs CE, Grossi EA, Eng K, Colvin SB, Galloway AC. Lexipitant inhibits platelet activating factor (PAF) induced superoxide production and CD11b expression by polymorphonuclear leukocytes (PMN). Association for Academic Surgery. Chicago, IL. November 1996.

Marcus SG, Shamamian P, Dobryansky M, Cohen H, Gouge TH, Pachter HL, Eng K. Endoscopic biliary drainage prior to pancreaticoduodenectomy for periampullary malignancies. American Hepato-Pancreato-Biliary Congress. Miami, FL. February 1997.

Hochwald SN, **Marcus SG**, Naik KS, Dobryansky M, Shamamian P, Rofsky N, Coppa G. Magnetic resonance cholangiopancreatography (MRCP) accurately predicts the presence of choledocholithiasis. Society for Surgery of the Alimentary Tract. Washington, D.C. May 1997.

Shamamian P, Grosso M, Guth A, Diflo T, **Marcus SG**, Coppa GF. Treatment of primary intrahepatic stones with a holmium laser. Society for Surgery of the Alimentary Tract. Washington, D.C. May 1997.

Naik KS, Hochwald S, **Marcus S**, Krinsky G, Rofsky N, Weinreb J, Megibow AJ. Magnetic resonance cholangiopancreatography (MRCP): Using HASTE (Half fourier acquisition single-shot turbo spin-echo) sequence - Clinical evaluation in 97 cases. European Society of Gastrointestinal and Abdominal Radiology. Amsterdam, NE. June 1997.

Zanetta L, **Marcus S**, Dobryanski M, Schwartz J, Yee H, Wieczorek R, Scholes J, Eng K, Shamamian P, Mignatti P. Tumor vascularity determined by semiquantitative reverse transcriptase-polymerase chain reaction (RT-PCR) for von Willebrand Factor (vWF). Association for Academic Surgery. Dallas, TX. November 1997.

Schwartz JD, Shamamian P, **Marcus SG**, Monea S, Patel S, Mitchell J, Zanetta L, Eng K, Mignatti P, Galloway AC. A soluble factor released from neutrophils activates endothelial cell matrix metalloproteinase 2. Association for Academic Surgery. Dallas, TX. November 1997.

Patel S, Pachter HL, Shamamian P, Mitchell J, Schwartz JD, Seghezzi G, Fernandez HA, Kallenbach K, **Marcus SG**, Bauman G, Mignatti P, Galloway AC. Topical hepatic hypothermia (THH) prevents distant organ injury following hepatic ischemia/reperfusion (I/R). Association for Academic Surgery. Dallas, TX. November 1997.

Monea S, Schwartz JD, Shamamian P, **Marcus SG**, Zanetta, Eng K, Galloway AC, Mignatti P. Plasmin-mediated activation of cell-bound matrix metalloproteinase-2 (MMP-2): A mechanism for the control of proteolytic activities involved in tumor invasion and angiogenesis. Association for Academic Surgery. Dallas, TX. November 1997.

Monea S, Lehti K, Shamamian P, **Marcus S**, Galloway AC, Keski-Oja J, Mignatti P. Cooperation between plasmin and membrane-type 1 metalloproteinase (MT1-MMP) in the activation of 72 kDa type IV collagenase (MMP-2) on the cell surface. Vth International Workshop on Molecular and Cellular Biology of Plasminogen Activation. San Diego, CA. November 1997.

Schwartz JD, Monea S, Shamamian P, **Marcus SG**, Whiting D, Galloway AC, Mignatti P. Activation of endothelial or tumor cell progelatinase A (MMP-2) by human polymorphonuclear neutrophils. American Society of Cell Biology. Washington D.C. December, 1997

Monea S, Lehti K, Schwartz J, Shamamian P, **Marcus S**, Galloway AC, Keski-Oja J, Mignatti P. Requirement for plasmin and membrane type 1 matrix metalloproteinase in the cell surface activation of gelatinase A (MMP-2). American Society of Cell Biology. Washington D.C. December, 1997

Patel S, Pachter HL, Galloway AC, Bauman G, **Marcus S**, Schwartz JD, Mignatti P, Shamamian P. Topical hepatic hypothermia (THH) attenuates ischemia/reperfusion (I/R) induced TNF- α release and hepatocellular injury. Society of University Surgeons. Milwaukee, WI. February, 1998.

Schwartz JD, Shamamian P, Monea S, Whiting D, **Marcus SG**, Patel S, Mignatti P, Galloway AC. Activation of tumor cell progelatinase A by neutrophil proteinases requires expression of membrane-type 1 matrix metalloproteinase. Society of University Surgeons. Milwaukee, WI. February, 1998.

Schwartz JD, Shamamian P, Whiting D, **Marcus SG**, Monea S, Patel S, Mignatti P, Galloway AC. Activation of endothelial cell pro-gelatinase A by inflammatory cell-derived serine proteinases. American Association for Cancer Research. New Orleans, LA. April, 1998.

Zanetta L, **Marcus SG**, Vasile J, Schwartz JD, Cohen H, Eng K, Shamamian P, Mignatti P, Mignatti P. Angiogenesis factors upregulate endothelial cell expression of von Willebrand factor (vWF). American Association for Cancer Research. New Orleans, LA. April, 1998.

Hochwald SN, Dobryansky M, Rofsky N, Shamamian P, **Marcus S**. Magnetic resonance imaging (MRI) with magnetic resonance cholangiopancreatography (MRCP) predicts resectability and ductal abnormalities in benign and malignant pancreatic disease. Society for Surgery of the Alimentary Tract. New Orleans, LA. May 1998.

Shamamian P, **Marcus S**, Deutsch E, Maldonado T, Liu A, Stewart J, Eng K, Gilvarg C. Carboxypeptidase A activity in pancreatic cancer and acute pancreatitis. Society for Surgery of the Alimentary Tract. New Orleans, LA. May 1998.

Patel S, Schwartz J, Chaung N, **Marcus S**, Pachter HL, Deutsch E, Galloway AC, Eng K, Mignatti P, Shamamian P. Matrix metalloproteinase (MMP) 2 and 9 activity in experimental acute pancreatitis. Society for Surgery of the Alimentary Tract. New Orleans, LA. May 1998.

Marcus SG, Karpoff HM, Shamamian P, Sivamurthy N, Oh C, Gouge TH, Pachter HL, Eng K. Outcome of patients with pancreatic fistulae following pancreaticoduodenectomy. Pancreas Club. New Orleans, LA. May, 1998.

Pocock BJZ, Monea S, Schwartz JD, Chuang N, **Marcus SG**, Eng K, Mignatti P, Shamamian P. Membrane type-1 matrix metalloproteinase-dependent tumor invasion is enhanced by neutrophil-derived serine proteinases. American College of Surgeons Surgical Forum, Orlando, FL. October, 1998.

Lee H, Ortega J, Karpoff H, Brooks A, Shamamian P, Newman E, Eng K, **Marcus SG**. Increased incidence of gastric carcinoma in asian patients. Chinese American Medical Society. New York, N.Y. November, 1998.

Brooks AD, Gradek CE, Karpoff H, Newman E, Shamamian P, Gouge TH, Pachter HL, Eng K, **Marcus SG**. Decreasing hospital length of stay after pancreaticoduodenectomy. American Hepato-Pancreato-Biliary Congress. Ft. Lauderdale, FL. February 1999.

Marcus SG, Villanueva G, Shamamian P, Newman E, Ortega J, Lam Y. Increased risk of gastric adenocarcinoma in east asian immigrants. Association for Academic Surgery. Philadelphia, PA. November, 1999.

Potmesil M, Newman E, Yee H, Newcomb EW, **Marcus SG**, Ahmed AN, Muggia FM. Neoadjuvant therapy of gastric adenocarcinoma by CPT-11 (Camptosar) and Cisplatin: Preliminary surgical and histopathologic findings. ASCO. May 2000.

Marcus SG, Dave J, Kim S, Newman E, Kim M. Gastric cancer in an underserved population with limited access to health care. 4th International Gastric Cancer Congress. New York, NY. May 2001.

Yee H, Potsemil M, Newcomb E, Newman E, **Marcus S**, Hochster H, Muggia F. Pathomorphologic changes of tumor primary and regional lymph nodes (LN) following neoadjuvant therapy of patients with gastric or gastroesophageal junction (GEJ) carcinoma as indicators of treatment response. 4th International Gastric Cancer Congress. New York, NY. May 2001.

Newman E, **Marcus S**, Potsemil M, Hochster H, Yee H, Sewak S, Hayek M, Muggia F. CPT-11 based neoadjuvant therapy followed by resection and intraperitoneal therapy (IP) for gastric cancer. 4th International Gastric Cancer Congress. New York, NY. May 2001.

Marcus SG, Tian H, Lam Y, Wong C, Ortega J, Newman E, Shamamian P, Garbers S, Villanueva G, Yee H. A prospective evaluation of esophagogastroduodenoscopy (EGD) in a population at increased risk for gastric cancer. Society for Surgery of the Alimentary Tract. Atlanta, GA. May 2001.

Newman E, **Marcus SG**, Potmesil M, Hochster H, Yee H, Sewak S, Hayak M, Muggia FM. CPT-11/Cisplatin neoadjuvant therapy downstages locally advanced gastric cancer. Society for Surgery of the Alimentary Tract. Atlanta, GA. May 2001.

Newman E, Marjanovic N, Alexander A, Mustalish D, Shamamian P, **Marcus S**, Melamed J, Scholes J, Delgado Y, Kaufman A, Jacobson D. Molecular staging in colon cancer (CC) with the aid of sentinel lymphnode (SLN) mapping. Society for Surgery of the Alimentary Tract. Atlanta, GA. May 2001.

Marcus SG, Burkholder HC, Goldberg JD, Porter C, Merali S. Plasma S-adenosylmethionine levels: A methyl donor as a potential aid in the diagnosis of pancreatic cancer. American Hepato-Pancreato-Biliary Congress. Miami Beach, FL. February 2003.

Marcus SG, Burkholder H, Burns P, Goldberg JD, Shivji M, Merali S. Plasma S-Adenosylmethionine level: A methyl donor as a potential aid in the diagnosis and treatment of colorectal cancer. Society for Surgery of the Alimentary Tract. Orlando, FL. May 2003.

Marcus SG, Cohen D, Lin K, Wong K, Thompson S, Rothberger A, Potmesil M, Hiotis S, Newman E. Complications of Gastrectomy following CPT-11 based neoadjuvant chemotherapy for gastric cancer. Society for Surgery of the Alimentary Tract. Orlando, FL. May 2003.

Colen KL, Berman R, **Marcus SG**, Newman E, Hiotis SP. Multi-organ resection for locally advanced gastric cancer: Clinical T4 disease does not accurately predict pathologic T4 disease. Society for Surgery of the Alimentary Tract. Orlando, FL. May 2003.

Newman E, Potmesil M, Ryan T, **Marcus SG**, Yee H, Hochster H, Muggia FM. The effective combination of systemic neoadjuvant chemotherapy, potentially curative surgery, and adjuvant intraperitoneal (IP) chemotherapy in patients with locally advanced gastric or GE-junction carcinoma. ASCO. Chicago, IL. May 2003.

Cho A, Chaudhry A, Minsky-Primus L, **Marcus S**, Diehl D, Tso A, Gany F. Determinants of follow-up and likelihood of participation in a gastric cancer screening intervention. The repeat endoscopy in patients from east asia trial (REPEAT). Chinese-American Medical Society. New York, NY. November, 2003.

Ryan T, Potmesil M, Newman E, **Marcus S**, Muggia FM. A review of New York University Medical Center's experience with intraperitoneal (IP) chemotherapy in patients with locally advanced resected gastric cancer. Gastrointestinal Cancer Symposium. San Francisco, CA. January, 2004.

Klegar EK, Newman E, Berman RS, **Marcus SG**, Hiotis SP. Comprehensive evaluation of the patient with viral hepatitis and potentially respectable hepatocellular carcinoma should include diagnostic laparoscopy and laparoscopic ultrasonography. IHPBA. Washington, D.C. June, 2004.

Newman E, Potmesil M, Ryan T, **Marcus SG**, Hiotis S, yee H, Hochster H, Muggia FM. Effective combination of neoadjuvant systemic chemotherapy, potentially curative surgery, and adjuvant intraperitoneal chemotherapy in patients with locally advanced gastric or gastroesophageal junction carcinoma. Gastrointestinal Oncology Conference. Arlington, VA. July, 2004.

Newman E, Chang RY, Potmesil M, Donahue B, **Marcus SG**, Hiotis SP, Iqbal S, Ryan T, Hochster HS, Muggia FM. Postoperative intraperitoneal (IP) 5'-fluoro-2'-deoxyuridine (FUDR) added to chemoradiation in patients curatively resected (R0) for locally advanced gastric and gastroesophageal junction (GEJ) adenocarcinoma. ASCO. May 2005.

Invited Speaker:

September 4, 1994, Grand Rounds, Department of Surgery, NYU School of Medicine, New York, N.Y., Therapeutic Strategies in Primary Rectal Adenocarcinoma.

April 30, 1997, Grand Rounds, Department of Surgery, NYU School of Medicine, New York, N.Y., Malignant Obstructive Jaundice.

October 24, 2001, Grand Rounds, Department of Medicine, North General Hospital, New York, N.Y., Necrotizing Pancreatitis,

January 3, 2002, Grand Rounds, Department of Surgery, Good Samaritan Hospital, West Islip, N.Y., Necrotizing Pancreatitis,

April 11, 2002, Provincial Bureau of Health of Fujian Province, Fuzhou, People's Republic of China, Current Concepts in the Treatment of Gastric Cancer.

May 22, 2002, Grand Rounds, Department of Surgery, NYU School of Medicine, New York, N.Y., New Modalities in the Diagnosis and Treatment of Colorectal Cancer.

June 5, 2002, Combined Radiation Oncology/Medical Oncology Program, NYU School of Medicine, New York, N.Y., New Modalities in the Diagnosis and Treatment of Colorectal Cancer.

October 7, 2002, American College of Surgeons Surgical Forum, Alimentary Tract I: Pancreas; Discussant, "Activation of the Vanilloid Receptor-1 Mediates Inflammation in Obstructive Pancreatitis in Rats" by Jaimie D. Nathan, MD.

October 22, 2003, Chicago, IL. Symposium Participant: Chronic Pancreatitis.

November 12, 2003, Grand Rounds, Department of Surgery, St. Joseph's Medical Center, Yonkers, N.Y. Current Concepts in Gastric Cancer.

March 15, 2005, American Express Corporation, New York, N.Y. Colorectal Cancer Awareness, What You Should Know.

March 9, 2012. Americas Hepato-Pancreato-Biliary Association, Miami, FL. Debate: Neoadjuvant Therapy is the Standard of Care for Pancreatic Cancer. Co-moderator.

March 22, 2012. Society of Surgical Oncology, Orlando, FL. Using Ongoing Professional Practice Evaluation (OPPE) to Improve Cancer Patient Outcomes.

July 12, 2012. Columbia University College of Physicians and Surgeons, Division of Hematology and Oncology. New York, N.Y. Grand Rounds. Patient Safety Initiatives in Cancer Care.

November 10, 2012. Lebo-DeSantie Center Pancreatic Cancer Symposium, St. Vincent's Medical Center, Bridgeport, CT. The Rising Incidence of Pancreatic Cancer.

September 19, 2013. St. Vincent's Listen and Learn Series. Fairfield, CT. How The Affordable Care Act Will Affect Patients

November 6, 2013. St. Vincent's Listen and Learn Series. Bridgeport, CT. How The Affordable Care Act Will Affect Patients

May 5, 2014. Society for Surgery of the Alimentary Tract (SSAT), Chicago, IL. The 2014 National Debate: Expected and Unintended Consequences of the Affordable Care Act. Positive Impact on Surgeons

April 21, 2015. American Association for Physician Leadership, Annual Meeting and Spring Institute, Las Vegas, NV. Preparing for the CEO Role.

DALE DANOWSKI, R.N. MBA, BSN
131 KYLES WAY, UNIT 73
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ddanowski@stvincents.org

Summary

Healthcare Executive with thirty years of leadership experience. Proven Transformational Leader in Nursing Management/Operations, Project Management, Strategic Planning and Physician Relations.

Experience

St. Vincent's Medical Center Bridgeport CT

October 2012-Present

Senior Vice President, Chief Operating Officer/Chief Nursing Officer

- Achieved Magnet Designation November 2013
- Administrative responsibility for Behavioral Health, Oncology, Women's Health/Pediatric Service Lines as well as Laboratory, Radiology and Pharmacy services.
- Senior Nursing Executive across system
- Report directly to President/Chief Executive Officer. Active participant on governing board and President's Council.

March 2005-October 2012

Vice President Patient Care Services/Chief Nursing Officer

- Responsible for Evidence Based Nursing Practice and Standards across the organization
- Ensure coordination and compliance with regulatory standards
- Administrative responsibility for Nursing Service, Nursing Staff Education, Radiology, Women's Health/Pediatric Service Line
- Responsible for Strategic Planning, Program Development, Performance Improvement, Marketing and Budget performance.
- Nursing Champion for Patient Safety and Patient Experience
- Oversaw Nursing Shared Governance Council structure to ensure staff nurse voice and participation in decision making

November 2001-March 2005

Vice President Clinical Service Line Management and Physician Services.

- Reported directly to Corporate Sr. VP/Chief Medical Officer. Responsible for Medical Staff Office and Physician Liaison functions.
- Responsible for strategic planning, program development and management of the Orthopedic, Cardiovascular, Oncology, Urgent and Emergent Care and Rehabilitation Service Lines.
- Administrative leader for Emergency Department, Urgent Care Centers, Occupational Health and Physician Services.
- Special Projects - Internal Consultant (Peri-Operative Service).

1991-2002 Director Medical-Surgical Nursing Services

- Progressive responsibility for multiple nursing departments.
- Facilitated major change in frontline management, mentoring four new Nursing Supervisors.
- Planned and implemented an Acute Rehabilitation Unit.
- Planned and implemented the Ambulatory Infusion Center.
- Developed and implemented a consolidation plan to reduce inpatient Surgical Service.
- Led the initiative to implement new Nurse Call and Remote Telemetry Systems.
- Facilitated a major revision in skill mix, introducing the CNA role.

1984-1991 Nursing Supervisor-Medical Nursing Unit

- Successful leadership of a 32 bed Acute Medical Unit.
- Intensively recruited and oriented majority of nursing staff.
- Established very high patient/staff satisfaction with low turnover
- Implemented Stroke Program-decreased LOS and improved care.

1981-1984 Staff Nurse-Medical Unit

Education

July 1990 University of New Haven-West Haven, CT
Masters Business Administration-Health Care Management

May 1981 University of Connecticut-Storrs, CT
Bachelor of Science Degree-Nursing

Membership

American Organization of Nurse Executives
American College of Healthcare Executives
Organization of Nurse Executives-Connecticut
American Nurses Association
Connecticut Nurses Association

CURRICULUM VITAE

RUBEN KIEM, M.D., Condensed 3/10/98

WORK ADDRESS:

Diagnostic Radiology, Bridgeport Hospital,
267 Grant Street, Bridgeport, CT 06610
Phone: 203-384-3170, FAX: 203-384-3030

EDUCATION:

High School: West Charlotte High School, Charlotte, NC,
graduated 1975
Honors: Valedictorian, Senior Class Vice President

College: Harvard University, Cambridge, MA, 1975 - 1979,
Bachelor of Arts in Biochemistry
Honors: Summa Cum Laude, Phi Beta Kappa, Detur Book Prize,
Whitaker Scholarship, John Harvard Scholarship

Medical School: Duke University Medical Center, Durham, NC,
Aug. 1979 - Oct. 1982, M.D.

INTERNSHIP:

Duke University Medical Center, Durham, NC, Department of
Surgery, Nov. 1982 - June 1983

RESIDENCY:

Duke University Medical Center, Durham, NC, Diagnostic
Radiology, July 1983 - June 1987

FELLOWSHIP:

Yale University School of Medicine, New Haven, CT,
Magnetic Resonance/Ultrasound/Computed Tomography,
July 1987 - June 1988

BOARD CERTIFICATION:

American Board of Radiology, June, 1987.
Medical Licensure: North Carolina #28879, Connecticut#028028

CURRENT POSITION:

Attending Radiologist, Bridgeport Hospital
Director of Body and Musculoskeletal MR Imaging,
Bridgeport MRI Center
Co-medical Director, Connecticut Open MRI

FACULTY APPOINTMENTS:

Yale University School of Medicine, Department of Radiology

1992-present: Clinical Assistant Professor of Radiology
1988-1992: Assistant Professor of Radiology
July-Dec 1989: Acting Director of Computed Tomography
Jan-Aug 1991: Acting Director of Clinical MR Imaging

PROFESSIONAL HONORS:

Editor's Recognition Award for Reviewing Manuscripts
Submitted to Radiology:
1989, 1990 and 1993, with Distinction
1991, 1992 and 1994 with Special Distinction

PROFESSIONAL ACTIVITIES:

Associate Editor of Radiology for articles related to MRI
and CT of the abdomen and pelvis, 1995 - present

Manuscript Reviewer for the following journals:

1989-Present	Radiology
1989-1993	Magnetic Resonance Imaging
1992-1993	Amer. Journal Roentgenology
1989 (Guest reviewer)	J. Clin. Endocrin. & Metab.
1990 (Guest reviewer)	J. Clinical Gastroenterology
1991 (Guest reviewer)	New England Journal Medicine

Program Director, Yale Postgraduate Course in MR Imaging:

May 22-24 and October 16-18, 1989
May 21-23 and October 22-24, 1990
May 20-22 and October 21-23, 1991
May 18-20, 1992

Director of Cross-Sectional Fellowship Training Program,
Yale Diagnostic Radiology, 1989-1992

Memberships in Professional Societies:
Radiological Society of North America
Society for Magnetic Resonance
American Roentgen Ray Society
American College of Radiology

Society for Magnetic Resonance Imaging - Activities:

Abstract reviewer for the 1991-1993 Annual
Meetings,
Moderator of annual scientific sessions, 1992 &
1993

MOST RECENT PUBLICATIONS:

1. Kier R. Magnetic resonance imaging of plantar fasciitis and other causes of heel pain. MRI Clinics of North America 1994, 2:97-107.
2. Kier R. MR imaging of the uterus. MRI Clinics of North America 1994, 2:189-210.
3. Lenchik L, Kier R. Popliteal cysts on MR imaging: Value as an ancillary sign of meniscal tears. American Journal of Roentgenology 1996,166:1232.
4. Patani S, Kier R, Deal R, Luchansky E. MRI of uterine leiomyosarcoma, Magnetic Resonance Imaging 1995, 13:331-333.
5. Silverman C, Kier R. Subligamentous disk herniations on MRI: technical considerations, American Journal of Neuroradiology 1996, 17:397.
6. Kier R, Mason B. Water-suppressed MR imaging of focal fatty infiltration of the liver, Radiology 1997, 203:575-576.

**Curriculum Vitae
Thomas D. Olsavsky, M.D.**

Date of Birth: September 7, 1955

Place of Birth: Bridgeport, Connecticut

Citizenship: USA

ACADEMIC TRAINING

1981 – M.D., University of Connecticut School of Medicine, Farmington, CT,
Connecticut License #26223

1977 – B.S. Degree, Georgetown University, Washington, D.C.

TRAINING

July 1982 – June 1985 – Resident, Diagnostic Radiology, George Washington University
Medical Center. Washington, D.C.

July 1981 – June 1982 – Resident, Internal Medicine, St. Mary's Hospital, Waterbury,
CT

BOARD QUALIFICATIONS

June 6, 1986 – Diplomate, American Board of Radiology

June 1, 1982 – Diplomate, National Board of Medical Examiners

MILITARY None

PROFESSIONAL ASSOCIATIONS

Society of Nuclear Medicine and Molecular Imaging
American College of Radiology
Radiological Society of North America
American Institute of Ultrasound in Medicine
American Roentgen Ray Society
Radiological Society of Connecticut
Connecticut State Medical Society
Fairfield County Medical Association

ACADEMIC APPOINTMENTS

February 2013 – Present - Assistant Professor of Radiology, Frank H. Netter M.D.,
School of Medicine Quinnipiac University, Hamden, CT

November 2009 – Present - Clinical Associate, Department of Diagnostic Imaging and
Therapeutics, University of Connecticut School of Medicine, Farmington, CT

June 1999 – November 2006 – Assistant Clinical Professor of Radiology, Columbia
University, New York, NY

**CURRICULUM VITAE
THOMAS D. OLSAVSKY, M.D.**

ACADEMIC APPOINTMENTS

July 1982 - June 1985 – Assistant in Radiology, George Washington University School of Medicine and Health Sciences, Washington, D.C.

HOSPITAL APPOINTMENTS

April 2012 – Present – Pediatric network Attending Radiologist, Yale New Haven Hospital, New Haven, CT

December 2011 – Present – Provisional Assistant Attending Radiologist, Bridgeport Hospital, Bridgeport, CT

May 2003 – Present – Chief, Nuclear Medicine, Attending Radiologist, St. Vincent's Medical Center Bridgeport, CT

July 1985 – May 2003 – Chief Abdominal Imaging (GI/GU) Attending Radiologist, St. Vincent's Medical Center, Bridgeport, CT

HONORS

PHI BETA KAPPA

SAINT VINCENT'S MEDICAL CENTER COMMITTEES

Medical Staff Evaluation Committee (Peer Review)
Credentials Committee
Radiation Safety Committee

TEACHING RESPONSIBILITIES

St. Vincent's Medical Center: 1) Focused one-hour monthly lecture in Nuclear Medicine and other modalities. Audience consists of Radiology staff and residents. 2) Daily review of all cases with residents. 3) Participation in monthly departmental "Interesting Case" Conferences.

PUBLICATIONS

NEONATAL TESTICULAR TORSION WITH AN UNUSUAL SONOGRAPHIC FEATURE; SINGHAL, A.; AGARWAL; A, METUGE; J. AND OLSAVSKY T., (2012), J CLIN. ULTRASOUND, 40: 243-246, May 2012

"PAGET SCHROETTER SYNDROME"; UDESHI M.; OLSAVSKY TD, Applied Radiology, May 1, 2008

CURRICULUM VITAE
THOMAS D. OLSAVSKY, M.D.

PUBLICATIONS

GASTROINTESTINAL STROMAL TUMOR ORIGINATING IN THE STOMACH; MARTINEZ F, GAGLIARDI JA, OLSAVSKY TD, Applied Radiology 2006, July issue, 43-46

"GENITOURINARY RADIOLOGY," OLSAVSKY, TD, CHAPTER IN PRACTICAL GUIDE TO DIAGNOSTIC IMAGING, ST. LOUIS: MOSBY, 1998

SEAN M. MATHEWS

42 Main Street #1113, Slatersville, Rhode Island 02876

(469) 278-6309; mathews.sean@gmail.com

Certifications: American Board of Radiology, Nuclear Medical Physics (2013)

Licenses: State of Texas Medical Nuclear Physicist Full License
State of Rhode Island Radiation Physics Services

Professional Experience

Medical Physicist III with Landauer Medical Physics – Providence, Rhode Island, January

2014 - Present

- Manage team of Medical Physicists providing services to Southern New England clients
- Radiation Safety Officer for Rhode Island Hospital Broad Scope Materials License
- Provide clients with Radiation Protection Program and Nuclear Medicine Imaging quality control assessments

Medical Physicist I with Baylor Health Care System – Dallas, Texas, December 2009 to December 2013

Radiation Safety

- Designated as Assistant Radiation Safety Officer on Baylor University Medical Center's broad scope license
- Correspond with State regarding hospitals' RAM license amendment requests and renewals
- Support hospitals during RAM license inspections by being present to meet and guide State officials
- Perform regular audits of the Radiation Protection Program for the broad scope license and for several RAM licenses throughout Baylor Health Care System
- Perform audits and surveys for research labs and irradiator units on broad scope license
- Provide IRB consent form radiation risk language for human research protocols involving radiation procedures
- Investigate and refresh radiation safety practices for ALARA II letter recipients
- Train authorized-user designates on irradiator safety and security in view of increased controls
- Provide RAM handler initial and refresher training for research labs
- Frequently give in-services on radiation safety to Nuclear Medicine, Nuclear Cardiology, Radiology, and nursing personnel
- Provide radiation safety support for I-125 prostate implant, I-131 thyroid ablation, Y-90 microsphere and Ra-223 therapy procedures

Medical Physics

- Assess the performance of Nuclear Medicine cameras, dedicated cardiac cameras, SPECT/CTs, PET/CTs, and a Positron Emission Mammography unit
- Assess the performance of Radiology imaging equipment including, radiographic systems, fluoroscopic systems, ultrasound, and CT
- Provide Joint Commission and ACR accreditation support for licensees and registrants
- Calculate fetal, patient, and estimated skin doses for requesting physicians
- Support CT protocol optimization

- Design shielding and perform shielding integrity for radiographic, fluoroscopic, and CT suites

Teaching

- Cardiology Fellows for 80 hours of radionuclide handling instruction
- Radiology Residents, year-round lectures and exam prep
- Nuclear Medicine Technology Students, Physics and Instrumentation

Committees

- Radiation Safety (2)
- Institutional Review Board, primary reviewer, Radiation Safety
- Medical physics residency committee member, until 2012 (program ended)
- CT Protocol and Fluoroscopically Guided Interventional Radiation Protocol committees

Training

- Five-day medical RSO course, Oak Ridge Associated Universities, August 2011
- MD Anderson NM & PET Hands-on Workshop: Annual Testing and Accreditation, October 19-21, 2012
- Medical Management of CBRNE Events, 16 hours, Texas A&M Engineering Extension Service

Licensed Medical Physicist with Radcom Associates, Inc. – Dallas, Texas, August 2012 to December 2013 (Part-time position)

- Assisted client in RAM license renewal
- Remodeling a new client's radiation protection program that has accumulated recurring notices of violation and monetary fines
- Assess the performance of Nuclear Medicine and Radiology imaging modalities for clients

Physicist Assistant with Bluegrass Radiological Physics – Lexington, Kentucky, May 2008 - June, 2009 (Part-time position)

- Analyzed sealed source leak-test wipes and completed appropriate documentation
- Performed linearity-test on dose calibrator data submitted by clients
- Calibrated GM meters, ionization chambers & pocket dosimeters
- Assisted in shielding design plans & various imaging modality QA reports

Facility Representative with the Department of Energy – Aiken, SC, September, 2006 - August, 2007

- Performed Conduct of Operations assessments for DOE nuclear facilities
- Ensured radiological work practices were performed in a safe and environmentally sound manner
- Earned division recognition for quality assessment input

Education

University of Kentucky – Lexington, Kentucky

Master of Science in Radiological Medical Physics, August 2009

- GPA: 3.86 on 4.00 scale
- CAMPEP Accredited Program, with 18 month part-time clinical practicum (therapeutic emphasis)

East Tennessee State University – Johnson City, Tennessee

Bachelor of Science in Physics (Mathematics Minor)

- Graduated Summa Cum Laude, 3.85 on 4.00 scale, May 2006

United States Naval Nuclear Power Training – December, 1994 - November, 1996

- Naval Nuclear Power Training Unit, Goose Creek, South Carolina: May-Nov. 1996

- Naval Nuclear Power School, Orlando, Florida: October 1995 - April 1996

- Naval Nuclear Field "A" School, Orlando, Florida: April 1995 - June 1995

Other Previous Work Experience

Department of Physics, ETSU – Johnson City, Tennessee

Research Assistant: March, 2005 - August, 2006 (Part-time position)

The Home Depot – Johnson City, Tennessee

Customer Service: March, 2004 - February, 2005 (Part-time position)

Tutoring

Physics and Mathematics: January, 2001 - December, 2006 (Part-time self employment)

PacOrd – Norfolk, Virginia

Electrical contract work: June, 2000 - August, 2000 (Summer before entering university)

United States Navy, December, 1994 - December, 2000

Associations

AAPM member - January, 2008 to Present

Health Physics Society

Military Honors and Awards

Admiral's Letter of Commendation

Commanding Officer's Letter of Commendation (3)

Commanding Officer's Letter of Appreciation (3)

Good Conduct Medal, National Defense Service Medal (2), Armed Forces Expeditionary Medal (2)

CURTIS L. McCLOGGAN, MHA, RT (R)

3 Eden Ct
Monroe, Connecticut 06606
401 451-1802
cmccloggan@msn.com

Summary Statement: Multi-faceted, efficient and reliable healthcare manager with 10+ years of experience supporting hospital imaging environments. I am proficient with RIS/HIS systems, PACS and related software. Diversified skill sets covering staff support, client relations, intra and interdepartmental collaborations, fiscal accountability and project management. I have excellent inter-personal, phone and digital communication skills; offering a unique combination of creativity with the ability to assess the positive or negative points to create cost-effective solutions for the institution.

PROFESSIONAL EXPERIENCE

St. Vincent's Medical Center~Bridgeport, Conn
Administrative Director of Radiology

3/2015-

Responsible for planning, organizing, directing, and evaluating activities in the Imaging Department in accordance with Regulatory Standards and in compliance with the Medical Center's goals and objectives. Other duties include the development of policies and procedures pertaining to the effective, efficient functioning of the Imaging Department with presentations to the Medical Center Administration. Accountable to ensure that all imaging services provided are of high quality and to seek to continuously improve them in collaboration with the Department Chairperson.

KENT COUNTY MEMORIAL HOSPITAL -- Warwick, RI
Site Manager/Assistant Director

2005-12/2013

Clinically and operationally responsible for a radiology department that provides 138,000 annual imaging exams. Work collaboratively with the Corporate Director setting the department budget and maintaining fiscal accountability. Oversee timekeeping, employee evaluations, meeting applicable regulatory standards, approving supply orders and departmental strategic planning. Managed 4 supervisors, 4 lead techs ,35 tech aides and other ancillary staff and 1 lead receptionist.

Achievements

- Challenged to achieve an outpatient/ED volume of 35,426 exams in 2011-12. I surpassed this goal by achieving a volume of 36,322 which was 2% or 896 exams over budget.
- Radiology area surpassed the productivity goal for the year by 2.56% and the Support area also ended with a positive variance.
- Become a green belt in Six Sigma in June 2012.
- Part of the Just Culture committee. Appointed by the CEO to be part of a committee to focus on improving our organization's disposition and transforming it from a punitive climate to a more just and fair culture.
- Created efficiency in our ordering process by identifying our most frequent exams and eliminating those exams less commonly used.
- Created a Physicians' Preference File (PPF) to identify the needs of the referring physicians.
- Updated the Radiology Department to full digital in less than 2 years. Reduced film and CAP budgets resulting in a \$1.2 M savings in past 4 years.
- Negotiated, purchased and implemented two new R/F rooms, several portable G.E. x-ray and ultrasound machines and four dry printers in five years.
- Assisted Bio-Med Department with contract negotiations regarding third party vendors.

- Effectively promoted intra-departmental and inter-departmental relationships.
- Implemented a continuous monitoring process and evaluation of performance improvement and CQI activities.
- Successfully provided cross-training to reduce departmental overtime and boost staff morale.
- Successfully altered employee shifts to provide continuous weekend coverage
- Worked with a team to create a Radiology SharePoint, an intra-departmental communication tool.

R.I.HOSPITAL SCHOOL OF IMAGING – Providence, RI
Clinical Coordinator

2011-2012

- Responsible for preparing students to be successful in the art and science of Radiography. Encouraging them to value life long learning as a means to achieve personal and professional growth.
- Evaluate student performance as well as make suggestions on how to improve their work ethic

MOUNT SINAI NYU HOSPITAL FOR JOINT DISEASE- New York, NY
Chief Technical Manager

2003-2005

Responsible for managing the Imaging Department of 70 employees including FT, PT and per diem technologists and other ancillary staff. Provided over 11,000 comprehensive diagnostic imaging examinations per month.

Achievements

- Implemented digital radiology for hospital's private, off-campus, orthopedic outpatient department that delivered 60,000+ radiologic examinations per year. This resulted in reduction of wait times and improved patient satisfaction.
- Worked on budgets prepared by the Administrative Director of Radiology. Successfully allocated expenses to the proper cost centers resulting in reduced waste and duplication.
- Selected to serve on the medical staff as a radiologic technologist at Shea Stadium, home of the NY Mets baseball team.
- Successfully raised staff morale and stability by forming groups to address departmental issues.

BETH ISRAEL MEDICAL CENTER- New York, NY
Technical Manager

2001-2003

Supervisory responsibilities included hiring, interviewing, scheduling, conducting performance evaluations, providing disciplinary action and recommending salary increases.

Achievements

- Successfully improved morale by providing clinical assistance to 40 technologists and ancillary personnel in all sections of the radiology department handling nearly 140,000 imaging cases per year.
- Oversaw ongoing departmental quality efforts, ie. repeat & reject analysis, a statistical study which shows how well individual techs and the department have done relative to the 2% national average of films needing to be repeated

EDUCATION

Walden University – Baltimore, MD.
Masters of Health Administration
Major course work in general Health Admin
Grade point average 3.85/4.0

2011

ST. JOSEPH'S COLLEGE - Brooklyn, New York **2000**
Bachelor of Science in Health Administration
Major course work in Healthcare Delivery Systems and Management
Grade point average 3.55/4.0

NEW YORK CITY TECHNICAL COLLEGE - Brooklyn, New York **1994**
A.A.S, Radiological Technology, AART Certification
Major course work consisted of Radiation Protection and Radiological Technology.
Honors include selection to **Dean's List** 1992-1994, **Otto Klitgord Memorial Award** for outstanding service and leadership, **Rem Rad Club Award** for outstanding service to the Radiological Department and a **clinical award** for professionalism.

PROFESSIONAL ASSOCIATIONS

I am a member of the **American College of Healthcare Executives (ACHE)**, currently working towards my Fellowship, as well as a member of the **Association for Medical Imaging Management (AHRA)**.

I serve on one of the committees for the **Hospital Association of Rhode Island (HARI)** recruiting members for the ACHE.

I was also a member of **The Urban League** as well as **The Young Professionals of Rhode Island**, volunteering my services as a mentor to underprivileged individuals.

LaTishia Greene
703 Thompson St.
East Haven, CT. 06513
(203) 214-8414
latishia@hotmail.com

Education

Master of Public Health (M.P.H.)	2009-2013
Walden University	Online/ Minneapolis, MN
Certificate, Diagnostic Ultrasound/Echocardiography	2002-2003
Yale New Haven Hospital School of Ultrasound	New Haven, CT
B.S. Radiologic Science, X-Ray/MRI	1997-2001
University of North Carolina at Chapel Hill	Chapel Hill, NC

Professional Registries and Certifications

RT(R): May 2001- Present
RDMS(AB)(OB/GYN): Jan 2003 - Present
RDCS: Jan 2004- Present
CPR Certified

Professional Committees and Groups

SVMC Cardiology Practice Council Committee

This committee is geared toward developing and implementing quality improvement goals for the cardiology service line at St. Vincent's.

Echo Quality Improvement Committee

In collaboration with the medical director of echocardiography, echocardiographers review studies to ensure that the quality of imaging and practice is in accordance with department protocols and standards.

Dr. Martin Luther King Jr. Love March Committee

A group formed through Shiloh Missionary Baptist Church to facilitate an annual event designed to commemorate the civil rights leader. My position on the committee is involved with marketing, advertisement, and communication with city officials who will attend and/or speak at the event.

Employment/Full Time

Radiology Manager Jan 2013- Present
St. Vincents Medical Center Bridgeport, CT.
Work duties include supervising and evaluating the radiology staff, as well as planning, directing, and establishing department goals. Departmental activities such as budget development, equipment quality control and maintenance, inventory and ordering of supplies, and performance improvement are also handled.

Echo cardiographer Jan 2004- Jan 2013
St. Vincents Medical Center Bridgeport, CT.
Performed echocardiography exams, including transthoracic, transesophageal, and stress echocardiograms, as well as contrast and emergency imaging.
Collaborated with cardiologists to interpret exams and offer recommendations for optimal patient care.

Ultrasound Technologist/Per Diem March 2005-Jan 2013
Whitney Imaging Center Hamden, CT.
Work as a staff technologist, performing cardiac, abdominal, OB/GYN, vascular, and small parts ultrasound studies. Provide clinical education and hands on training for students in the Quinnipiac University ultrasound program.

Vascular Ultrasound Technologist/Per Diem Oct. 2011-Jan 2013
Cardiology Physicians of Fairfield County Trumbull, CT.
Execute both cardiac and vascular ultrasound exams in an outpatient setting.

Vascular Ultrasound Technologist March 2005-Sept. 2011
Cardiology Physicians, PC. Bridgeport, CT.
Delivered cardiac and vascular services in an outpatient setting

Ultrasound Technologist Jan 2004-March 2005
Yale New Haven Hospital New Haven, CT.

Scanned abdominal, OB/GYN, vascular, small parts, and biopsy procedures as well as transthoracic and transesophageal echocardiography exams. Participated in clinical training of students in Yale School of Ultrasound.

MRI Technologist June 2003-Sept. 2005
Yale New Haven Hospital New Haven, CT.
Per Diem position conducting MRI/MRA exams on both inpatients and outpatients

Ultrasound Technologist/Temp Jan 2003-June 2003
Yale New Haven Ambulatory Services New Haven, CT.
Performed sonography exams in abdominal, OB/GYN, vascular, small parts, and biopsy procedures.

MRI Technologist June 2001-June 2003
The Stamford Hospital Stamford, CT.
Performed MRI/MRA procedures in both an inpatient and outpatient setting.
Contributed to efficiency of procedures, patient care, and daily operations of the department.

Radiologic Technologist August 2000- June 2001
Wesley Long Hospital Greensboro, NC
Completed diagnostic radiographic procedures ranging from general X-ray imaging, to portable radiography and fluoroscopic procedures.

References available upon request

Hiral Shah
201-595-9660
yourshiral@gmail.com

13 Aspetuck lane,
Monroe,CT 06468

OBJECTIVE

Seek the Position of Nuclear Medicine Diagnostic Technician and provide high quality patient care with the help of medical and technical skills and compassion.

PROFESSIONAL SUMMARY

- Team oriented with superior organizational and interpersonal skills.
- Maintain excellent rapport with patients, co-workers and doctors.
- Work well under pressure and establish priorities to complete an assignment in a timely manner.

PROFESSIONAL EXPERIENCE

ST.VINCENTS MEDICAL CENTER,BRIDGEPORT,CT

08/2008 To Present:

Full Time Level II Technologist. Also work as a PET/CT Technologist.

- Performed nuclear medicine technologist duties in the NM Department.
- Extensive clinical experience on a full range of procedures in General NM & Nuclear Cardiology.
- Preparation, QC & administration of radiopharmaceuticals, Equipment QC.
- Great ability to learn quickly and work under pressure.
- Uncommon ability to use initiative and work independently.

New York Presbyterian Medical Center, New York, NY:

04/06 To 04/07 Nuclear Medicine Technologist - clinical internship.

- Performed nuclear medicine technologist duties in the NM Department.
- Extensive clinical experience on a full range of procedures in General NM & Nuclear Cardiology.
- Preparation, QC & administration of radiopharmaceuticals, Equipment QC.
- Great ability to learn quickly and work under pressure.
- Uncommon ability to use initiative and work independently.

Kreitchman PET Center, Columbia University, New York,NY

Columbia-Presbyterian Medical Center

10/06 to 11/06 PET/CT training rotation

New York Presbyterian Medical Center, New York, NY:

Nuclear pharmacy training.

Medical business Administration,Chattanooga,TN.

08/05 to 04/06 :Worked full time in Medical billing and coding for doctors.

Mumbadevi Hospital, Vile parle,Mumbai:

01/03 to 12/03 Clinical internship training.

- Attended various out patient department and treated patients under supervision of senior doctors.
- Assisting the medical officer in various health care programs such as Immunization program, School health program and Tuberculosis control program.

EDUCATION/QUALIFICATION

- 2009 Certificate course for Computed Tomography. St.Vincent's College,Bridgeport,CT
- 2007 Post-Baccalaureate **Nuclear Medicine Technology Certificate**
Program with **High Honors**. Institute of Allied Medical Professions, New York, NY.
- 2002 **Bachelors of Homoeopathic Medicine and Surgery**
Smt.Chandaben Mohanbhai Patel Homoeopathic Medical College, Vile parle, Mumbai.
Medical licence: Registration no 37150 issued by **Maharashtra Council**
Of Homoeopathy, India.

PROFESSIONAL CERTIFICATION

- American Registry of Radio logic Technologists.
- Nuclear Medicine Technology Certification Board.
- Society of Nuclear Medicine

ADDITIONAL PERSONAL INFORMATION

- Interested in reading, music and debates.

References Available Upon Request

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Hardworking, innovative Nuclear Medicine technologist offering in-depth industry knowledge and follow department protocols to meet and exceed the needs of the patient and organization. Recognized for consistently meeting corporate goals and fulfilling requirements for NRC, JACHO and OSHA compliance. Collaborative team player with diverse skill set in imaging, patient care and customer service.

Professional Skills

- Experienced in assuring quality operations through equipment monitoring and maintenance communication and fulfillment of regulatory requirements, and enforcement of safety precautions.
- Possess strong interpersonal, communication, and negotiation skills evidenced through effective communications with personnel and clients at all organizational levels.
- Position patients and adjust immobilization devices
- Explain procedures to patients and address concerns
- Administer and record isotope dosage
- Perform diagnostic studies on patients using various scanners or scintillation cameras
- Administer therapeutic doses of radiopharmaceuticals under direction of physician
- Maintain and calibrate equipment
- Monitor, record and communicate as appropriate utilizing computerized documentation systems
- Utilize knowledge of age specific needs of patient in performance of duties and responsibilities
- Follow radiation safety techniques in use and disposal of radioactive materials
- Follow Standard Precautions using personal protective equipment as required
- Prepare radioactive isotopes for administration to patients in accordance with physicians' orders

Professional Experience

- **GREATER HARTFORD CARDIOLOGY GROUP**
 - Nuclear medicine Technologist..... 2013—2013
- **ST. VINCENT'S MEDICAL CENTER**
 - PET/Nuclear Medicine Technologist.....per diem.....2012—Present
- **CT HEART & VASCULAR CENTER**
 - Nuclear Medicine Technologist.....per diem.....2010—Present
- **R D RUSSO & ASSOCIATES**
 - PET/Nuclear Medicine Technologist.....2009—2012

- **MURPHY SECURITY**
 - Security Guard.....2005—2013
- **WALKABOUT COMPUTERS**
 - Final Test Technician.....2004—2005
- **THE CONNECTICUT HOSPICE**
 - Junior Network Specialist.....2003—2004
- **VECTRON INTERNATIONAL**
 - Network Specialist/ Electronic Documentation Manager.....1996 — 2002
 - Documentation Coordinator.....1995 — 1996
 - Electronic Technician..... 1994 — 1995

Education

- **Briarwood College**
 - Associate of Science Degree in Nuclear Medicine Technology
- **Fairfield University**
 - Computer Engineering/Networking Studies
- **Norwalk Technical College**
 - Associate of Science Degree In Electrical Engineering

Certifications

- **CNMT**
- **CPR**

References available upon request

Attachments
Scholarly Articles

The Value and Practice of Attenuation Correction for Myocardial Perfusion SPECT Imaging: A Joint Position Statement from the American Society of Nuclear Cardiology and the Society of Nuclear Medicine

Robert C. Hendel, MD; James R. Corbett, MD; S. James Cullom, PhD; E. Gordon DePuey, MD; Ernest V. Garcia, PhD; and Timothy M. Bateman, MD

Despite advancements in technologies, non-uniform soft tissue attenuation still affects the diagnostic accuracy of single photon emission computed tomography (SPECT) myocardial perfusion imaging. A variety of indirect measures have been used to reduce the impact of attenuation, most notably electrocardiography-gated SPECT imaging. However, all available techniques have limitations, making interpretation in the presence of attenuation difficult. The ultimate solution, similar to positron emission tomography imaging, is to use hardware/software algorithms to eliminate attenuation and provide images that are more uniform and easier to interpret. Several attenuation correction solutions are currently available and more will be available soon. The value of these solutions has been varied, particularly with clinical applications. Guidelines and standards clearly are necessary.

In recognition of the importance of this issue, the American Society of Nuclear Cardiology and the Society of Nuclear Medicine convened a joint task force to develop a position statement on attenuation correction. It is being published concurrently in the *Journal of Nuclear Cardiology* and *The Journal of Nuclear Medicine*, a first for these societies.

The purpose of this position statement is to clarify the role of attenuation correction in SPECT procedures, to provide guidelines for its clinical use, and to provide a basis for the evaluation of published validation. It is hoped that this position statement will provide an important and useful road map to the widespread adoption of attenuation correction into clinical practice.

Gary V. Heller, MD, PhD
President, American Society of Nuclear Cardiology

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President, Society of Nuclear Medicine

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Key Words: attenuation correction; SPECT; myocardial perfusion; guidelines

J Nucl Med 2002; 43:273-280

PREAMBLE

The diagnostic accuracy of single photon emission computed tomography (SPECT) myocardial perfusion imaging is profoundly influenced by the presence of tissue attenuation. Although interpretative education, experience, and the application of gated SPECT imaging have had a favorable impact on the clinical value of radionuclide perfusion imaging, the nuclear cardiology community has long-awaited correction techniques for photon attenuation. The purposes of this statement are to review the recent developments in the field of attenuation correction, to define its clinical utility, and to delineate contemporary recommendations regarding attenuation correction techniques.

BACKGROUND

Soft tissue attenuation, Compton scatter, and depth-dependent reduction of spatial resolution degrade myocardial perfusion SPECT image quality, thereby decreasing test sensitivity in the detection of coronary artery disease. In addition, localized soft tissue attenuation by the breasts, lateral chest wall, abdomen, and left hemidiaphragm may create artifacts that mimic true perfusion abnormalities and thereby decrease test specificity.

Conventional SPECT imaging has used a variety of techniques to minimize the impact of attenuation, including breast binding, prone imaging, and electrocardiography-gated SPECT imaging. However, each technique is an indirect solution and possesses specific limitations. For example, normal regional wall motion on a gated SPECT study after stress is not helpful in distinguishing artifact from

ischemia in the presence of a reversible perfusion defect. Therefore gated SPECT and other methods fail to provide a universal solution for attenuation artifacts.

The diagnostic accuracy of conventional SPECT is also compromised by artifacts associated with localized subdiaphragmatic tracer concentration in the abdominal viscera, including the liver, stomach, and bowel. Such visceral activity that approximates the heart may scatter into the adjacent left ventricular walls, resulting in artifactually increased associated count densities. Alternatively, intense visceral tracer concentration may result in a ramp filter (negative lobe) artifact, which results in decreased count densities adjacent to "hot" objects.

TECHNIQUES

Several types of systems with transmission hardware modifications and external sources have emerged for clinical implementation. They predominantly use gadolinium 153 (100 keV) as the external source but may use cobalt 57 (122 keV), barium 133 (360 keV), americium 241 (60 keV), and technetium 99m (140 keV). The main configurations (Figure 1) are (1) fixed line source with convergent collimation on a triple-detector system, (2) scanning line sources with parallel-hole collimation on dual 90° systems, (3) the multiple line source array approach with parallel-hole collimation on 90° dual-detector systems, (4) scanning point sources on dual- and triple-detector systems, and (5) rotating x-ray tube-based technology on dual-detector systems. Each system has unique attributes and limitations. The fixed line source with convergent geometry provides highly efficient transmission image acquisition that allows the use of comparatively low source strength. The limited field of

view of convergent collimation can cause regions of the body to be outside of the field of view for some projection images, leading to truncation artifacts that may limit the accuracy of attenuation correction, unless highly sophisticated iterative reconstruction algorithms are used to minimize these effects.

The most widely implemented configuration for commercial transmission acquisition is the scanning line source geometry on 90° dual-detector SPECT systems. This approach has collimated line sources that scan mechanically across the field of view at each angle and project onto the opposing detector, where an electronic window moves opposite the source to accept transmission photons. These systems have a maximum field of view, thereby minimizing the likelihood of patient truncation. The electronic window provides maximal separation of the emission and transmission images. Scanning hardware requires careful monitoring because some systems are prone to mechanical instability.

The multiple line source array approach uses groups of collimated line sources mounted on the gantry opposite the detectors for transmission image acquisition. This method provides highly efficient measurement geometry without the need for additional mechanical motion. The photon flux from the collimated source arrays spans the field of view of each opposing detector. The continuous incidence of the transmission source photons over the fields of view for both detectors with this geometry can cause significant crosstalk from downscatter with thallium 201 imaging requiring interleaved or sequential emission-transmission imaging.

A system that uses a conventional x-ray tube and detector mounted on a large-field-of-view SPECT gantry has recently been introduced. The photon flux is very high with this approach, yielding high-quality attenuation maps. This system was developed largely for anatomic registration with emission images for oncology studies but should have application in attenuation correction of cardiac images. A system that uses scanning point sources of Ba-133 (360 keV) has recently become available. The point sources are collimated, but the holes of the detectors are not aligned with the focal point of each source. The high-energy emissions from these sources penetrate the low-energy collimators' septa, forming the transmission projections from which the attenuation map is reconstructed.

CLINICAL TRIALS

Several clinical trials have now been presented in the literature (Table 1). One of the most encouraging methods was used by Ficaro and colleagues, who reported the results of attenuation correction in phantoms and patient cohorts using a 3-detector system equipped with 2 parallel-hole collimators for collection of emission data and a third detector with a fan-beam collimator to acquire the transmission data from an Am-241 line source. They demonstrated significant improvement in diagnostic accuracy in 60 patients with Tc-99m sestamibi SPECT imaging, with a marked improvement in specificity

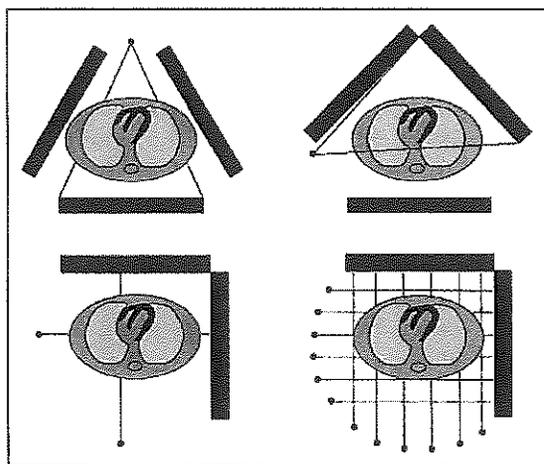


FIGURE 1. Commercial configurations for SPECT-based transmission imaging for cardiac attenuation-corrected myocardial perfusion imaging: fan-beam (A), off-axis (B), scanning line source (C), and source array (D).

TABLE 1
Diagnostic Value of Attenuation Correction Systems

Author	System	n	Sensitivity (%)		Specificity (%)		Normalcy (%)	
			NC	AC	NC	AC	NC	AC
Ficaro	U Mich	119	78	84	48	82	88	98
Hendel	ADAC	200	76	78	44	50	86	96
Links*	SMV	112	84	88	69	92	69	92
Gerson**	Picker	113	85	90	NA	NA	72	70
Gallowitsch	Elscont	49	89	94	69	84	NA	NA
Lenzo**	Siemens	171	93	93	84	88	78	85
Composite		764	81	85	64	81	80	89

NC = Non-attenuation-corrected SPECT; AC = attenuation-corrected SPECT; NA = not available.

*Includes motion correction and depth-dependent blur correction.

**Includes scatter correction.

(from 48% to 82%). Similarly, in a group of 59 patients with a low likelihood of coronary artery disease, an increase in the normalcy rate from 88% to 98% was demonstrated. Although the increase in test sensitivity was not statistically significant, there were significant increases in sensitivity for individual vessels overall (63% vs. 78%) and in 2 of 3 vascular territories.

The method used in the above trial was subsequently compared in 171 patients with the commercially available technique that uses the multiple line source array method for acquiring the transmission maps (Profile, Siemens). Profile attenuation correction demonstrated improved diagnostic specificity by patient, as well as sensitivity and accuracy for individual coronary arteries. Attenuation correction also demonstrated statistically significant increases in normalcy rates. The overall sensitivity by patient was similar with both the corrected and uncorrected images.

The first prospective multicenter trial was performed by Hendel et al. using a commercially available 90° dual-detector system with a scanning Gd-153 line source (Vantage, ADAC Laboratories). The diagnostic sensitivity ($n = 96$) for the detection of 50% or greater stenoses was similar with the use of uncorrected perfusion data or attenuation- and scatter-corrected data. The normalcy rate ($n = 88$), however, was significantly improved (86% vs. 96%, respectively), and false-positive perfusion images were reduced by more than 4-fold (from 14% to 4%). Furthermore, observer confidence for the presence or absence of image normalcy was increased, as reflected in the visual diagnostic scores. Regional differences were noted with reduced sensitivity but improved specificity for right coronary lesions through use of attenuation-scatter correction methods. However, the ability to detect multivessel disease was reduced with attenuation-scatter correction, which may have important prognostic implications.

Gallowitsch et al. studied 107 patients with known or suspected coronary artery disease with Tl-201 imaging using another dual-detector system equipped with a scanning Gd-153 line source and an iterative Chang reconstruction algorithm (Transact, Elscint). There were no significant

improvements in diagnostic accuracy noted in this trial, although specificity was somewhat improved with attenuation correction, from 69% for non-attenuation-corrected SPECT to 84% for attenuation-corrected SPECT ($P =$ not significant).

Another multicenter trial was recently completed by Links et al. using a similar system (TAC/Restore, SMV), in which the transmission data were acquired with a scanning Gd-153 source for Tc-99m emissions and a Tc-99m transmission source for Tl-201 emission imaging. The imaging algorithm incorporated a motion correction algorithm along with attenuation correction and depth-dependent resolution compensation. These investigators demonstrated significant gains in overall specificity (from 69% to 92%; $P = .002$) and in all 3 coronary territories. In addition, normalcy increased from 74% to 91% ($P = .04$) with combined attenuation, motion, and blur correction, and test sensitivity demonstrated a slight but insignificant increase from 84% to 88% ($P =$ not significant).

Additional clinical trials are under way that are using second-generation systems (Vantage Pro, ADAC Laboratories), as well as new approaches for transmission map generation including the translucent collimator with high-energy photons (Ba-133) (Beacon, Marconi) described earlier. Hybrid systems, such as those that use x-ray computed tomography-generated transmission maps, may provide high-quality transmission maps as a result of the high count density and spatial resolution that these systems provide (Hawkeye, GE Medical Systems).

The impact of attenuation correction on the detection of coronary artery disease within a specific vascular territory is variable (Figures 2 and 3). Several studies have shown a substantial improvement in specificity for right coronary artery disease, but occasionally with a loss of sensitivity in either right coronary artery or left anterior descending coronary artery distribution. The promise of enhanced sensitivity is yet to be realized clinically, although a recent phantom study demonstrated that defect detection is improved with attenuation correction. In addition, some trials

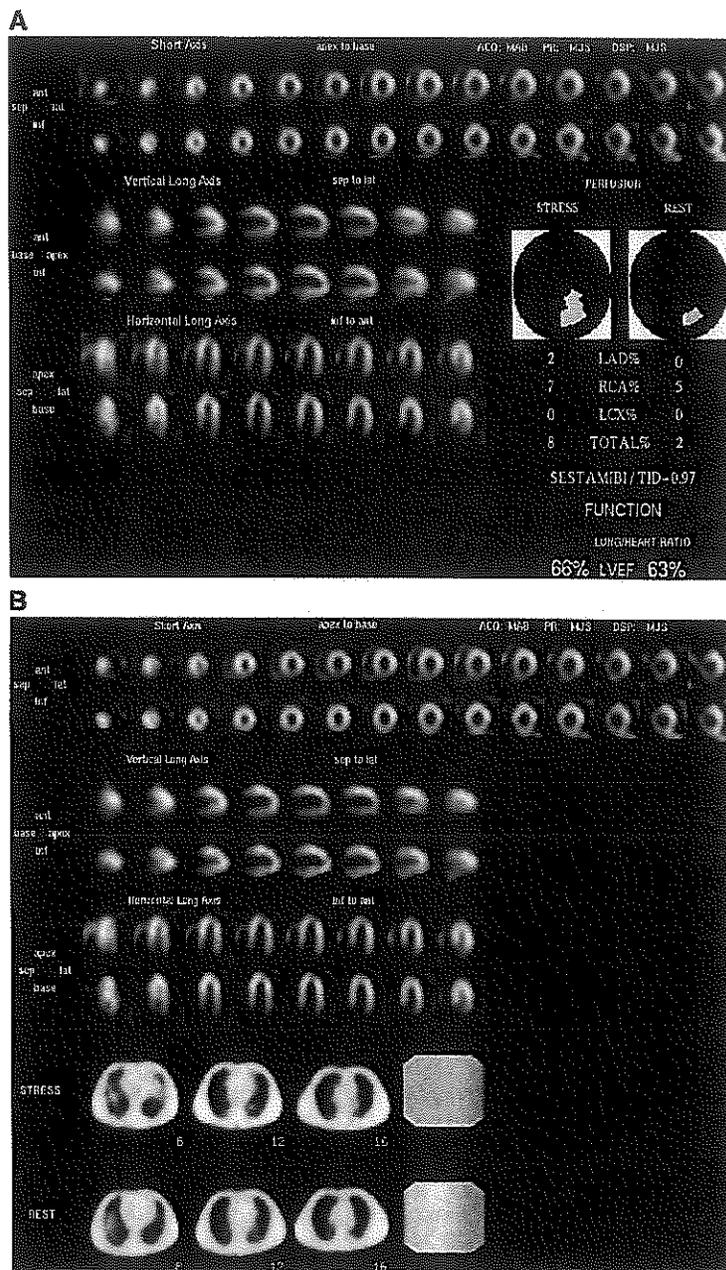


FIGURE 2. (A) Exercise-rest Tc-99m sestamibi SPECT study, suggestive of ischemia in the inferior, inferolateral, and inferoseptal regions but confounded by the presence of possible subdiaphragmatic attenuation. (B) After attenuation correction, the SPECT study demonstrates definite ischemia in the distribution of the right coronary artery. Attenuation map samples and daily reference scans are shown for quality control.

have demonstrated that attenuation correction enables improved recognition of multivessel and left main disease. Complete and accurate correction for attenuation and scatter would be a major step toward the long-held promise of absolute perfusion quantification and the enhanced diagnostic accuracy it would afford, especially in the setting of "balanced" 3-vessel disease.

Quantitative analysis programs specific for each camera system and radiopharmaceutical are limited but are under active development. It is anticipated that quantitative reference (normal) databases will be available for each manufacturer's system. Ideally, these databases obtained from healthy subjects should be gender-independent, assuming total correction for attenuation.

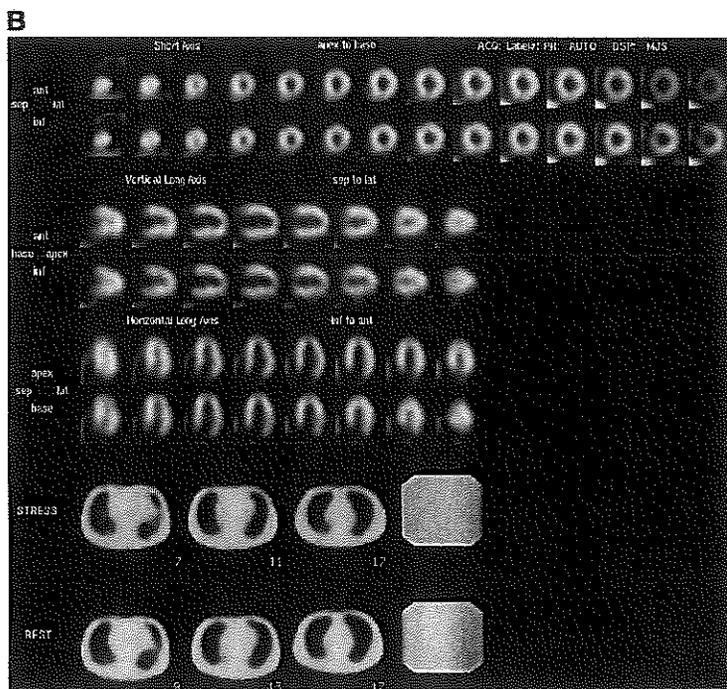
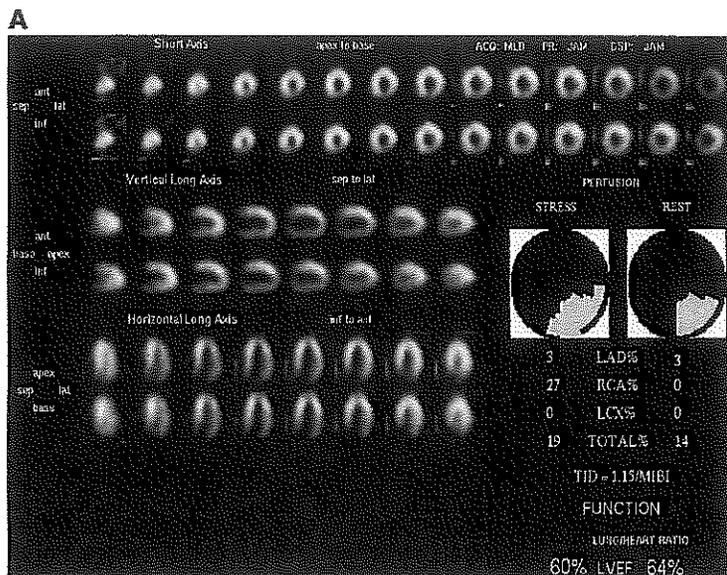


FIGURE 3. (A) Exercise-rest Tc-99m sestamibi SPECT study in a large man depicting a persistent reduction of activity in the inferior and inferolateral regions of the left ventricle, suggestive of a prior infarction. (B) Attenuation-corrected images reveal normal perfusion in all regions. Attenuation map samples and daily reference scans are shown for quality control.

Attenuation correction may have substantial value for specific applications beyond the detection of coronary artery disease (Table 2). Preliminary data reveal superior diagnostic performance in the triage of emergency department patients with chest pain. Attenuation-corrected SPECT images have demonstrated the ability to better detect areas of viable myocardium, correlate better with positron emission

tomography imaging, and provide improved prediction of functional recovery after revascularization. Attenuation correction also possesses the potential to further improve the prognostic value of myocardial perfusion imaging, as patients with soft tissue attenuation artifacts may be more accurately categorized as being at low risk for cardiac events. The use of attenuation and scatter correction tech-

TABLE 2
Clinical Value of Attenuation Correction

Confirmed	Potential
Improved artifact recognition Higher specificity	Increased sensitivity Improved recognition of MVD and LM
Higher normalcy rates Increased reader confidence Acute-use applications	Enhanced prognostic value Stress-only imaging Absolute flow quantitation

MVD = multivessel coronary disease; LM = left main coronary disease.

niques may be especially valuable for less-experienced interpreters of myocardial perfusion studies, with improvements in both sensitivity and overall diagnostic accuracy demonstrated in some studies for this group of interpreters.

QUALITY CONTROL

Experience with SPECT myocardial perfusion data processed with filtered backprojection has led to widespread appreciation of the importance of quality control measures. Attenuation correction introduces a number of additional quality issues that, if not addressed systematically and satisfactorily, will translate into suboptimal and in some cases clinically misleading image data (Table 3). Over the past several years, it has become increasingly apparent that accurate attenuation correction is dependent upon high-quality transmission images, and to ensure accuracy, appropriate quality control measures have been developed. In particular, count densities must be sufficient to overcome the intrinsic inconsistencies of scans with poor signal-to-noise ratios. Other important quality control issues related to the creation of transmission maps include body truncation, patient motion, scaling of attenuation coefficients to the correct tissue densities, accurate registration of attenuation maps and emission data, and gating artifacts unique to attenuation correction processing, especially with scanning transmission source systems. Objective measurements of these technical factors are crucial to the accuracy of attenuation correction. Automated quality control procedures should be provided by each vendor and routinely used.

Correct windowing of relevant photopeaks for attenuation-corrected SPECT imaging is also essential. Besides the energy window of the main emission photon, additional windows are required for transmission data and for scatter and crosstalk measurements; scatter and crosstalk between transmission and emission photopeaks significantly degrade the quality of the attenuation map.

Reference transmission scans should be performed daily to ensure optimal equipment performance and should include quantitative analysis. In addition, each manufacturer should provide automatic safeguards to ensure that the transmission and emission data are reconstructed properly.

Finally, education of technologists, physicists, and interpreting physicians is an essential component of the quality assurance process.

Therefore quality control should include each of the following for the performance of attenuation correction: criteria for uniformity, variability, and temporal drift of the reference transmission scan; consistency of hardware performance; pre-scanning methods to ensure sufficient transmission scan counts; and algorithms that assist the operator and interpreting physician in assessing the sufficiency of the data. Although these tools are essential to all commercial methods of attenuation correction, implementation of many of the aforementioned quality control techniques has not been incorporated in the current releases of all available attenuation correction protocols. Furthermore, quality control of transmission data and attenuation-corrected reconstructed images should be performed for each patient.

SCATTER CORRECTION AND DEPTH-DEPENDENT RESOLUTION

Attenuation-corrected images, although usually of higher diagnostic quality than uncorrected images, need to be corrected for scattered photons coming from activity in structures near the heart, such as the liver and intestines. These scatter photons may result in regional overcorrection following attenuation correction techniques. The planar transmission images also must be corrected for scatter into the energy window of the transmission source because failure to perform scatter correction may result in undercorrection for attenuation.

Simultaneous emission-transmission acquisition methods must address crosstalk from downscattering of photons from the emission or transmission photopeaks (whichever is higher). Crosstalk minimization is accomplished through the geometric design of the transmission sources and detectors and consideration of the position of the patient and possible scattering angles. Software methods applied after image acquisition may be used to correct for crosstalk with data collected in additional energy windows. In order to perform attenuation, scatter, and crosstalk correction, 3 or 4 independent energy windows for data must be collected: one window for the emission information (perfusion photopeak energy); a second window for transmission data (photopeak of transmission source); a third window for scatter, positioned between the other windows; and in some systems, a fourth window, slightly above the emission win-

TABLE 3
Quality Control Methods for Attenuation Correction

Ensure adequate count density
Recognition of truncation
Appropriate gating
Correct photopeak windowing
Recognition of patient motion
Transmission scan uniformity

dow, used in conjunction with the third window to estimate scatter.

In addition to correcting for attenuation, some methods correct for photopeak scatter and the variable distance-dependent spatial resolution from the collimator. These are primarily software implementations that use additional "scatter" information acquired simultaneously with the emission data, models of the distance-dependent collimator effects, and knowledge of the orbital position of the detectors. Scatter compensation may be performed by mapping photons back to their point of origin; although promoting less noise propagation, this approach may require substantial computation time.

Image degradation is related to increasing cross-sectional area detected by each collimator hole with distance (depth) from a radioactive source, thereby creating a loss of resolution with increasing object distance away from the collimator. The use of iterative correction algorithms may be applied for Compton scatter, photon attenuation, and depth-dependent resolution to achieve higher contrast between perfusion defects and more uniformly distributed counts within normal myocardium. One commonly employed method for such compensation is the use of collimator- and energy-dependent pre-processing filters.

CONCLUSION

Attenuation correction SPECT techniques represent a significant advance in myocardial perfusion imaging and hold great promise for improved assessment of cardiac patients. Substantial technical advances have been made in the past several years, including the recognition of the importance of effective quality control and the continued development of scatter correction and resolution compensation. Advanced SPECT perfusion imaging systems, including features such as attenuation correction, must undergo complete system characterization, development of normal activity distribution profiles, and definition of differences among various manufacturers' solutions. Finally, quantitative analysis programs adapted for each camera system and radiopharmaceutical are limited but are under active development. Ideally, reference databases from healthy subjects should be gender-independent after total correction for attenuation.

Clinical validation has been performed for several but not all commercially available systems, although "complete" correction still does not occur in all patients. The true value of these methods to improve diagnostic accuracy compared with other techniques has yet to be fully defined. Attenuation correction methods offer the potential for improved diagnostic accuracy but require a modified approach to image interpretation accounting for the effects of these methods on the resultant images. Technologist and physician education in the details of these advanced imaging techniques, along with effective quantitative tools and improved processing algorithms, will continue to advance the

value and acceptance of attenuation-corrected SPECT imaging.

RECOMMENDATIONS

On the basis of the available clinical evidence and the rapid development of attenuation correction technology, it is recommended that providers (institutions and practitioners) consider the addition of hardware and software that have undergone clinical validation and include appropriate quality control tools to perform non-uniform attenuation correction. Currently, it is suggested that both noncorrected and corrected image sets be reviewed and integrated into the final report. However, as the reader gains the appropriate experience and confidence in correction methodology, only the corrected images may be necessary, as is the standard in positron emission tomography. On the basis of current information and the rate of technology improvement, the Society of Nuclear Medicine and the American Society of Nuclear Cardiology believe that attenuation correction should be regarded as a rapidly evolving standard for SPECT myocardial perfusion imaging. Therefore it is our recommendation that the adjunctive technique of attenuation correction has become a method for which the weight of evidence and opinion is in favor of its usefulness.

ACKNOWLEDGMENT

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SELECTED REFERENCES

- Attnquist, H, Arvidsson AH, Pahlm O, Palmer J. Clinical implications of down-scatter in attenuation-corrected myocardial SPECT. *J Nucl Cardiol.* 1999;6:406-11.
- Chouaqui, P, Livschitz S, Sharir T, et al. Evaluation of an attenuation correction method for thallium-201 myocardial perfusion tomographic imaging of patients with low likelihood of coronary artery disease. *J Nucl Cardiol.* 1998;5:369-77.
- Corbett JR, Ficaro EP. Clinical review of attenuation-corrected cardiac SPECT. *J Nucl Cardiol.* 1999;6:54-68.
- Cullom SJ, Case JA, Bateman TM. Attenuation correction of cardiac SPECT: clinical and developmental challenges. *J Nucl Med.* 2000;41:860-2.
- DePuey EG, Garcia EV. Optimal specificity of thallium-201 SPECT through recognition of imaging artifacts. *J Nucl Med.* 1989;30:441-9.
- Duvernoy CS, Ficaro EP, Karabadjian MZ, Rose PA, Corbett JR. Improved detection of left main coronary artery disease with attenuation-corrected SPECT. *J Nucl Cardiol.* 2000;7:639-48.
- Ficaro EA, Fessler JA, Ackermann RJ, Rogers WL, Corbett JR, Schwaiger M. Simultaneous transmission-emission thallium-201 cardiac SPECT: effect of attenuation correction on myocardial tracer distribution. *J Nucl Med.* 1995;36:905-6.
- Ficaro EA, Fessler JA, Shreve PD, Kritzman JN, Rose PA, Corbett JR. Simultaneous transmission/emission myocardial perfusion tomography: diagnostic accuracy of attenuation corrected Tc-99m sestamibi single-photon emission computed tomography. *Circulation.* 1996;93:463-73.
- Ficaro E, Duvernoy C, Karabadjian M, Corbett J. Evaluation of attenuation corrected SPECT perfusion imaging in patients with multi-vessel disease [abstract]. *Circulation.* 1997;96:1-308.
- Gallowitsch HJ, Sykora J, Mikosch P, et al. Attenuation-corrected thallium-201 single-photon emission tomography using a gadolinium-153 moving line source: clinical value and the impact of attenuation correction on the extent and severity of perfusion abnormalities. *Eur J Nucl Med.* 1998;25:220-8.
- Gallowitsch HJ, Unterwieser O, Mikosch P, et al. Attenuation correction improves the detection of viable myocardium by thallium-201 cardiac tomography in patients

- with previous myocardial infarction and left ventricular dysfunction. *Eur J Nucl Med*. 1999;26:459-66.
- Garcia EV. Quantitative myocardial perfusion single-photon emission computed tomographic imaging: quo vadis? (Where do we go from here?) *J Nucl Cardiol*. 1994;1:83-93.
- Gerson MC, Singh BKM, Lukes J, Bauman BD. Comparison of attenuation and Compton scatter corrected to uncorrected thallium-201 tomograms for diagnosis of coronary artery disease (CAD) [abstract]. *J Nucl Med*. 1999;40:89P.
- Hendel RC, Berman DS, Follansbee W, Heller GV, Cullom SJ. A multicenter clinical trial to evaluate the efficacy of correction for photon attenuation and scatter in SPECT myocardial perfusion imaging. *Circulation*. 1999;99:2742-9.
- Hendel RC, Selker HR, Heller GV, et al. The impact of attenuation correction and gating on SPECT perfusion imaging in patients presenting to the emergency department with chest pain [abstract]. *Circulation*. 2000;102:II-543.
- Jaszczak RJ, Greer KL, Floyd CG, Harris CG, Coleman E. Improved SPECT quantification using compensation for scattered photons. *J Nucl Med*. 1984;25:893-900.
- Kadmas DJ, Frey EC, Tsui BMW. Application of reconstruction-based scatter compensation to thallium-201 SPECT: implementations for reduced reconstruction image noise. *IEEE Trans Med Imaging*. 1998;17:325-33.
- King MA, Tsui BMW, Pan TS. Attenuation compensation for cardiac single-photon emission computed tomographic imaging: part 1. Impact of attenuation and methods of estimating attenuation maps. *J Nucl Cardiol*. 1995;2:513-524.
- King MA, Tsui BMW, Pan TS, Glick SJ, Soares EJ. Attenuation compensation for cardiac single-photon emission computed tomographic imaging: part 2. Attenuation compensation algorithms. *J Nucl Cardiol*. 1996;3:55-63.
- Kluge R, Sattler B, Seese A, Knapp WH. Attenuation correction by simultaneous emission-transmission myocardial single-photon emission tomography using a technetium-99m-labelled radiotracer: impact on diagnostic accuracy. *Eur J Nucl Med*. 1997;24:1107-1114.
- Lacroix KJ, Tsui BMW, Frey EC, Jaszczak RJ. Receiver operating characteristic evaluation of iterative reconstruction with attenuation correction in Tc-99m sestamibi myocardial perfusion SPECT images. *J Nucl Med*. 2000;41:502-513.
- Lee DS, So Y, Cheon GJ, et al. Limited incremental diagnostic values of attenuation noncorrected gating and ungated attenuation correction to rest/stress myocardial perfusion SPECT in patients with an intermediate likelihood of coronary artery disease. *J Nucl Med*. 2000;41:852-859.
- Lenzo N, Ficaro NP, Krizman JN, Corbett JR. Clinical comparison of Profile attenuation correction and the Michigan modified STEP methods [abstract]. *J Nucl Cardiol*. 2001;8:S19.
- Links JM, Becker LC, Rigo P, et al. Combined corrections for attenuation, depth-dependent blur, and motion in cardiac SPECT: a multicenter trial. *J Nucl Cardiol*. 2000;7:414-425.
- Matsunari I, Boning G, Ziegler SI, et al. Attenuation-corrected Tc-99m tetrofosmin single-photon emission computed tomography in the detection of viable myocardium: comparison with positron emission tomography using F-18 fluorodeoxyglucose. *J Am Coll Cardiol*. 1998;32:927-935.
- Matsunari I, Boning G, Ziegler SI, et al. Attenuation corrected rest thallium-201/stress technetium 99m sestamibi myocardial SPECT in normals. *J Nucl Cardiol*. 1998; 5:48-55.
- Miles J, Cullom SJ, Case JA. An introduction to attenuation correction. *J Nucl Cardiol*. 1999;6:449-457.
- Prvulovich EM, Lonn AHR, Bomnji JB, Jarritt PH, Elf PJ. Effect of attenuation correction on myocardial thallium-201 distribution in patients with a low likelihood of coronary artery disease. *Eur J Nucl Med*. 1997;24:266-275.
- Vidal R, Buvat I, Darceout J, et al. Impact of attenuation correction by simultaneous emission/transmission tomography on visual assessment of Tl-201 myocardial perfusion images. *J Nucl Med*. 1999;40:1301-1309.

APPENDIX

The Boards of Directors of the American Society of Nuclear Cardiology and the Society of Nuclear Medicine have reviewed and approved this position statement with the belief that it provides balanced and objective information on the value of attenuation correction for myocardial perfusion SPECT imaging. However, to ensure that the most recent information and diverse perspectives on attenuation correction were included in this statement, individuals with potential conflicts of interest participated in the development of this document. The following contributing authors have provided declarations of potential conflicts of interest as listed and have excluded themselves from the final position statement review and approval process: Timothy M. Bateman, MD, stock ownership (Cardiovascular Consultants Imaging Technologies, Inc) and research grants (ADAC Laboratories, Inc, and Dupont Pharmaceuticals), and S. James Cullom, PhD, and Ernest V. Garcia, PhD, royalties from the sale of ExSPECT II software (ADAC Laboratories, Inc).

JOINT POSITION STATEMENT

On the basis of current information, the American Society of Nuclear Cardiology and the Society of Nuclear Medicine recommend that, when available and technically feasible, attenuation correction should be used in addition to electrocardiography gating with single photon emission computed tomographic (SPECT) myocardial perfusion imaging to maximize its diagnostic accuracy and clinical usefulness.

American Society of Nuclear Cardiology and Society of Nuclear Medicine joint position statement: Attenuation correction of myocardial perfusion SPECT scintigraphy

Gary V. Heller, MD, PhD, Jonathan Links, PhD, Timothy M. Bateman, MD, Jack A. Ziffer, MD, PhD, Edward Ficaro, PhD, Mylan C. Cohen, MD, MPH, and Robert C. Hendel, MD

INTRODUCTION

The Society of Nuclear Medicine (SNM), founded in 1953, and the American Society of Nuclear Cardiology (ASNC), founded in 1993, are professional medical societies whose missions are 3-fold: (1) to facilitate optimal delivery of nuclear medicine/nuclear cardiology services through professional education, (2) to support research, and (3) to establish standards and guidelines for training and practice. Recently, both societies recognized attenuation correction of myocardial perfusion single photon emission computed tomography (SPECT) studies as a potentially important means of distinguishing attenuation artifact from coronary artery disease, and they issued a statement to this effect.¹ Since that publication, additional scientific studies have been published. Manufacturers have substantially improved commercially available and validated attenuation correction approaches, and there is now a growing acceptance of the technology by clinicians. As a result, the boards of ASNC and the SNM have determined that, in the interest of the highest-quality patient care, a new statement should be made regarding attenuation correction.

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JUSTIFICATION

Following its initial description and demonstration,² multiple investigators have shown that attenuation correction adds to the diagnostic accuracy of stress myocardial perfusion SPECT.³⁻⁷ Single-institution trials were followed by independent multicenter trials by use of different hardware/software approaches that clearly demonstrated the utility of attenuation correction.⁸⁻¹³ In a prior joint statement, the SNM and ASNC concluded that "the objective technique of attenuation correction has become a method for which the weight of evidence and opinion is in favor of its usefulness."¹ At that time, however, concerns regarding the level of validation and quality-control aspects of the existing commercial systems limited the emphasis that could be included in the statement.

The ability to accurately perform attenuation correction with validated commercial hardware/software solutions by use of strict quality-control measures enhances the interpretive confidence and accuracy of SPECT myocardial perfusion imaging. With recent publications further validating attenuation correction by using a variety of methods including electrocardiography (ECG)-gated SPECT imaging,¹⁰⁻¹⁶ there has been growing clinical acceptance of attenuation correction by practitioners. Recent investigations have also demonstrated the possibility for stress-only imaging in selected patients, therefore improving laboratory efficiency.¹⁷⁻¹⁹

As a result of these developments, several manufacturers now have commercial hardware/software approaches that have been clinically validated and have

implemented quality-control schemes in association with attenuation correction. ASNC and the SNM thus believe a more supportive statement of the utility of attenuation correction is justified.

PREREQUISITES

There are important prerequisites for the incorporation of attenuation correction into routine clinical practice; these prerequisites cover acquisition, processing, and interpretation.¹

1. High-quality transmission scans and sufficient transmission counts with low cross-talk from the emission radionuclide are essential to reduce the propagation of noise and error into the corrected emission images.
2. Quality-control procedures for image registration should be used for projection data acquired by use of sequential transmission-emission imaging protocols (eg, computed tomography-SPECT systems).
3. Motion correction, scatter correction, and resolution recovery should be used with attenuation correction.
4. Attenuation correction should be employed concurrently with ECG-gated SPECT imaging.
5. Technologists must have adequate training in the acquisition and processing of attenuation-corrected studies. Physicians must have adequate training in the interpretation of attenuation-corrected images.
6. Physicians should view and interpret both uncorrected and corrected images.

CLINICAL SIGNIFICANCE

It is the position of ASNC and the SNM that incorporation of attenuation correction in addition to ECG gating with SPECT myocardial perfusion images will improve image quality, interpretive certainty, and diagnostic accuracy. These combined results are anticipated to have a substantial impact on improving the effectiveness of care and lowering health care costs.

References

1. Hendel RC, Corbett JR, Cullom SJ, et al. The value and practice of attenuation correction for myocardial perfusion SPECT imaging: a joint position statement from the American Society of Nuclear Cardiology and the Society of Nuclear Medicine. *J Nucl Cardiol* 2002;9:135-43.
2. Ficaro EP, Fessler JA, Shreve PD, et al. Simultaneous transmission/emission myocardial perfusion tomography. *Circulation* 1996; 93:463-73.
3. Prvulovich EM, Lonn AHR, Bomanji JB, Jarritt PH, Ell PJ. Effect of attenuation correction on myocardial thallium-201 distribution in patients with a low likelihood of coronary artery disease. *Eur J Nucl Med* 1997;24:266-75.
4. Kluge R, Sattler B, Seese A, Knapp WH. Attenuation correction by simultaneous emission-transmission myocardial single-photon emission tomography using a technetium-99m labelled radiotracer: impact on diagnostic accuracy. *Eur J Nucl Med* 1997;24:1107-14.
5. Chouraqui P, Livschitz S, Sharir T, et al. Evaluation of an attenuation correction method for thallium-201 myocardial perfusion tomographic imaging of patients with low likelihood of coronary artery disease. *J Nucl Cardiol* 1998;5:369-77.
6. Gallowitsch HJ, Sykora J, Mikosch P, et al. Attenuation-corrected thallium-201 single-photon emission tomography using a gadolinium-153 moving line source: clinical value and the impact of attenuation correction on the extent and severity of perfusion abnormalities. *Eur J Nucl Med* 1998;25:220-8.
7. Gallowitsch HJ, Unterwieser O, Mikosch P, et al. Attenuation correction improves the detection of viable myocardium by thallium-201 cardiac tomography in patients with previous myocardial infarction and left ventricular dysfunction. *Eur J Nucl Med* 1999;26:459-66.
8. Hendel RC, Berman DS, Cullom SJ, et al. Multicenter clinical trial to evaluate the efficacy of correction for photon attenuation and scatter in SPECT myocardial perfusion imaging. *Circulation* 1999; 99:2742-9.
9. Links JM, Becker LC, Rigo P, et al. Combined corrections for attenuation, depth-dependent blur, and motion in cardiac SPECT: a multicenter trial. *J Nucl Cardiol* 2000;7:414-25.
10. Shotwell M, Singh BM, Fortman C, et al. Improved coronary disease detection with quantitative attenuation-corrected Tl-201 images. *J Nucl Cardiol* 2002;9:52-61.
11. Links JM, DePuey G, Taillefer R, Becker LB. Attenuation correction and gating synergistically improve the diagnostic accuracy of myocardial perfusion SPECT. *J Nucl Cardiol* 2002;9:183-7.
12. Bateman TM, Heller GV, Johnson LL, et al. Does attenuation correction add value to non-attenuation corrected ECG-gated technetium-99m sestamibi SPECT [abstract]? *J Nucl Cardiol* 2003;10:S91.
13. Lui Y, Wackers FJ, Natale D, et al. Validation of a hybrid SPECT/CT system with attenuation correction: a phantom study and multicenter trial [abstract]. *J Nucl Med* 2003;44:290p.
14. Case JA, Cullom SJ, Galt JR, Garcia FV, Bateman TM. Impact of transmission scan reconstruction using an iterative algorithm (BITGA) versus PBP: clinical appearance of attenuation-corrected myocardial perfusion SPECT images [abstract]. *J Nucl Med* 2001;42:51P.
15. Cullom SJ, Case JA, Bateman TM, O'Keefe JHO, McGhie A. Reconstruction of attenuation maps from low-count Gd-153 transmission studies using an iterative Bayesian algorithm: clinical evaluation with simultaneous Tc-99m sestamibi SPECT [abstract]. *J Nucl Med* 2000;41:134P.
16. Simon E, Narayanan MV, Dahlberg ST, et al. Observer ROC evaluation of attenuation scatter and resolution compensation strategies for Tc-99m myocardial perfusion imaging [abstract]. *J Nucl Cardiol* 2003;10:S61.
17. Heller GV, Bateman TM, Botvinick EH, et al. Value of attenuation correction in interpretation of stress only exercise Tc-99m sestamibi SPECT imaging: results of a multicenter trial [abstract]. *J Am Coll Cardiol* 2002;39:343A.
18. Gibson PB, Demus D, Noto R, Hudson W, Johnson LL. Low event rate for stress-only perfusion imaging in patients evaluated for chest pain. *J Am Coll Cardiol* 2002;39:999-1004.
19. Vallejo EE, Acevedo C, Varela S, Alburez JC, Bialostozky D. Cost-efficiency and safety for stress-only myocardial perfusion SPECT imaging in patients evaluated for coronary artery disease [abstract]. *J Nucl Cardiol* 2003;10:S75.



Why Hybrid SPECT/CT?

What can Hybrid SPECT/CT imaging do for you?

- Help expand your referral base
- Help enable change in your patient management
- Help increase your diagnostic confidence
- Help speed-up your interpretation & diagnosis
- Help prepare for challenging surgeries
- Help in treatment planning or in follow-up

Why SPECT and CT?

Nuclear Imaging is based on the bio-distribution of a radiotracer over time and space, revealing functional characteristics of diseases. However, it lacks accurate anatomic localization and characterization of findings.

CT provides information on organ size and tissue density, as well as its localization. Diagnosis and characterization of disease by CT is based on morphologic criteria (i.e., size, texture and tissue density).

However, structural data does not necessarily correlate with the metabolic status of disease. Therefore, NM and CT complement each other in terms of diagnostic information.

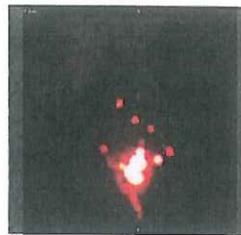
How does Hybrid SPECT/CT work?

The SPECT part of the SPECT/CT procedure is performed by a dual-head gamma camera, and the CT imaging is done by the integrated multi-slice CT. For AC or localization purposes, the CT images are acquired either before or after the SPECT acquisition. Precise image registration is made by mechanically integrating the SPECT system with the CT system in order to ensure alignment of the NM and CT data sets. CT data is used to correct the emission data for tissue attenuation and localize the NM uptake on the anatomical (CT) images.

General purpose SPECT/CT Procedures*

Care areas for SPECT/CT include but are not limited to imaging of/for the following:

- Tumors
- Thyroid disorders
- Parathyroid disorders
- Skeleton disorders
- Inflammation or infection
- Lymphatic system
- Heart disorders
- Brain disorders
- Other organs



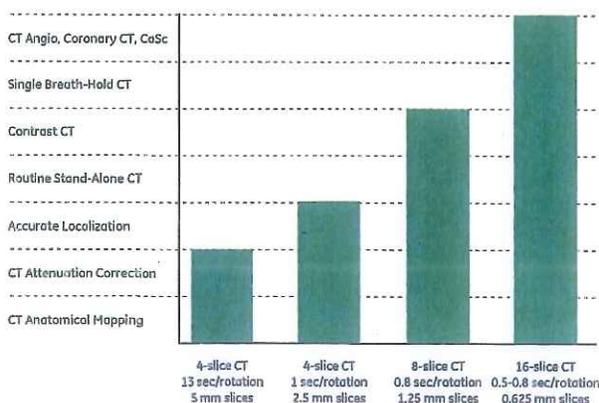
Ovarian cancer SPECT scan.



3D Fusion of NM uptake with CT.

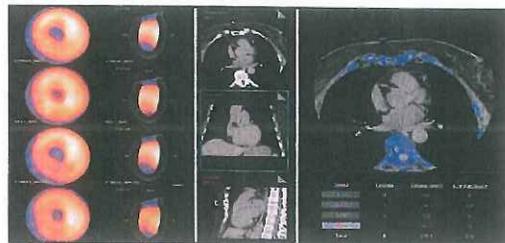
Courtesy of UZA, Antwerp, Belgium. Prof. Stroobants & Dr. Huyghe.

Hybrid systems positioning by CT clinical applications



Heart/Pulmonary SPECT/CT Procedures

- Myocardial perfusion imaging with CT AC
- Cardiac SPECT/CTA for assessing the significance of coronary artery lesions
- Coronary artery calcification for short- and long-term risk stratification
- Pulmonary artery imaging for assessment of pulmonary embolism



MPI SPECT & CT CaSc. Courtesy of Rambam Hospital, Haifa, Israel.

*Procedure Guideline for SPECT/CT Imaging 1.0 (approved by the Board of Directors of the SNM on April 30, 2006).

Voice of Customers:** "...referral physicians are requesting SPECT/CT and our competitor hospital is getting one, therefore we expect to lose business unless we can offer it ..." "(hybrid will deliver) better quality imaging and patient care with accurate cardiac interpretations...", "... building our hospital's cancer practice and the ability to perform specialized studies like Octreotide is important..."

How can Hybrid SPECT/CT help impact your clinical practice?

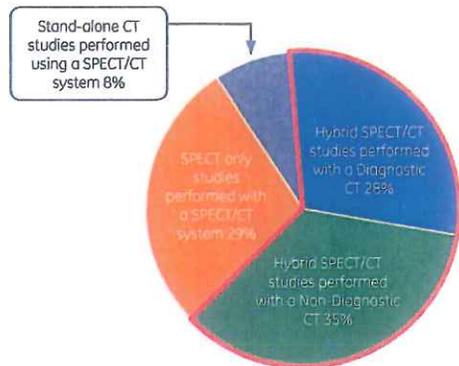
- May help diagnosis when using nuclear imaging procedures
- May help increase NM study clarity
- May help show lesions that could be overlooked by nuclear imaging alone
- May help improve NM image quality by reducing attenuation artifacts
- May help quantify tracer uptake

How can Hybrid SPECT/CT help impact your financial performance?

- **Faster interpretation** may help drive high throughput workflow, potentially increasing income
- **More informative reports** may help enhance your competitive edge, expanding your referral base for higher income potential
- **Reimbursement** for CT in hybrid scans may help increase income for better ROI***
- **Backup CT** may help improve resource utilization for better ROI***

Current SPECT/CT use patterns**

What percentage of all studies performed using each SPECT/CT system at your facility would fall into each of the following categories?



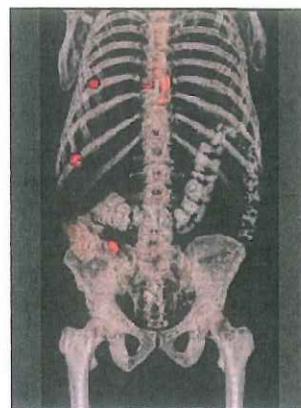
SPECT/CT Owners, n=75

In what situations could SPECT/CT be useful?

- **High suspicion for active disease**, or known structural pathology, as SPECT/CT may localize multiple sites and define extent of disease
- **Planning treatment:** medical, surgical or radiation therapy
- **Monitoring response** to treatment
- Based on previous anatomic imaging, such as:
 - **Abnormal structural findings** of equivocal functional significance, either at diagnosis or post-treatment
 - **Absence of overt structural pathology** in the presence of high clinical suspicion

**Nuclear Medicine Hybrid SPECT/CT Research, Quantitative Report prepared for GE Healthcare by ITG Market Research; November 18, 2013.

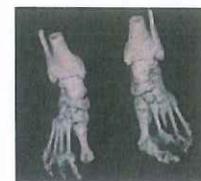
***Actual throughput, revenues and expenses will vary depending on specific costs, savings, procedures, etc. Third party reimbursement amounts and coverage policies for specific procedures will vary by payer, time period, location and other criteria. You should consult with your reimbursement manager or healthcare consultant prior to submitting claims or expanding service.



Bone metastases in lytic/sclerotic CT lesions at D9 vertebra level and right iliac bone. Courtesy of Rambam Hospital; Haifa, Israel.



Melanoma on the left auricle. Courtesy of UZA, Antwerp, Belgium. Prof. Stroobants & Dr. Huyghe.



Uptake in the 3rd MTP joint area. Co-registered low dose CT reveals destruction of the metatarsal & luxation of MTP joint. Courtesy of UZA, Antwerp, Belgium. Prof. Stroobants & Dr. Huyghe.



Intense uptake (somatostatin receptor activity) in a large mesenteric tumor causing intestinal occlusion.

SPECT/CT also reveals small local metastasis. Courtesy of Dr. Ph. Declerck, Clinic Saint Jean, Belgium.



New generation general-purpose SPECT/CT myocardial perfusion imaging improves diagnostic accuracy and reduces radiation exposure compared to traditional SPECT

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Purpose: While improvements in accuracy and reduction in radiation exposure in myocardial perfusion imaging have been demonstrated with new 'cardiac only' SPECT cameras, general-purpose wide field-of-view SPECT cameras continue to be used for the majority of cardiac nuclear imaging. Since nearly ¼ of SPECT systems in the US are over 10 years old, many are due for replacement. It is unclear whether new generation general-purpose SPECT/CT systems improve diagnostic accuracy in cardiac nuclear imaging compared to older systems. This study aims to show whether replacement of an older general-purpose SPECT camera (Siemens eCAM, Gd153 AC) with a new SPECT/CT system (GE NM 670 SPECT/CT with GE Evolution® software) results in improvements in diagnostic accuracy or decreased patient radiation exposure in patients undergoing myocardial perfusion imaging (MPI).

Methods: Patients who underwent SPECT MPI and then had coronary angiography within 6 months were identified from two cohorts: One group prior immediately prior to retiring the old scanner (SPECT group; n=280), and another starting one year after implementation of the new scanner (SPECT/CT group, n=277). Results of SPECT imaging and coronary angiography were compared to assess the accuracy of SPECT MPI in each group. Radiation exposure was estimated from both radioisotope dose and CT imaging. Among patients who had CT attenuation correction, presence or absence of coronary artery calcifications was identified from the report.

Results: Compared to the SPECT group, the SPECT-CT group had decreased overall per study false positive results (21 vs. 58%; $P=.008$) and increased true positive results (63 vs. 22%; $P=.004$), resulting in an increase in the overall positive predictive value (PPV) from 0.28 to 0.75. At the individual vessel level, PPV for perfusion findings in the LAD territory increased from 0.47 to 0.92 due a significant increase in true positive results (46 vs. 22%; $P=0.05$). Mean radiation exposure decreased from 13.56 mSv to 11.68 mSv ($P=.02$). On multivariate analysis, the strongest predictor of true positivity was the camera system, which correlated strongly with coronary calcifications noted on attenuation correction CT.

Conclusions: Replacement of an older SPECT system with a new generation general-purpose SPECT/CT system with resolution recovery software resulted in a significant improvement in PPV and a decrease in radiation exposure. This data suggests that upgrading older SPECT with newer SPECT/CT systems improves quality of patient care.

Figure: Accuracy of SPECT MPI tests

Significant values representing improvement are in **bold**. Significant p values representing worsening are in *italics*.

Positive predictive values of SPECT MPI (with 95% CI)

	SPECT	SPECT-CT
LAD	0.47 (.23 to .71)	0.92 (.76 to 1.0)
LCX	0.50 (.24 to .76)	0.75 (.45 to 1.0)
RCA	0.60 (.39 to .81)	0.82 (.59 to 1.0)

Test overall	0.28 (.11 to .44)	0.75 (.56 to .94)
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Significance of changes in prevalence of different test outcomes (p values):

	TP	FP	TN	FN
LAD	0.054	0.034	0.14	0.147
LCX	0.61	0.24	0.14	0.014
RCA	0.74	0.16	0.094	<0.002
Test overall	0.004	0.008	0.22	0.34

SPECT/CT*

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In view of the commercial success of integrated PET/CT scanners, there is an increasing interest in comparable SPECT/CT systems. SPECT in combination with CT enables a direct correlation of anatomic information and functional information, resulting in better localization and definition of scintigraphic findings. Besides anatomic referencing, the added value of CT coregistration is based on the attenuation correction capabilities of CT. The number of clinical studies is limited, but pilot studies have indicated a higher specificity and a significant reduction in indeterminate findings. The superiority of SPECT/CT over planar imaging or SPECT has been demonstrated in bone scintigraphy, somatostatin receptor scintigraphy, parathyroid scintigraphy, and adrenal gland scintigraphy. Also, rates of detection of sentinel nodes by biopsy can be increased with SPECT/CT. This review highlights recent technical developments in integrated SPECT/CT systems and summarizes the current literature on potential clinical uses and future directions for SPECT/CT in cardiac, neurologic, and oncologic applications.

Key Words: scintigraphy; SPECT; CT; PET; hybrid imaging

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Hybrid imaging techniques allow the direct fusion of morphologic information and functional information. Since its introduction to clinical medicine in 2001, PET/CT has become the fastest growing imaging modality (1,2). CT coregistration has led to definite diagnoses by PET and more acceptance of functional imaging. Recently, integrated SPECT/CT scanners have been made available. With SPECT/CT, lesions visualized by functional imaging can be correlated with anatomic structures. The addition of anatomic information increases the sensitivity as well as the specificity of scintigraphic findings (Fig. 1). SPECT/CT has an additional value in sentinel lymph node (SLN) mapping,

especially in head and neck tumors and tumors draining into pelvic nodes. In addition to improved anatomic localization of scintigraphic findings, SPECT/CT offers the opportunity to add true diagnostic information derived from CT imaging. Given the growing number of studies demonstrating the added value of hybrid SPECT/CT relative to single imaging modalities, it appears likely that this promising technique will play an increasingly important role in clinical practice. The broad spectrum of existing SPECT tracers and their widespread availability suggest that SPECT/CT can be complementary to PET/CT.

TECHNICAL ASPECTS OF SPECT/CT

Before the introduction of dedicated SPECT/CT cameras, various software algorithms were established to allow image fusion for anatomic imaging (CT or MRI) and functional imaging (SPECT) (3). In the early 1980s, efforts were made to allow image fusion in brain studies. Current software algorithms permit highly accurate coregistration of anatomic and functional datasets. This kind of nonrigid image coregistration is therefore a regular component in daily clinical practice, such as image-guided surgery or radiation treatment planning. However, motion artifacts markedly affect image fusion in the thorax, abdomen, pelvis, or head and neck region when CT and SPECT acquisitions are obtained separately (4,5). Functional images of the thorax or the abdomen contain little or no anatomic landmarks that can be correlated with anatomic reference points. Moreover, the chest and the abdomen do not represent rigid structures. Differences in patient positioning and respiratory motion make the correct alignment of anatomic and functional images even more complicated. More recently, 3-dimensional elastic transformations or nonlinear warping has been established to further improve the accuracy of image fusion. With these modern approaches, the accuracy of software-based image coregistration is in the range of approximately 5–7 mm (6). Although software algorithms are not in widespread clinical use for image coregistration of the abdomen or the thorax, this technology will still play an important role by allowing the correction of misregistrations attributable to patient motion or breathing artifacts, which may also arise from integrated SPECT/CT cameras.

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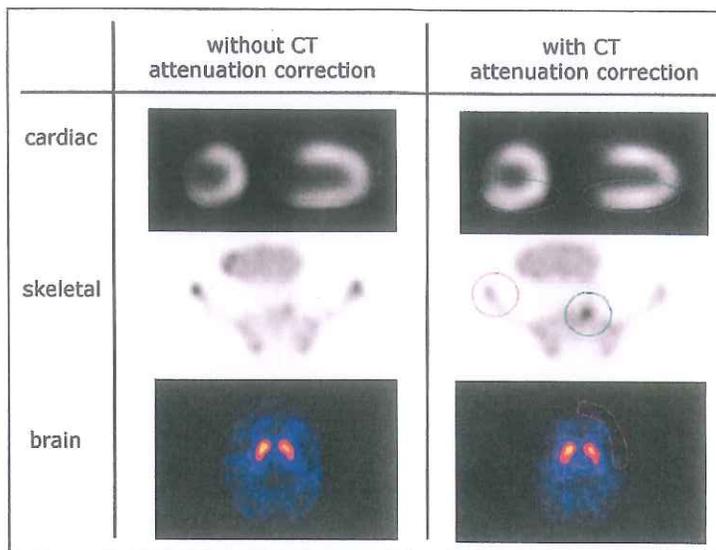
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No potential conflict of interest relevant to this article was reported.
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FIGURE 1. Impact of CT attenuation correction. Upper row (myocardial perfusion scintigraphy) shows attenuation of ^{99m}Tc -MIBI uptake in inferior myocardium. CT-corrected image demonstrates normal perfusion of inferior myocardium (green circles). Middle row (skeletal scintigraphy with ^{99m}Tc -hydroxymethylene diphosphonate) shows superior localization of bone metastasis in os sacrum (green circle) after CT attenuation correction. Lower row shows CT attenuation correction of brain study (^{99m}Tc -iodobenzamide SPECT). Without CT attenuation correction, background activity may be overestimated, especially in peripheral structures (red circles) and may appear with similar intensity as pathologic findings (e.g., skeletal scintigraphy, middle row).



Initial work was done by Hasegawa et al., who introduced a system that is capable of simultaneous CT and SPECT acquisitions (7). This group was the first to demonstrate that CT data can be used for attenuation correction, allowing superior quantification of radiotracer uptake. This technology translated into the first commercial SPECT/CT system, Hawkeye, which was introduced by GE Healthcare (8). Here, the modalities are combined, allowing sequential CT and SPECT acquisitions with only an axial shift of the patient between measurements. An enhanced version developed by GE Healthcare contained a 4-row multidetector CT capable of acquiring four 5-mm slices instead of one 10-mm slice. Philips combined a 6- or 16-slice CT scanner with a Skylight double-head camera system (Precedence). Philips also introduced a system for scientific purposes combining SPECT with 64-slice CT. Siemens Medical Solutions combined an E-Cam dual-detector γ -camera system with optional 1-, 2-, or 6-slice CT. With both systems, slice thickness can be adjusted from 0.6 to 10 mm, and the scan speed is <30 s for a 40-cm axial field of view. With the availability of coregistered CT information for the patient, methods that include spatially dependent collimator deblurring become feasible (9). Algorithms that combine this approach with attenuation on scatter correction (both based on CT information) have been implemented in SPECT/CT systems and may enable quantitative SPECT (10).

SUGGESTED PROTOCOLS FOR SPECT/CT

Although planar imaging and SPECT are routinely performed studies and respective protocols have been documented for various clinical settings, the roles of CT coregistration and specific imaging protocols have not yet

been clearly defined. In general, instead of standard protocols, combined SPECT/CT procedures should be selected on an individual basis and should reflect clinical needs. The radiation dose delivered by CT is a major issue in this regard, because diagnostic CT can increase the overall radiation dose by up to 14 mSv (11). Low-dose CT is associated with relatively low radiation doses of 1–4 mSv and should be sufficient for anatomic referencing of SPECT lesions and attenuation correction (Table 1). Usually, if a recent contrast-enhanced diagnostic CT scan is available, there is no need to perform another contrast-enhanced CT scan during SPECT/CT. Also, when SPECT/CT is performed for treatment monitoring and follow-up, low-dose CT should be sufficient. Therefore, the use of low-dose, nonenhanced spiral CT can be recommended in most cases when SPECT/CT is performed for anatomic referencing or attenuation correction. The standard protocol for integrated SPECT/CT at our institution (Siemens Symbia 6) is shown in Table 1.

When SPECT/CT is performed for tumor staging or restaging, the detection of small pulmonary nodules that may be negative on functional imaging is important. Therefore, the acquisition of an additional low-dose CT scan of the thorax during maximal inspiration should be considered for patients at risk for the presence of lung metastases (Table 1). This strategy applies especially to patients who have high-risk differentiated thyroid cancer and are undergoing radioiodine scintigraphy. In this setting, an additional 40-mA low-dose CT scan acquired during inspiration is a feasible approach, because it has been demonstrated that a reduction of the tube current to 40 mA results in satisfactory image quality and reduces overall radiation exposure (11).

TABLE 1
Suggested CT Protocols* for Inclusion in Noncardiac SPECT/CT Protocols

Protocol	Parameter	Comments	
SPECT-guided low-dose CT	Indications (general)	Preferred protocol when recent diagnostic CT is available and when follow-up studies are performed (monitoring of response to treatment)	
	Indications (specific)	Further anatomic localization or characterization of focal pathology present on planar or SPECT images, e.g., at bone scintigraphy, ¹³¹ I scintigraphy (thyroid cancer), sentinel node scintigraphy, ^{99m} Tc-MIBI SPECT (parathyroid tumors), ¹²³ I-MIBG SPECT (adrenocortical tumors), or ¹¹¹ In-pentetreotide imaging (neuroendocrine tumors)	
	Field of view	Including all areas with nonclassifiable scintigraphic lesions, e.g., cervical, thoracic, and abdominal regions, pelvis, skull, extremities, or any combination of these	
	CT overview (topogram)	Covering field of view as indicated earlier	
	CT scan (tomogram)		
	Scan direction	Caudocranial	
	Tube current	20–40 mA	
	Tube voltage	130 kV	
	Collimation	Depending on CT scanner; thinnest possible collimation for optimal multiplanar reconstructions; in areas prone to breathing artifacts, thicker collimation may be necessary to reduce scan duration and to minimize motion artifacts	
	Slice thickness	5 mm; increment of 2.5 mm; thinnest possible slice thickness with overlap in reconstruction increment necessary for optimal 3-dimensional reconstructions	
	Breathing protocol (general)	Shallow breathing; breath holding in expiration when lower thorax is scanned	
	Breathing protocol (screening for lung metastases)	Maximum inspiration during acquisition of CT	
	Radiation dose (in addition to that of SPECT)	2–4 mSv (depending on field of view in z-axis)	
	SPECT-guided diagnostic CT	Indications (general)	Preferred protocol when recent diagnostic CT is not available and when detailed anatomic information is mandatory to address clinical needs
		Indications (specific)	Further anatomic localization or characterization of lesions present at bone scintigraphy, ¹³¹ I scintigraphy (thyroid cancer, cervical region), ^{99m} Tc-MIBI SPECT (parathyroid tumors), ¹²³ I-MIBG SPECT, or ¹¹¹ In-pentetreotide imaging, especially when sufficient diagnostic accuracy cannot be expected from low-dose CT (e.g., when lesions are suspected in mediastinum or in proximity of liver or intestinal structures)
Field of view		Including areas with lesions present on planar or SPECT images or areas with suspected lesions (e.g., upper gastrointestinal tract for detection of pheochromocytoma)	
CT overview (topogram)		Covering field of view as indicated earlier	
CT scan (tomogram)		Specific protocols should be selected according to clinical needs (e.g., 3-phase CT of liver)	
Scan direction		Caudocranial	
Scan delay		60–80 s after start of intravenous injection of contrast material (depending on field of view in z-axis)	
Tube current		100 mA	
Tube voltage		130 kV	
Collimation		Depending on CT scanner; thinnest possible collimation for optimal multiplanar reconstructions; in areas prone to breathing artifacts, thicker collimation may be necessary to reduce scan duration and to minimize motion artifacts	
Slice thickness		5 mm; increment of 2.5 mm; thinnest possible slice thickness with overlap in reconstruction increment necessary for optimal 3-dimensional reconstructions	
Breathing protocol (general)		Shallow breathing; breath holding in expiration when lower thorax is scanned	
Breathing protocol (screening for lung metastases)		Breath holding in maximum inspiration during acquisition of CT	
Radiation dose (in addition to that of SPECT)		6–14 mSv (depending on field of view in z-axis)	

*Performed directly before or after SPECT acquisition.

TABLE 2
Suggested CT Protocols for Inclusion in Cardiac SPECT/CT Protocols

Protocol	Parameter	Comments
Low-dose cardiac CT	Indications	Coronary artery calcium (CAC) scoring; attenuation correction
	CT overview (topogram)	140–180 mm
	CT scan (tomogram)	Electrocardiographic gating mandatory for CAC scoring
	Field of view	Sternum–thoracic spine (140–180 mm)
	Acquisition	Diastolic phase
	Tube current	20–40 mA
	Tube voltage	130 kV
	Slice thickness	≤3 mm; increment of ≤3 mm
	Breathing protocol	Breath holding
	Radiation dose (in addition to that of SPECT)	1–3 mSv
Diagnostic cardiac CT (64-slice CT)	Indications	CT coronary angiography
	CT scan (tomogram)	Electrocardiographic gating mandatory
	Field of view	Sternum–thoracic spine (140–180 mm)
	Acquisition	Diastolic phase
	Scan delay	“Smart preparation” (~10 s after start of intravenous injection of contrast material [100 mL]; flow rate of 4 mL/s)
	Tube current	≤900 mA
	Tube voltage	130 kV
	Collimation	Thinnest possible collimation necessary for optimal 3-dimensional reconstructions
	Slice thickness	≤3 mm; increment of ≤3 mm; thinnest possible slice thickness with overlap in reconstruction increment necessary for optimal 3-dimensional reconstructions
	Breathing protocol	Breath holding
Radiation dose (in addition to that of SPECT)	4–14 mSv	

Compared with PET/CT, diagnostic CT protocols including intravenous or oral contrast agent enhancement are seldom performed at SPECT/CT but may be appropriate in certain clinical situations (Tables 1 and 2). These protocols will have to be implemented and modified continually, especially with the availability of new scanners offering very high spatial resolution (64-slice CT). Potential CT protocols suitable for cardiac imaging are discussed later (Table 2).

SPECT/CT FOR SLN MAPPING

For patients with cancer, accurate lymph node staging is mandatory for appropriate treatment planning. A combination of lymphoscintigraphy before surgery and mapping with blue dye during surgery has been demonstrated to be a practicable approach for accurately localizing the SLN. Although most sentinel nodes can be identified during surgery with a hand-held probe, SLN identification may be impossible in certain cases. Localization with CT coregistration before surgery may facilitate surgical access and thus improve overall detection rates. The added value of CT coregistration for SLN mapping has been demonstrated by several groups. Although inguinal and lower axillary nodes can be reliably detected on planar scintigrams, anatomic coregistration represents a valuable tool for SLN detection in the pelvis, the mediastinum, or the

head and neck region. For patients with melanoma of the head and neck or the trunk, a pilot study indicated that SPECT/CT enabled the detection of sentinel nodes in up to 43% of patients with negative planar scintigrams (12). For patients with early-stage cervical cancer (13) and invasive bladder cancer (14), better detection of sentinel nodes by SPECT/CT than by planar scintigrams was described. The CT portion of the examination was especially helpful for the identification of SLNs during surgery. For 20 patients with head and neck cancer, Khafif et al. reported a sensitivity of SPECT/CT of 87.5% (15). SPECT/CT further improved SLN identification and localization over those provided by planar images for 6 patients (30%). For a series of 34 patients, SPECT/CT identified sentinel nodes in 94% of patients (32/34) and identified additional nodes in 15 (47%) of those 32 patients (16). More accurate localization of SLNs in oral cavity squamous cell carcinoma was described by Keski-Santti et al. (17). Superior topographic SLN identification was described in 2 further studies of head and neck cancer or melanoma (12,18).

Husarik and Steinert examined the added value of SPECT/CT in breast cancer (Fig. 2) (19). For 41 consecutive patients, findings from planar scintigrams and SPECT/CT were identical in only 7 patients (17%); SPECT/CT indicated the correct anatomic localization in 29 patients (70%), according to the American Joint Committee on Cancer staging system

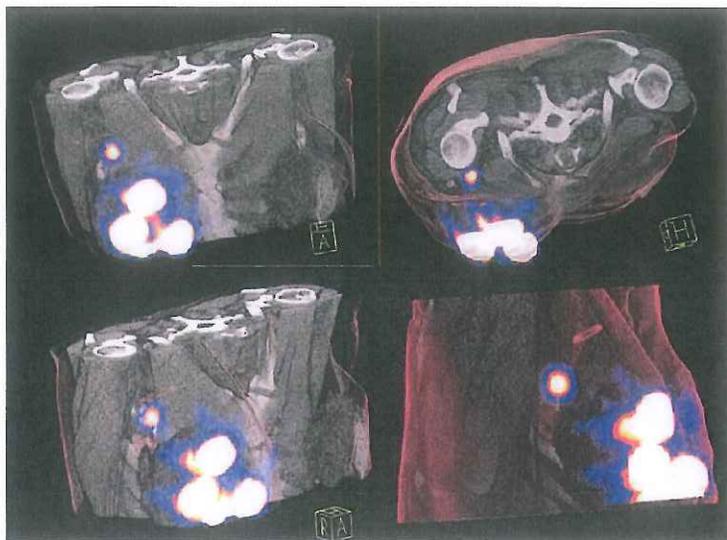


FIGURE 2. Accurate anatomic localization of sentinel node in patient with breast cancer by sentinel node scintigraphy (^{99m}Tc -Nanocol; Amersham) and CT coregistration. Correct anatomic localization of sentinel node in left axilla is illustrated by 3-dimensional projections of fused images.

(levels I–III). For 6 patients, additional SLNs were detected. For 26 patients (63%), exact anatomic localization could be derived exclusively from SPECT/CT; 3 sentinel nodes close to the injection site were not detected by SPECT but could be clearly visualized by SPECT/CT. Similar findings were described earlier by Lerman et al. (20). For 157 consecutive patients, 13% of sentinel nodes were visualized by SPECT/CT but not on planar scintigrams. Unexpected sites of drainage and non-node-related hot spots were identified for 33 patients. For a prospective series of 51 patients, sentinel nodes could be assigned to axillary levels I–III on the basis of SPECT/CT data but not on the basis of planar images (21). In a pilot study by van der Ploeg et al., SPECT/CT was superior to SPECT for SLN detection; for 4 of 31 patients, 6 additional SLNs were detected by SPECT/CT, leading to a change in management for 5% of patients because of upstaging in the axilla (22). SPECT/CT has been shown to be especially useful in overweight patients. In a prospective study of 220 patients with breast cancer, 122 patients had a body mass index of greater than 25 (23). For 49 patients (22%), planar images failed to identify a sentinel node. However, for 29 of these 49 patients (59%), sentinel nodes could be identified by SPECT/CT. Overall, the sensitivity of SPECT/CT in overweight patients was 89%. SPECT/CT was also superior to blue dye labeling during surgery and identified sentinel nodes in 75% of patients in whom the blue dye technique failed to detect sentinel nodes. Although the current literature does not indicate a major role for SPECT/CT in SLN identification in breast cancer, this modality may be helpful when the standard approach fails to identify the SLN.

SPECT/CT IN SKELETAL DISEASES

For more than 30 y, planar bone scintigraphy has been used as a valuable method for sensitively detecting or character-

izing focal bone pathology; more recently, SPECT has been used in this capacity (24). Although functional bone imaging is a highly sensitive method, it lacks specificity (25). Therefore, radiography, CT, or MRI is frequently performed after bone scintigraphy to further characterize lesions evident on bone scans. Integrated SPECT/CT offers a direct correlation of focal bone pathology with anatomic structures and therefore minimizes the number of equivocal findings.

Applications in Malignant Skeletal Diseases

Screening for bone metastases and evaluation of the treatment response are the most frequent indications for bone scanning. Although the majority of bone metastases appear as hot spots, some appear as cold lesions. Benign lesions, such as hemangioma, may also appear as cold, making the differential diagnosis problematic. The differentiation of benign and malignant lesions can usually be achieved with CT coregistration and is a major advantage of SPECT/CT (Fig. 3). In addition, fused images can be used to further guide biopsies of bone lesions.

A normal tracer distribution on planar bone scans usually makes the use of SPECT/CT unnecessary. Although in many cases the correct diagnosis can be derived from planar bone scans, SPECT/CT is necessary to make the correct diagnosis in cases of undefined lesions. In particular, scintigraphic lesions in the spine or pelvis frequently may not be defined exactly, requiring the additional use of CT or MRI. Recently, image coregistration was demonstrated to be superior to planar radiographic techniques or SPECT and proved useful in further characterizing benign skeletal abnormalities. The presence of accompanying complications, such as fractures or compression of the spinal cord, can also be diagnosed in a single examination (26).

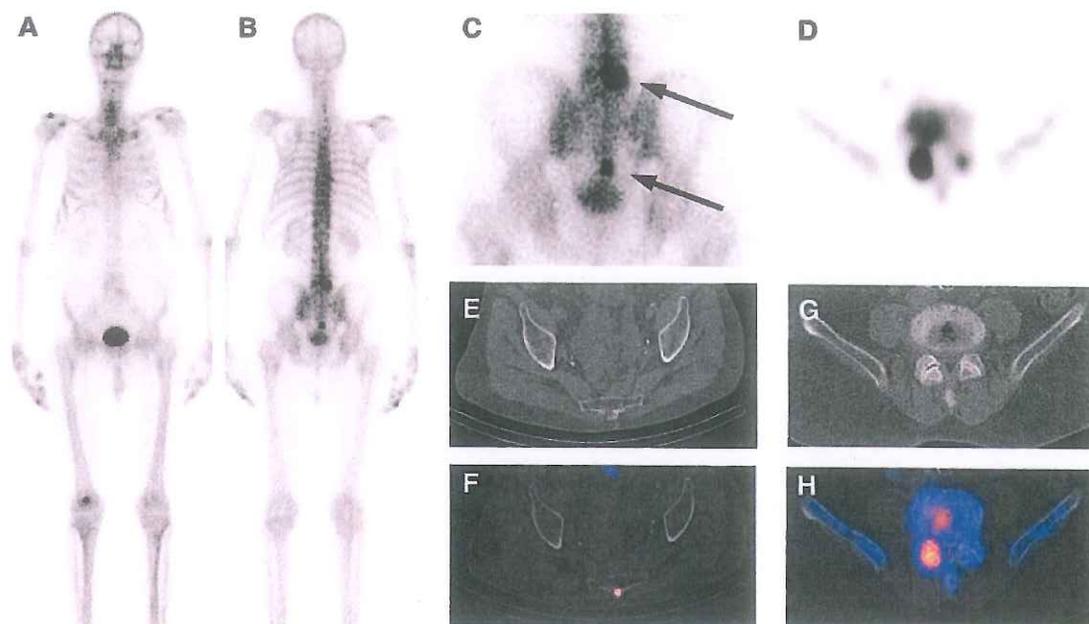


FIGURE 3. Patient with lung cancer and 2 hot spots, in lower lumbar spine and pelvis (os sacrum). (A and B) Planar scintigrams from skeletal scintigraphy (^{99m}Tc -hydroxymethylene diphosphonate). (C) Detailed view of pelvis with 2 hot spots (arrows). (D) Transverse section of upper lesion in lumbar vertebra 5. (E) Small osteolytic lesion with intense tracer uptake indicating bone metastasis. (F) Fused image. (G and H) Spondylarthrosis of right facet joint with intense tracer uptake indicating degenerative lesion.

The first report demonstrating the superiority of SPECT/CT over planar imaging or SPECT was published by Römer et al. (27). In this retrospective study, SPECT-guided CT was reported to clarify more than 90% of bone lesions that were indeterminate at SPECT: 63% of indeterminate findings could be definitely assigned as benign lesions involving mostly osteochondrosis, spondylosis, or spondylarthrosis of the spine; 29% of lesions could be clearly assigned as osteolytic or osteosclerotic bone metastases; and 4 lesions (8%) remained indeterminate at SPECT/CT because of a missing anatomic correlate. The majority of these lesions were located in the ribs or scapula. Because the performance of MRI in the thorax is affected by motion artifacts, the authors concluded that even MRI might not be able to confirm or exclude bone metastases in such lesions. The study also indicated that exact matching of functional and anatomic data may be necessary, especially in small anatomic structures. Small osteolytic bone metastases were observed in close proximity to facet joints, potentially causing misinterpretation of lesions at SPECT. The concept of Römer et al. (27) included the use of SPECT data for determination of the field of view for CT, resulting in reduced additional radiation exposure. On a per-patient basis, the mean radiation exposure from additional CT was as low as 2.3 mSv. SPECT-guided CT therefore results in acceptable overall radiation exposure. The use of CT data for attenuation

correction may also increase the performance of SPECT, but this issue has not been studied in detail (28,29).

Using a combination of a dual-head SPECT camera and a nondiagnostic low-dose CT scanner, Horger et al. were also able to correctly classify 85% of unclear foci; in comparison, 36% of such foci were correctly classified by SPECT alone (30). Integrated SPECT/CT also seems to be superior to side-by-side reading of SPECT and CT images. Using juxtaposed CT and SPECT scanners, Utsunomiya et al. demonstrated that fused images were superior to side-by-side reading for the differentiation of malignant from benign lesions (31).

Applications in Benign Skeletal and Infectious Diseases

Even-Sapir et al. reported recently that SPECT/CT allowed a definite diagnosis for the majority of indeterminate scintigraphic findings in nononcologic situations (32). Infectious bone lesions, such as osteomyelitis, may be diagnosed by 3-phase bone scintigraphy with ^{99m}Tc -labeled diphosphonates. This approach has high sensitivity but lacks specificity. Another option is the use of radiolabeled autologous leukocytes (WBC), still considered the gold standard for localizing an area of infection by scintigraphic procedures. A more practicable approach is the use of ^{99m}Tc -labeled monoclonal antigranulocyte antibodies directed against the CD66 antigen, which is expressed on

granulocytes and macrophages. ^{99m}Tc -labeled ciprofloxacin was recently suggested to specifically detect infection through the accumulation of the radiotracer in living bacteria. CT coregistration may improve the specificity as well as the sensitivity of these scintigraphic techniques. CT is able to detect small areas of cortical destruction and to identify soft-tissue abscesses or empyema located in neighboring soft-tissue structures. CT data can be correlated with the accumulation of granulocytes or increased bone turnover, as indicated by scintigraphy, thus confirming or excluding infectious bone lesions. It is obvious that combined imaging makes the interpretation of SPECT and CT easier and more reliable.

The added value of SPECT/CT for diagnosing infections has been demonstrated by several authors (33–40). Bar-Shalom et al. recently evaluated the role of SPECT/CT in the diagnosis and localization of infections by using ^{67}Ga - or ^{111}In -labeled WBC (33). The patients examined had fever of unknown origin and suspected osteomyelitis, soft-tissue infection, or vascular graft infection. SPECT/CT provided additional information for the diagnosis and localization of infections in 48% of patients (39/82). For 4 patients with physiologic bowel uptake, SPECT/CT allowed the exclusion of infection, and the diagnosis based on SPECT/CT was incorrect in 2 other patients. The authors concluded that SPECT/CT with ^{67}Ga - or ^{111}In -labeled WBC made an incremental contribution to scintigraphy by improving the diagnosis, localization, or definition of the extent of disease. Another study evaluated the performance of SPECT/CT in 28 patients with suspected bone infection or infection of orthopedic implants. WBC planar scanning or SPECT accurately detected infections in 18 of 28 patients, with true-negative results in 10 of 28 patients; SPECT/CT provided accurate anatomic localization for all lesions. There was a significant clinical contribution of SPECT/CT in 36% of patients. For

patients with osteomyelitis, SPECT/CT was also able to differentiate soft-tissue from bone involvement and allowed the correct diagnosis of osteomyelitis in patients with structural tissue alterations attributable to trauma. The superiority of SPECT/CT with ^{111}In -labeled WBC over side-by-side reading of SPECT and CT images was also suggested by a recent pilot study (36).

The added value of integrated SPECT/CT relative to triple-phase bone scintigraphy was evaluated by Horger et al. (35). For 31 patients with pathologic results from a triple-phase bone scan, the sensitivity and the specificity of SPECT/CT were 78% and 86%; those of SPECT and planar imaging were 78% and 50%, respectively. However, a combination of SPECT and separately performed MRI, radiography, or CT returned the highest sensitivity. SPECT/CT avoided false-positive findings and reduced the number of equivocal findings, but an additional benefit beyond the benefits of separately performed imaging modalities has not been demonstrated.

SPECT/CT IN DIFFERENTIATED THYROID CANCER

In patients with differentiated thyroid carcinoma, whole-body imaging after oral administration of ^{131}I or ^{123}I is commonly performed to identify residual or metastatic disease. ^{131}I scintigraphy has a higher sensitivity than morphologically based imaging modalities. However, the interpretation of ^{131}I images may be difficult because of the absence of anatomic landmarks. Therefore, precise localization of hot spots is frequently not possible. In addition, physiologic uptake of ^{131}I may cause false-positive findings (Fig. 4). Integrated SPECT/CT potentially allows the differentiation of physiologic, artificial, and pathologic uptake of ^{131}I (41). In a retrospective study by Tharp et al., SPECT/CT had an incremental diagnostic value for 41 of 71 patients

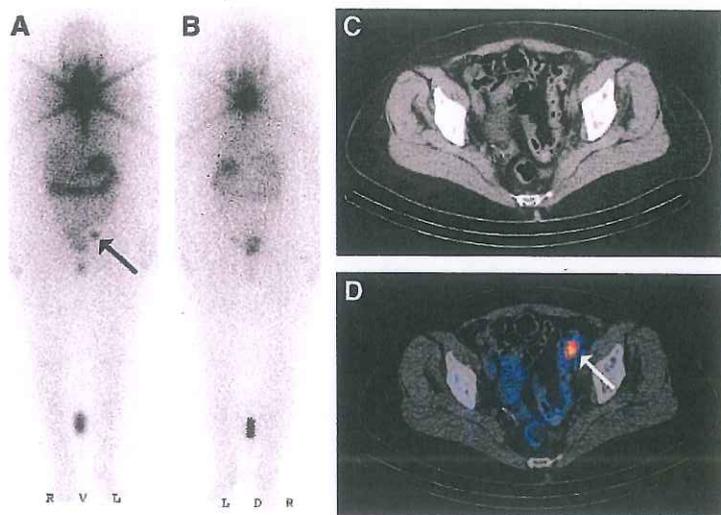


FIGURE 4. Exact delineation of focal pelvic ^{131}I uptake in patient with differentiated thyroid cancer. (A and B) Planar ^{131}I scintigrams (anterior view [A] and posterior view [B]) showing focal tracer uptake in left pelvic region (arrow). Lesion cannot be definitely assigned as benign or solitary bone metastasis. (C and D) Corresponding CT section (C) and fused SPECT/CT image (D) demonstrating non-specific tracer uptake in diverticulum of colon (arrow).

(58%) (42). In particular, in the neck region, SPECT/CT allowed the precise characterization of equivocal lesions for 14 of 17 patients and changed the lesion location for 5 patients. SPECT/CT also improved the characterization of indeterminate findings as definitely benign in 13% of patients (9/71) and the precise assignment of metastases to the skeleton in 17% of patients (12/71) and to the lungs versus the mediastinum in 7% of patients (5/71). SPECT/CT further optimized the assignment of ^{131}I uptake to lymph node metastases versus remnant thyroid tissue and to lung versus mediastinal metastases. Overall, additional findings at SPECT/CT had an impact on management for 41% of patients.

In a study by Yamamoto et al. of 17 patients with differentiated thyroid carcinoma, fusion of SPECT and CT images with external markers improved the diagnosis in 15 of 17 patients (88%), mainly because of better anatomic localization of scintigraphic findings and differentiation of physiologic from specific uptake (43). Fused images resulted in a change in management for 4 of 17 patients (24%). A pilot study of 25 patients undergoing ablative radioiodine treatment of the thyroid also indicated an added value of SPECT/CT image fusion. Using an integrated SPECT/CT camera, Ruf et al. reported superior anatomic localization of 44% of suspected lesions (17/39) (44). The findings returned by fused images influenced therapeutic management for 25% of patients (6/24).

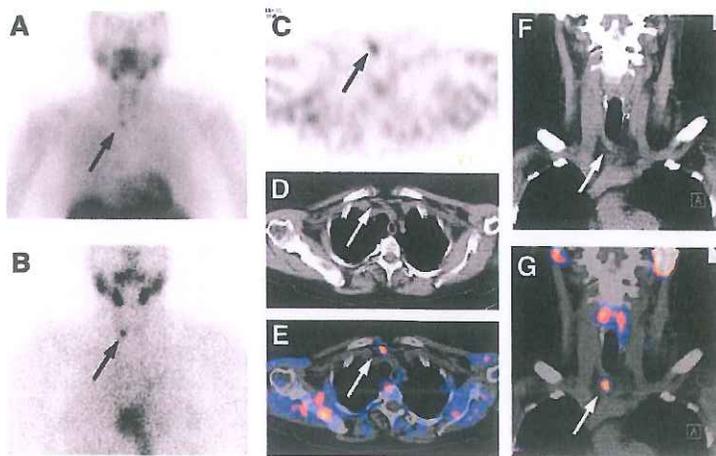
SPECT/CT IN PARATHYROID TUMORS

In primary hyperparathyroidism, $^{99\text{m}}\text{Tc}$ -methoxyisobutylisonitrile (MIBI) scintigraphy plays a minor role, because bilateral neck exploration has a success rate of up to 95%. However, with the increasing use of minimal invasive parathyroidectomy, presurgical imaging and precise localization of a parathyroid adenoma are critical for successful surgery. For a series of 110 patients, Lavelly et al. compared the diagnostic performance of planar imaging, SPECT,

SPECT/CT, and single- and dual-phase $^{99\text{m}}\text{Tc}$ -MIBI parathyroid scintigraphy (45). In this prospective study, dual-phase planar imaging, SPECT, and SPECT/CT were significantly more accurate than single-phase early or delayed planar imaging. Early-phase SPECT/CT in combination with any delayed imaging method (planar or SPECT) was superior to dual-phase planar imaging or dual-phase SPECT with regard to sensitivity, area under the curve, and positive predictive value (PPV). Sensitivity ranged from 34% for single-phase planar imaging to 73% for dual-phase studies including an early SPECT/CT scan. The PPV was as high as 86%–91% for dual-phase studies including an early SPECT/CT scan. The specificity was greater than 98% for all of the imaging techniques, and the negative predictive value was greater than 95%. Furthermore, early SPECT/CT had a higher sensitivity and a significantly higher PPV than delayed SPECT/CT. The authors therefore concluded that CT coregistration is a valuable tool for the precise delineation of parathyroid adenomas (Fig. 5).

Superior localization of parathyroid adenomas was also reported by Harris et al. (46). For a series of 23 patients, SPECT/CT performed well for the detection and localization of solitary adenomas (89%), but performance for the detection of multifocal disease was reduced. In a pilot study, Ruf et al. performed low-dose CT for attenuation correction and reported that the sensitivity of attenuation-corrected $^{99\text{m}}\text{Tc}$ -MIBI SPECT/CT was only slightly higher than that of non-attenuation-corrected SPECT (47). Also, Gayed et al. reported that SPECT/CT was only of limited value (8% of patients) (48). On the contrary, a retrospective study indicated a change in therapeutic management for 39% of patients (14/36) because of the localization of ectopic parathyroid adenomas or accurate localization in patients with distorted neck anatomy (49). Because of some inconsistent reports, a definite role of SPECT/CT in the imaging of parathyroid adenomas has not yet been indicated, and evaluations with larger patient cohorts are needed.

FIGURE 5. Parathyroid scintigraphy with SPECT/CT. (A and B) Planar views of $^{99\text{m}}\text{Tc}$ -MIBI scintigraphy 60 min (A) and 15 min (B) after $^{99\text{m}}\text{Tc}$ -MIBI injection. Arrows indicate lesions. (C) Transverse section of $^{99\text{m}}\text{Tc}$ -MIBI SPECT showing mildly intense focal lesion in right lower neck region (arrow). (D and E) Corresponding CT section (D) and fused image (E) indicating parathyroid adenoma below right thyroid gland (arrows). (F and G) Demonstration of parathyroid adenoma (arrows) in corresponding coronal CT (F) and SPECT/CT (G) images.



SPECT/CT IN TUMORS OF SYMPATHETIC NERVOUS SYSTEM AND ADRENOCORTICAL TUMORS

Morphologic imaging modalities, such as CT or MRI, offer high sensitivity for the detection of tumors of the sympathetic nervous system. The major advantages of radionuclide imaging, such as ^{123}I -metaiodobenzylguanidine (MIBG) SPECT, ^{18}F -L-3,4-dihydroxyphenylalanine PET, or ^{11}C -metahydroxyephedrine (HED) PET, are high specificity, which can be used to better characterize lesions, and superior differentiation of scar tissue and residual tumor after surgery (Fig. 6) (50,51). Radionuclide imaging is also helpful for the detection of extraadrenal tumor sites. In a prospective study, Franzius et al. evaluated the clinical use of ^{123}I -MIBG SPECT/CT in 19 patients with a variety of tumors of the sympathetic nervous system, including neuroblastoma and pheochromocytoma (52). ^{123}I -MIBG SPECT/CT had a sensitivity (93%) similar to that (99%) achieved by PET/CT with ^{11}C -HED as a tracer. ^{11}C -HED PET/CT was demonstrated to show a higher spatial resolution and to return a final diagnosis within 30 min. SPECT/CT was compromised by a longer examination time and the need for delayed imaging (24 h after tracer administration). However, no superiority of PET/CT over SPECT/CT was observed. Because of the high cost and low availability of ^{11}C , ^{123}I -MIBG SPECT/CT seems to be appropriate for the imaging of tumors derived from the sympathetic nervous system, such as neuroblastoma, pheochromocytoma, ganglioneuroblastoma, and paraganglioma.

Scintigraphic techniques also complement anatomically based imaging modalities for the evaluation of adrenocortical disease. The impact of hybrid SPECT/CT on the performance of functional imaging, such as ^{75}Se -selenomethylnorcholesterol or ^{131}I -iodocholesterol imaging, remains to be determined, because only scant data can be found in the literature.

In a pilot study, Even-Sapir et al. reported a change in clinical management for a few patients undergoing ^{75}Se -cholesterol SPECT/CT (53). Despite an obvious lack of clinical studies demonstrating the superiority of SPECT/CT over separately performed imaging modalities, it can be speculated that hybrid imaging will increase diagnostic accuracy and may lead to the more frequent use of functional imaging techniques.

SPECT/CT IN NEUROENDOCRINE TUMORS

Neuroendocrine tumors usually exhibit increased expression of somatostatin receptors (SSTR), enabling their detection through the specific binding of radiolabeled ligands, such as ^{111}In -octreotide or ^{111}In -pentetreotide. SSTR scintigraphy is predominantly used for the detection of primary tumors or hepatic or mesenteric metastases but can also be used for assessment of the response to treatment with somatostatin analogs. The number of publications illustrating the added value of CT coregistration for SSTR planar imaging or SSTR SPECT is limited. The largest study to date evaluated SSTR SPECT/CT in 72 patients with various neuroendocrine tumors, including 45 carcinoid tumors, medullary thyroid carcinoma, or islet cell tumors (54). No additional information beyond that provided by planar imaging or SPECT was achieved for 48 patients, whereas SPECT/CT improved the localization of scintigraphic findings for 23 patients (32%) and changed clinical management for 14% of patients. For a series of 27 patients with various neuroendocrine tumors, Even-Sapir et al. demonstrated increased accuracy of detection of lesions by ^{131}I , ^{123}I -MIBG, ^{75}Se -cholesterol, or ^{111}In -pentetreotide SPECT/CT (53). For one third of patients, a change in clinical

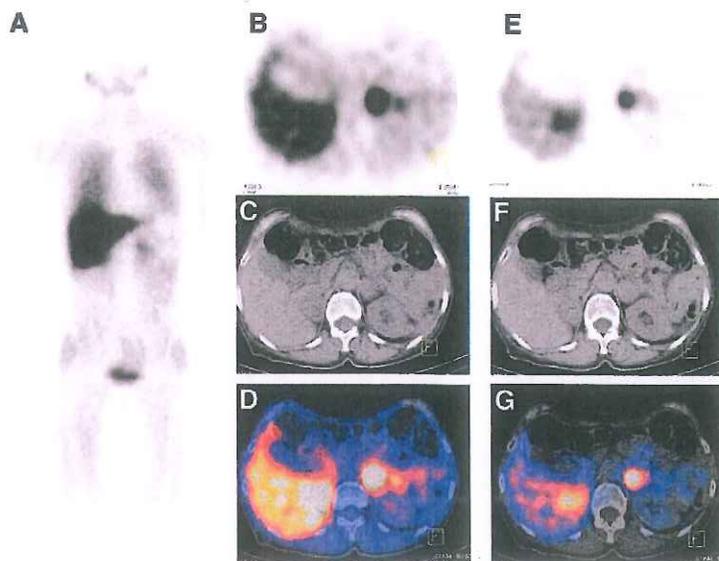


FIGURE 6. Diagnosis of pheochromocytoma with $^{99\text{m}}\text{Tc}$ -MIBG SPECT/CT. (A) Planar image showing mildly intense focal lesion extending to left suprarenal area. (B–D) Corresponding sections of SPECT (B), CT (C), and fused SPECT/CT (D) images showing focal uptake extending to enlarged left adrenal gland, indicating pheochromocytoma. (E–G) Corresponding transverse sections of right adrenal gland showing additional hot spot and enlargement of gland, indicating second pheochromocytoma, which was proven histologically. Lesion may be missed on planar image (A) or overexposed transaxial SPECT image (B).

management occurred. A significant impact of SPECT/CT on therapeutic management was also demonstrated by Hillel et al. for 29 patients with carcinoid or other neuroendocrine tumors (55). The addition of clinically relevant information for 40% of patients by SPECT/CT compared with SPECT was described by Gabriel et al. (56).

SPECT/CT IN CARDIAC IMAGING

As an example of the increased interest in hybrid cardiac imaging, the Society of Nuclear Medicine awarded its 2006 image of the year award to a cardiac SPECT/CT study (57). This study demonstrated a defect in the inferior myocardium together with corresponding stenosis on CT angiography (CTA). Combining function and morphology is highly attractive for several reasons: improved diagnosis and logistics as well as illustrative visualization. In this review, we focus on the methodologic perspective for hybrid SPECT/CT in nuclear perfusion imaging (Table 2), because the number of clinical procedures and research studies is still small compared with the number of studies of conventional methods. Where SPECT, CT, and SPECT/CT are positioned best in the clinical decision-making process is outside the scope of this review; discussion of this topic is ongoing and is the focus of recent reviews (58–60). Specifically, Berman et al. proposed “possible risk-based strategies through which imaging might be used to identify candidates for more intense prevention and risk factor modification strategies as well as those who would benefit from coronary angiography and revascularization” (59). We are convinced that cardiac SPECT/CT will play a prominent role in these scenarios and have compiled arguments ranging from improved attenuation correction to the assessment of complementary information with the potential of reducing radiation burden.

Use of CT for Attenuation Correction

Nonhomogeneous photon attenuation in the thorax is one of the most notable limitations of myocardial perfusion imaging. It creates the appearance of a nonuniform, regional perfusion distribution even for normal hearts, thus limiting clinical specificity. To overcome this obstacle, the correction of photon attenuation requires the assessment of attenuating tissue in the volume of interest (Fig. 1). Unfortunately, cardiac imaging poses a particular problem for attenuation correction because of respiratory and cardiac motion. Technically, SPECT attenuation correction with external sources was introduced in the early 1990s; retrospectively, however, its success appears to be rather limited. Thus, the integration of CT components in 2000 was a major step forward, with clinically relevant results being reported in larger studies (61,62).

The technical developments were summarized in recent review articles (3,63). Two different technical approaches were previously investigated. The first was a protocol with a radiation burden as low as possible (<0.5 mSv). The second was a CT examination allowing diagnostic imaging that, for cardiac imaging, would be either an assessment of coronary

calcifications or, if the CT system were suitable, contrast-based angiography (typically 1–3 mSv for calcium scoring or 4–14 mSv for CTA). It is important to note that the actual doses varied substantially for the imaging hardware and the imaging protocol used and recently showed a trend toward a decrease, at least for CTA studies. For the low-dose approach and the coronary calcification scan, the contribution to the overall dose is moderate; for SPECT and CTA, the contributions are almost the same (Table 2).

PET/CT studies have already shown that very low-dose CT acquisitions are feasible for attenuation correction (64). Koepfli et al. (65) and a recent study with SPECT/CT confirmed these findings (66). However, a potential misalignment between emission and transmission data poses the risk of incomplete correction and thus artificial perfusion defects and requires careful quality control to avoid reconstruction artifacts. PET/CT (67,68) and SPECT/CT (69,70) studies have shown that the frequency of misalignment is high ($\approx 50\%$) and that the consequences are clinically significant. Fortunately, a recent study with a digital phantom showed that the effects of misalignment are less severe for SPECT/CT than for PET/CT, mainly because of reduced spatial resolution (71). The alignment of SPECT and CT is usually performed manually, a process that contributes to certain variabilities. However, automated approaches for quality control are under investigation (10,72,73). It is relevant that even low-quality CT scans for attenuation correction provide clinically useful information. Goetze et al. reported that for 10% of 200 patients, noncardiac-related abnormal findings were detected (69,70). Similar data with even higher incidence rates are available from cardiac CT studies (74,75). Incidental findings may result in legal liabilities. It is clear that modifications in the clinical reading process are needed.

Cardiac SPECT Versus PET and Absolute Quantification

The superiority of cardiac PET over cardiac SPECT was demonstrated in several publications (3,58,71,76,77). However, in almost all of these reports, non-attenuation-corrected SPECT was used. Thus, assuming the availability of reliable CT-based attenuation correction for single-photon imaging and given an increased tolerance of motion artifacts, new studies should provide further insight into whether PET will remain superior. From a technical point of view, the capability of PET for absolute quantification in general and for blood flow quantification in particular is a substantial advantage. Nevertheless, through the use of animal models and a SPECT/CT system, it was shown that absolute activity values can be generated when attenuation correction and partial-volume effects are considered (78,79). For assessing absolute flow and coronary flow reserve, imaging with SPECT appears to be promising but requires large-scale validation work (80–82).

Integration of Calcium Scoring CT

In general, a trend toward the integration of low- and medium-quality CT systems—as opposed to high-end sys-

tems suitable for contrast-enhanced CT of the coronary arteries—into SPECT/CT devices has been observed. Consequently, those hybrid systems are not necessarily suitable for analysis of the vessel lumen with contrast agents but may be capable of the technically less demanding imaging of coronary calcium as a potential marker of atherosclerosis; however, this hypothesis has been debated in the last few years. It is not the aim of this review to repeat this discussion, but some selected, potential hybrid applications deserve mention.

A recent study investigated the incidence of significant calcifications in 84 patients referred for ^{82}Rb PET with adenosine stress (83). Non-contrast-enhanced CT was used for attenuation correction. Thirty-four patients with negative calcium findings also had normal PET results (negative predictive value, 100%). The remaining 50 patients had calcifications, and a myocardial perfusion defect was detected in 13 patients (PPV, 26%; sensitivity, 100%; specificity, 48%). Using this combined approach, the investigators concluded that myocardial perfusion PET could have been obviated in 63% of patients with no smoking history and no prior myocardial infarction or coronary revascularization procedure and in 37% of the total patient cohort. Although this study was a PET/CT study, this approach might allow a nuclear scan in a resting state to be avoided, and the overall radiation dose from SPECT/CT could be markedly reduced. Similarly, Henneman et al. investigated the hypoenhancement resulting from delayed contrast agent washin in CTA studies (84). On the basis of the fact that the scar scores calculated from SPECT myocardial perfusion imaging and by CTA washin analysis corresponded well for SPECT and CTA, another approach to avoiding a resting SPECT examination could be envisioned. However, although these studies appear to be promising, the incremental value of assessing coronary calcifications or coronary morphology as part of a nuclear examination needs to be investigated in large prospective studies, and it is too early to answer the question of optimal work flow.

Myocardial Perfusion and CT Coronary Angiography

As with combined PET/CT acquisitions of perfusion and coronary morphology (85), visually very attractive displays can be created with SPECT/CT systems (86). In one of the largest studies to date, including 56 patients with a high prevalence of coronary artery disease, the authors concluded that “hybrid SPECT/CTCA imaging results in improved specificity and PPV to detect hemodynamically significant coronary lesions in patients with chest pain” (87). However, this study also showed that the total radiation burden was as high as 41.5 mSv.

It is interesting that the fusion approach is not restricted to integrated devices (88,89). In particular, for CTA studies, the integrated CT component is typically less advanced than stand-alone CT. Thus, the use of external CT is feasible and may even offer a resolution advantage. Technically, SPECT and CT studies must be spatially registered even with hybrid

cameras because of differences in breathing positions (expiration vs. averaged respiratory motion). A relevant additional aspect of cardiac contrast-enhanced CT is the imaging of delayed enhancement, as in MRI. The different washout rates for contrast agents in normal myocardium and damaged myocardium are now widely used in MRI (90) and recently were used in CT (91,92). Thus, delineating scar tissue with low-dose CT after contrast agent injection appears to be feasible.

In summary, the prospects for hybrid cardiac imaging are promising, and new clinical applications are being proposed. Large, prospective, outcome-based studies for proving these concepts are lacking. In addition, economic and biologic aspects must be considered (93,94). However, reliable attenuation correction and the integration of complementary, multimodality information into an attractive display facilitating communication with cardiologists will influence the future development of nuclear cardiac imaging.

SPECT/CT IN NEUROLOGIC AND PSYCHIATRIC DIAGNOSES

So far, data on the added value of combined SPECT/CT examinations of the brain remain rather limited. However, the diagnostic value of various cerebral SPECT examinations, such as cerebral perfusion or receptor studies, might be increased, to some extent, by additional CT examinations.

In general, individual CT scan-based attenuation correction of brain SPECT data may lead to improved image quality and more accurate data evaluation (Fig. 1). These features may be particularly important for regional data analysis, such as semiquantitative region-of-interest-based image analysis, as regularly applied for the evaluation of imaging studies of presynaptic dopamine transporters with ^{123}I -2 β -carbomethoxy-3 β -(4-iodophenyl)tropane (DaTSCAN; GE Healthcare) or postsynaptic dopamine receptors with ^{123}I -iodobenzamide. These examinations are usually applied for the verification of idiopathic Parkinson's disease, respectively, the differentiation from atypical Parkinson syndromes. In both types of studies, ratios of striatal to background tracer uptake are calculated, and predefined thresholds for striatum-to-background ratios are used for the differentiation of normal uptake and pathologic findings reflecting reduced receptor or transporter density. For attenuation correction of these studies, ellipse-based calculated attenuation correction techniques, such as the procedure described by Chang (95), are usually applied and have been demonstrated to show sufficient reliability. However, it has been shown that attenuation correction based on individual CT scans produces more accurate results (96). In particular, for borderline findings, it is possible that attenuation correction has a significant influence on quantitative assessment and, thus, on the resulting clinical diagnosis. In such cases, individual CT scan-based attenuation correction may lead to a more appropriate diagnosis. In addition to optimized data quality, access to individual coregistered CT data may also improve the standardized definition and

positioning of regions of interest, particularly in datasets with pathologically low uptake (97). However, a systematic analysis is required to assess differences between individually measured and conventionally calculated attenuation corrections, and clarification of whether currently applied thresholds need to be modified is also required.

In addition to individualized attenuation correction, the performance of CT scans simultaneously with SPECT examinations may offer several additional advantages. A recent study examined the additional diagnostic value of the low-dose (CT) component of a combined ^{99m}Tc -hexamethylpropyleneamine oxime SPECT/CT examination of cerebral perfusion in a large population (98). Interestingly, 25% of the low-dose CT images demonstrated abnormalities such as infarcts, cerebral atrophy, dilated ventricles, basal ganglion calcifications, and other findings, such as subdural hematoma or meningioma. The authors concluded that the CT component of cerebral perfusion SPECT/CT investigations should be routinely reported separately.

Finally, with the advent of modern SPECT/CT hybrid systems containing state-of-the-art CT scanners, it is possible, in principle, to perform high-quality diagnostic CT examinations of the brain in a single session with simultaneous SPECT examinations. This feature may offer opportunities to assess vascular pathologies, such as cerebral ischemia, stroke, or carotid stenosis, and even to diagnose brain death through the examination of cerebral perfusion with ^{99m}Tc -hexamethylpropyleneamine oxime in combination with CT assessment of vascular abnormalities (CT perfusion imaging, or CTA). The value of this type of combined examinations has not yet been sufficiently assessed and needs to be evaluated in specific clinical trials.

COMBINED SPECT/CT FOR OPTIMIZED DOSIMETRY

The complementation of scintigraphic examinations with detailed anatomic information derived from CT offers the possibility of improving organ-specific dosimetry for radiation treatment planning and radionuclide therapy. Dosimetry for treatment planning and for retrospectively ascertaining the absorbed dose delivered during treatment should be regarded as mandatory for all radionuclide therapies, such as radioiodine (^{131}I) treatment of thyroid cancer; radioimmunotherapy of lymphoma with, for example, ^{90}Y -ibritumomab tiuxetan; or therapy of neuroectodermal tumors, such as pheochromocytoma, neuroblastoma, or paraganglioma, with ^{131}I -MIBG. Conventionally, dosimetry for radionuclide treatment has been performed mostly by application of a low dose of the therapeutic radionuclide used for imaging or by application of the therapeutic compound labeled with a different radiotracer more suitable for scintigraphy (e.g., ^{111}In or ^{123}I) followed by tracer uptake measurements in planar scintigrams. However, more accurate dosimetry may require 3-dimensional assessment, proper attenuation correction of the image data, and assessment of organ or target volumes, which can be derived from

simultaneously acquired CT scans. Several studies have already demonstrated that 3-dimensional dosimetry based on anatomic information derived for regional organ volumes or masses from CT leads to superior assessments of regionally applied doses in critical organs (99–103). Integration of the data collected by multimodality imaging into complex calculation models, such as the Monte Carlo simulation, may significantly improve regional dosimetry for the spatial distribution of the absorbed dose (104).

In addition to dosimetry of critical organs at risk, evaluation by multimodality imaging with SPECT/CT may also allow accurate dosimetry of tumor targets for treatment planning and evaluation of the response to radionuclide therapy (105). This process may also be valuable for establishing a clear correlation between the absorbed dose and the biologic effect.

In summary, it appears likely that combined SPECT/CT will be highly useful for performing valid and clinically applicable dosimetry, for improving treatment planning, and for ensuring safe and effective radionuclide therapy.

Furthermore, combined SPECT/CT may also be useful for planning radiation treatment for prostate cancer. Hybrid imaging of capromab pendetide (Prostascint; Cytogen) with SPECT and CT has been demonstrated to show increased sensitivity for the identification of prostate cancer. Recently, it was proposed that this combined imaging approach be used to confine the dose escalation of radiation treatment to discrete regions of known disease, as defined by focal uptake on fused radioimmunoscinographic and anatomic image sets (106). It has been suggested that intensification of treatment directed to tumor targets without an increase in rectal toxicity may be achieved. Suggestions also have been extended toward guiding the implantation of radioactive seeds in brachytherapy (107). In general, it may be assumed that SPECT/CT will be equally valid for individualized planning of radiation treatment for other tumor entities, and further clinical research should be encouraged.

CONCLUSION

The role of integrated SPECT/CT is growing, especially in oncologic applications. CT coregistration results in higher specificity as well as sensitivity of scintigraphic findings and markedly reduces the number of indeterminate findings. The superiority of SPECT/CT over planar scintigraphy or SPECT has been clearly demonstrated for the imaging of benign and malignant skeletal diseases, thyroid cancer, neuroendocrine cancer, parathyroid adenoma, and mapping of SLNs in the head and neck and in the pelvic region. Studies demonstrating superiority in other clinical applications are lacking; however, pilot studies have encouraged the use of SPECT/CT in cardiac and neurologic imaging. Interesting developments occurring with less frequently used radiopharmaceuticals and imaging technologies may become clinically relevant in the near future.

REFERENCES

- Czermin J, Allen-Auerbach M, Schelbert HR. Improvements in cancer staging with PET/CT: literature-based evidence as of September 2006. *J Nucl Med*. 2007;48(suppl 1):78S-88S.
- von Schulthess GK, Steinert HC, Hany TF. Integrated PET/CT: current applications and future directions. *Radiology*. 2006;238:405-422.
- O'Connor MK, Kemp BJ. Single-photon emission computed tomography/computed tomography: basic instrumentation and innovations. *Semin Nucl Med*. 2006;36:258-266.
- Perault C, Schwartz C, Wampach H, Lichu JC, Delisle MJ. Thoracic and abdominal SPECT-CT image fusion without external markers in endocrine carcinomas. The Group of Thyroid Tumoral Pathology of Champagne-Ardenne. *J Nucl Med*. 1997;38:1234-1242.
- Frank A, Lefkowitz D, Jaeger S, et al. Decision logic for retreatment of asymptomatic lung cancer recurrence based on positron emission tomography findings. *Int J Radiat Oncol Biol Phys*. 1995;32:1495-1512.
- Forster GJ, Laumann C, Nickel O, Kann P, Rieker O, Bartenstein P. SPECT/CT image co-registration in the abdomen with a simple and cost-effective tool. *Eur J Nucl Med Mol Imaging*. 2003;30:32-39.
- Hasegawa BH, Wong KH, Iwata K, et al. Dual-modality imaging of cancer with SPECT/CT. *Technol Cancer Res Treat*. 2002;1:449-458.
- Bocher M, Balan A, Krausz Y, et al. Gamma camera-mounted anatomical X-ray tomography: technology, system characteristics and first images. *Eur J Nucl Med*. 2000;27:619-627.
- Xia W, Lewitt RM, Edholm PR. Fourier correction for spatially variant collimator blurring in SPECT. *IEEE Trans Med Imaging*. 1995;14:100-115.
- Chen J, Caputo-Wilson SF, Shi H, Galt JR, Faber TL, Garcia EV. Automated quality control of emission-transmission misalignment for attenuation correction in myocardial perfusion imaging with SPECT-CT systems. *J Nucl Cardiol*. 2006;13:43-49.
- Kuehl H, Veit P, Rosenbaum SJ, Bockisch A, Antoch G. Can PET/CT replace separate diagnostic CT for cancer imaging? Optimizing CT protocols for imaging cancers of the chest and abdomen. *J Nucl Med*. 2007;48(suppl 1):45S-57S.
- Even-Sapir E, Lerman H, Lievshitz G, et al. Lymphoscintigraphy for sentinel node mapping using a hybrid SPECT/CT system. *J Nucl Med*. 2003;44:1413-1420.
- Zhang WJ, Zheng R, Wu LY, Li XG, Li B, Chen SZ. Clinical application of sentinel lymph node detection to early stage cervical cancer [in Chinese]. *Ai Zheng*. 2006;25:234-228.
- Sherif A, Garske U, de la Torre M, Thorn M. Hybrid SPECT-CT: an additional technique for sentinel node detection of patients with invasive bladder cancer. *Eur Urol*. 2006;50:83-91.
- Khafif A, Schneebaum S, Fliss DM, et al. Lymphoscintigraphy for sentinel node mapping using a hybrid single photon emission CT (SPECT)/CT system in oral cavity squamous cell carcinoma. *Head Neck*. 2006;28:874-879.
- Bilde A, Von Buchwald C, Mortensen J, et al. The role of SPECT-CT in the lymphoscintigraphic identification of sentinel nodes in patients with oral cancer. *Acta Otolaryngol*. 2006;126:1096-1103.
- Keski-Santti H, Matzke S, Kauppinen T, Tornwall J, Atula T. Sentinel lymph node mapping using SPECT-CT fusion imaging in patients with oral cavity squamous cell carcinoma. *Eur Arch Otorhinolaryngol*. 2006;263:1008-1012.
- Wagner A, Schicho K, Glaser C, et al. SPECT-CT for topographic mapping of sentinel lymph nodes prior to gamma probe-guided biopsy in head and neck squamous cell carcinoma. *J Craniomaxillofac Surg*. 2004;32:343-349.
- Husarik DB, Steinert HC. Single-photon emission computed tomography/computed tomography for sentinel node mapping in breast cancer. *Semin Nucl Med*. 2007;37:29-33.
- Lerman H, Metzger U, Lievshitz G, Sperber F, Schneebaum S, Even-Sapir E. Lymphoscintigraphic sentinel node identification in patients with breast cancer: the role of SPECT-CT. *Eur J Nucl Med Mol Imaging*. 2006;33:329-337.
- Gallowitsch HJ, Kraschl P, Igere I, et al. Sentinel node SPECT-CT in breast cancer: can we expect any additional and clinically relevant information? *Nuklearmedizin*. 2007;46:252-256.
- van der Ploeg IM, Valdes Olmos RA, Nieweg OE, Rutgers EJ, Kroon BB, Hoefnagel CA. The additional value of SPECT/CT in lymphatic mapping in breast cancer and melanoma. *J Nucl Med*. 2007;48:1756-1760.
- Lerman H, Lievshitz G, Zak O, Metzger U, Schneebaum S, Even-Sapir E. Improved sentinel node identification by SPECT/CT in overweight patients with breast cancer. *J Nucl Med*. 2007;48:201-206.
- Hamaoka T, Madewell JE, Podoloff DA, Hortobagyi GN, Ueno NT. Bone imaging in metastatic breast cancer. *J Clin Oncol*. 2004;22:2942-2953.
- Minoves M. Bone and joint sports injuries: the role of bone scintigraphy. *Nucl Med Commun*. 2003;24:3-10.
- Even-Sapir E. Imaging of malignant bone involvement by morphologic, scintigraphic, and hybrid modalities. *J Nucl Med*. 2005;46:1356-1367.
- Römer W, Nomayr A, Uder M, Bautz W, Kuwert T. SPECT-guided CT for evaluating foci of increased bone metabolism classified as indeterminate on SPECT in cancer patients. *J Nucl Med*. 2006;47:1102-1106.
- Seo Y, Wong KH, Sun M, Franc BL, Hawkins RA, Hasegawa BH. Correction of photon attenuation and collimator response for a body-contouring SPECT/CT imaging system. *J Nucl Med*. 2005;46:868-877.
- Römer W, Reichel N, Vija HA, et al. Isotropic reconstruction of SPECT data using OSEM3D: correlation with CT. *Acad Radiol*. 2006;13:496-502.
- Horger M, Eschmann SM, Pfannenberg C, et al. Evaluation of combined transmission and emission tomography for classification of skeletal lesions. *AJR*. 2004;183:655-661.
- Utsumomiya D, Shiraishi S, Imuta M, et al. Added value of SPECT/CT fusion in assessing suspected bone metastasis: comparison with scintigraphy alone and nonfused scintigraphy and CT. *Radiology*. 2006;238:264-271.
- Even-Sapir E, Flusser G, Lerman H, Lievshitz G, Metzger U. SPECT/multislice low-dose CT: a clinically relevant constituent in the imaging algorithm of nononcologic patients referred for bone scintigraphy. *J Nucl Med*. 2007;48:319-324.
- Bar-Shalom R, Yefremov N, Guralnik L, et al. SPECT/CT using ⁶⁷Ga and ¹¹¹In-labeled leukocyte scintigraphy for diagnosis of infection. *J Nucl Med*. 2006;47:587-594.
- Filippi L, Schillaci O. Usefulness of hybrid SPECT/CT in ^{99m}Tc-HMPAO-labeled leukocyte scintigraphy for bone and joint infections. *J Nucl Med*. 2006;47:1908-1913.
- Horger M, Eschmann SM, Pfannenberg C, et al. Added value of SPECT/CT in patients suspected of having bone infection: preliminary results. *Arch Orthop Trauma Surg*. 2007;127:211-221.
- Ingui CJ, Shah NP, Oates ME. Infection scintigraphy: added value of single-photon emission computed tomography/computed tomography fusion compared with traditional analysis. *J Comput Assist Tomogr*. 2007;31:375-380.
- Nathan J, Crawford JA, Sodee DB, Bukale G. Fused SPECT/CT imaging of peri-iliopsoas infection using indium-111-labeled leukocytes. *Clin Nucl Med*. 2006;31:801-802.
- Palestro CJ, Love C, Miller TT. Diagnostic imaging tests and microbial infections. *Cell Microbiol*. 2007;9:2323-2333.
- Rouch PJ, Schenbri GP, Ho Shon IA, Bailey EA, Bailey DL. SPECT/CT imaging using a spiral CT scanner for anatomical localization: impact on diagnostic accuracy and reporter confidence in clinical practice. *Nucl Med Commun*. 2006;27:977-987.
- Start RH, Koopmans KP, Gunneweg P, Luijckx GJ, de Jong BM. Persistent aseptic meningitis due to post-surgical spinal CSF leakage: value of fused ^{111m}In-DTPA SPECT-CT cisternography. *Eur J Nucl Med Mol Imaging*. 2006;33:856.
- Ingui CJ, Shah NP, Oates ME. Endocrine neoplasm scintigraphy: added value of fusing SPECT/CT images compared with traditional side-by-side analysis. *Clin Nucl Med*. 2006;31:665-672.
- Tharp K, Israel O, Hausmann J, et al. Impact of ¹³¹I-SPECT/CT images obtained with an integrated system in the follow-up of patients with thyroid carcinoma. *Eur J Nucl Med Mol Imaging*. 2004;31:1435-1442.
- Yamamoto Y, Nishiyama Y, Monden T, Matsumura Y, Satah K, Ohkawa M. Clinical usefulness of fusion of ¹³¹I SPECT and CT images in patients with differentiated thyroid carcinoma. *J Nucl Med*. 2003;44:1905-1910.
- Ruf J, Lehnkuhl L, Bertram H, et al. Impact of SPECT and integrated low-dose CT after radioiodine therapy on the management of patients with thyroid carcinoma. *Nucl Med Commun*. 2004;25:1177-1182.
- Lavelly WC, Goetze S, Friedman KP, et al. Comparison of SPECT/CT, SPECT, and planar imaging with single- and dual-phase ^{99m}Tc-sestamibi parathyroid scintigraphy. *J Nucl Med*. 2007;48:1084-1089.
- Harris L, Yoo J, Driedger A, et al. Accuracy of technetium-99m SPECT-CT hybrid images in predicting the precise intraoperative anatomical location of parathyroid adenomas. *Head Neck*. 2008;30:509-517.
- Ruf J, Seehofer D, Denecke T, et al. Impact of image fusion and attenuation correction by SPECT-CT on the scintigraphic detection of parathyroid adenomas. *Nuklearmedizin*. 2007;46:15-21.
- Gayed IW, Kim EE, Broussard WF, et al. The value of ^{99m}Tc-sestamibi SPECT/CT over conventional SPECT in the evaluation of parathyroid adenomas or hyperplasia. *J Nucl Med*. 2005;46:248-252.
- Krausz Y, Bettman L, Guralnik L, et al. Technetium-99m-MIBI SPECT/CT in primary hyperparathyroidism. *World J Surg*. 2006;30:76-83.
- Avram AM, Fig LM, Gross MD. Adrenal gland scintigraphy. *Semin Nucl Med*. 2006;36:212-227.

51. Gross MD, Avram A, Fig LM, Rubello D. Contemporary adrenal scintigraphy. *Eur J Nucl Med Mol Imaging*. 2007;34:547-557.
52. Franzius C, Helmreich K, Weckesser M, et al. Whole-body PET/CT with ^{11}C -meta-hydroxyephedrine in tumors of the sympathetic nervous system: feasibility study and comparison with ^{123}I -MIBG SPECT/CT. *J Nucl Med*. 2006;47:1635-1642.
53. Even-Sapir E, Keidar Z, Sachs J, et al. The new technology of combined transmission and emission tomography in evaluation of endocrine neoplasms. *J Nucl Med*. 2001;42:998-1004.
54. Krausz Y, Keidar Z, Kogan I, et al. SPECT/CT hybrid imaging with ^{111}In -pentetate in assessment of neuroendocrine tumours. *Clin Endocrinol (Oxf)*. 2003;59:565-573.
55. Hillel PG, van Beek EJ, Taylor C, et al. The clinical impact of a combined gamma camera/CT imaging system on somatostatin receptor imaging of neuroendocrine tumours. *Clin Radiol*. 2006;61:579-587.
56. Gabriel M, Hausler F, Baile R, et al. Image fusion analysis of $^{99\text{m}}\text{Tc}$ -HYNIC-Tyr(3)-octreotide SPECT and diagnostic CT using an immobilisation device with external markers in patients with endocrine tumours. *Eur J Nucl Med Mol Imaging*. 2005;32:1440-1451.
57. 2006 Image of the year: focus on cardiac SPECT/CT. *J Nucl Med*. 2006;47:14N-15N.
58. Berman DS, Hachamovitch R, Shaw LJ, et al. Roles of nuclear cardiology, cardiac computed tomography, and cardiac magnetic resonance: assessment of patients with suspected coronary artery disease. *J Nucl Med*. 2006;47:74-82.
59. Berman DS, Shaw LJ, Hachamovitch R, et al. Comparative use of radionuclide stress testing, coronary artery calcium scanning, and noninvasive coronary angiography for diagnostic and prognostic cardiac assessment. *Semin Nucl Med*. 2007;37:2-16.
60. Raggi P, Berman DS. Computed tomography coronary calcium screening and myocardial perfusion imaging. *J Nucl Cardiol*. 2005;12:96-103.
61. Dondi M, Fagioli G, Salgarello M, Zoboli S, Nanni C, Cidka C. Myocardial SPECT: what do we gain from attenuation correction (and when)? *Q J Nucl Med Mol Imaging*. 2004;48:181-187.
62. Masood Y, Liu YH, Depuey G, et al. Clinical validation of SPECT attenuation correction using x-ray computed tomography-derived attenuation maps: multicenter clinical trial with angiographic correlation. *J Nucl Cardiol*. 2005;12:676-686.
63. Madsen MT. Recent advances in SPECT imaging. *J Nucl Med*. 2007;48:661-673.
64. Souvatzoglou M, Bengel F, Busch R, et al. Attenuation correction in cardiac PET/CT with three different CT protocols: a comparison with conventional PET. *Eur J Nucl Med Mol Imaging*. 2007;34:1991-2000.
65. Koepfli P, Hany TF, Wyss CA, et al. CT attenuation correction for myocardial perfusion quantification using a PET/CT hybrid scanner. *J Nucl Med*. 2004;45:537-542.
66. Preuss R, Weise R, Lindner O, Fricke E, Fricke H, Burchert W. Optimisation of protocol for low dose CT-derived attenuation correction in myocardial perfusion SPECT imaging. *Eur J Nucl Med Mol Imaging*. 2008;35:1133-1141.
67. Martinez-Moller A, Souvatzoglou M, Navab N, Schwaiger M, Nekolla SG. Artifacts from misaligned CT in cardiac perfusion PET/CT studies: frequency, effects, and potential solutions. *J Nucl Med*. 2007;48:188-193.
68. Gould KL, Pan T, Loghin C, Johnson NP, Guha A, Sdringola S. Frequent diagnostic errors in cardiac PET/CT due to misregistration of CT attenuation and emission PET images: a definitive analysis of causes, consequences, and corrections. *J Nucl Med*. 2007;48:1112-1121.
69. Goetze S, Brown TL, Lavelly WC, Zhang Z, Bengel FM. Attenuation correction in myocardial perfusion SPECT/CT: effects of misregistration and value of reregistration. *J Nucl Med*. 2007;48:1090-1095.
70. Goetze S, Wihl RL. Prevalence of misregistration between SPECT and CT for attenuation-corrected myocardial perfusion SPECT. *J Nucl Cardiol*. 2007;14:200-206.
71. McQuaid SJ, Hutton BF. Sources of attenuation-correction artefacts in cardiac PET/CT and SPECT/CT. *Eur J Nucl Med Mol Imaging*. 2008;35:1117-1123.
72. Guetter C, Wacker M, Xu C, Hornegger J. Registration of cardiac SPECT/CT data through weighted intensity co-occurrence priors. *Med Image Comput Comput Assist Interv Int Conf Med Image Comput Comput Assist Interv*. 2007;10:725-733.
73. Kovalski G, Israel O, Keidar Z, Frenkel A, Sachs J, Azhari H. Correction of heart motion due to respiration in clinical myocardial perfusion SPECT scans using respiratory gating. *J Nucl Med*. 2007;48:630-636.
74. Onuma Y, Tanabe K, Nakazawa G, et al. Noncardiac findings in cardiac imaging with multidetector computed tomography. *J Am Coll Cardiol*. 2006;48:402-406.
75. Schietinger BJ, Bozlar U, Hagspiel KD, et al. The prevalence of extracardiac findings by multidetector computed tomography before atrial fibrillation ablation. *Am Heart J*. 2008;155:254-259.
76. Ballok ZE. Nuclear cardiology. *Heart Lung Circ*. 2005;14(suppl 2):S27-S30.
77. Stonka PJ, Berman DS, Germano G. Applications and software techniques for integrated cardiac multimodality imaging. *Expert Rev Cardiovasc Ther*. 2008;6:27-41.
78. Kalki K, Blankespoor SC, Brown JK, et al. Myocardial perfusion imaging with a combined x-ray CT and SPECT system. *J Nucl Med*. 1997;38:1535-1540.
79. Da Silva AJ, Tang HR, Wong KH, Wu MC, Døe MW, Hasegawa BH. Absolute quantification of regional myocardial uptake of $^{99\text{m}}\text{Tc}$ -sestamibi with SPECT: experimental validation in a porcine model. *J Nucl Med*. 2001;42:772-779.
80. Storto G, Sorrentino AR, Pellegrino T, Liuzzi R, Petretta M, Cuocolo A. Assessment of coronary flow reserve by sestamibi imaging in patients with typical chest pain and normal coronary arteries. *Eur J Nucl Med Mol Imaging*. 2007;34:1156-1161.
81. Storto G, Cirillo P, Vicario ML, et al. Estimation of coronary flow reserve by Tc-99m sestamibi imaging in patients with coronary artery disease: comparison with the results of intracoronary Doppler technique. *J Nucl Cardiol*. 2004;11:682-688.
82. Lodge MA, Bengel FM. Methodology for quantifying absolute myocardial perfusion with PET and SPECT. *Curr Cardiol Rep*. 2007;9:121-128.
83. Esteves TP, Sanyal R, Santana CA, Shaw L, Raggi P. Potential impact of noncontrast computed tomography as gatekeeper for myocardial perfusion positron emission tomography in patients admitted to the chest pain unit. *Am J Cardiol*. 2008;101:149-152.
84. Henneman MM, Schuijff JD, Dibbets-Schneider P, et al. Comparison of multislice computed tomography to gated single-photon emission computed tomography for imaging of healed myocardial infarcts. *Am J Cardiol*. 2008;101:144-148.
85. Nandam M, Hany TF, Koepfli P, et al. Integrated PET/CT for the assessment of coronary artery disease: a feasibility study. *J Nucl Med*. 2005;46:930-935.
86. Gherlin E, Keidar Z, Rispler S, et al. Images in cardiovascular medicine: hybrid cardiac single photon emission computed tomography/computed tomography imaging with myocardial perfusion single photon emission computed tomography and multidetector computed tomography coronary angiography for the assessment of unstable angina pectoris after coronary artery bypass grafting. *Circulation*. 2006;114:e237-e239.
87. Rispler S, Keidar Z, Gherlin E, et al. Integrated single-photon emission computed tomography and computed tomography coronary angiography for the assessment of hemodynamically significant coronary artery lesions. *J Am Coll Cardiol*. 2007;49:1059-1067.
88. Gaemperli O, Schepis T, Kalff V, et al. Validation of a new cardiac image fusion software for three-dimensional integration of myocardial perfusion SPECT and stand-alone 64-slice CT angiography. *Eur J Nucl Med Mol Imaging*. 2007;34:1097-1106.
89. Gaemperli O, Schepis T, Valenta I, et al. Cardiac image fusion from stand-alone SPECT and CT: clinical experience. *J Nucl Med*. 2007;48:696-703.
90. Kim RJ, Fieno DS, Parrish TB, et al. Relationship of MRI delayed contrast enhancement to irreversible injury, infarct age, and contractile function. *Circulation*. 1999;100:1992-2002.
91. Mahnken AH, Koos R, Katoh M, et al. Sixteen-slice spiral CT versus MR imaging for the assessment of left ventricular function in acute myocardial infarction. *Eur Radiol*. 2005;15:714-720.
92. Lardo AC, Cordeiro MA, Silva C, et al. Contrast-enhanced multidetector computed tomography viability imaging after myocardial infarction: characterization of myocyte death, microvascular obstruction, and chronic scar. *Circulation*. 2006;113:394-404.
93. Picao E. Economic and biological costs of cardiac imaging. *Cardiovasc Ultrasound*. 2005;3:13.
94. Wijns W. Anatomic-functional imaging by single-photon emission computed tomography/computed tomography as the cornerstone of diagnosis and treatment for coronary patients: a glimpse into the (near) future? *J Am Coll Cardiol*. 2007;49:1068-1070.
95. Chang L. A method for attenuation correction in radio-nuclide computed tomography. *IEEE Trans Nucl Sci*. 1978;25:638-643.
96. Hayashi M, Deguchi J, Utsunomiya K, et al. Comparison of methods of attenuation and scatter correction in brain perfusion SPECT. *J Nucl Med Technol*. 2005;33:224-229.
97. Van Laere K, Koole M, D'Asseler Y, et al. Automated stereotactic standardization of brain SPECT receptor data using single-photon transmission images. *J Nucl Med*. 2001;42:361-375.

98. Sulkin TV, Coussens C. SPECT/CT cerebral perfusion scintigraphy: is the low-dose CT component of diagnostic value? *Clin Radiol*. 2008;63:289–298.
99. Boucek JA, Turner JH. Validation of prospective whole-body bone marrow dosimetry by SPECT/CT multimodality imaging in ^{131}I -anti-CD20 rituximab radioimmunotherapy of non-Hodgkin's lymphoma. *Eur J Nucl Med Mol Imaging*. 2005;32:458–469.
100. Rajendran JG, Fisher DR, Gopal AK, Durack LD, Press OW, Eary JF. High-dose ^{131}I -tositumomab (anti-CD20) radioimmunotherapy for non-Hodgkin's lymphoma: adjusting radiation absorbed dose to actual organ volumes. *J Nucl Med*. 2004;45:1059–1064.
101. Thicrens HM, Monsieurs MA, Bacher K. Patient dosimetry in radionuclide therapy: the whys and the wherefores. *Nucl Med Commun*. 2005;26:593–599.
102. Crenonesi M, Ferrari M, Grana CM, et al. High-dose radioimmunotherapy with ^{90}Y -ibritumomab tiuxetan: comparative dosimetric study for tailored treatment. *J Nucl Med*. 2007;48:1871–1879.
103. Assie K, Dieudonne A, Gardin I, Buvat I, Tilly H, Vera P. Comparison between 2D and 3D dosimetry protocols in ^{90}Y -ibritumomab tiuxetan radioimmunotherapy of patients with non-Hodgkin's lymphoma. *Cancer Biother Radiopharm*. 2008;23:53–64.
104. Prideaux AR, Song H, Habbs RF, et al. Three-dimensional radiobiologic dosimetry: application of radiobiologic modeling to patient-specific 3-dimensional imaging-based internal dosimetry. *J Nucl Med*. 2007;48:1008–1016.
105. Flux G, Bardies M, Monsieurs M, Savolainen S, Strands SE, Lassmann M. The impact of PET and SPECT on dosimetry for targeted radionuclide therapy. *Z Med Phys*. 2006;16:47–59.
106. Ellis RJ, Kaminsky DA. Fused radioimmunoscintigraphy for treatment planning. *Rev Urol*. 2006;8(suppl 1):S11–S19.
107. Sodee DB, Sodee AE, Bakate G. Synergistic value of single-photon emission computed tomography/computed tomography fusion to radioimmunoscintigraphic imaging of prostate cancer. *Semin Nucl Med*. 2007;37:17–28.



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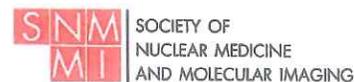
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⁶⁸Ga-DOTATATE PET/CT, ^{99m}Tc-HYNIC-Octreotide SPECT/CT, and Whole-Body MR Imaging in Detection of Neuroendocrine Tumors: A Prospective Trial

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There are different metabolic imaging methods, various tracers, and emerging anatomic modalities to stage neuroendocrine tumor (NET). We aimed to compare NET lesion detectability among ^{99m}Tc-hydrazinonicotinamide (HYNIC)-octreotide (somatostatin receptor scintigraphy [SSRS]) SPECT/CT, ⁶⁸Ga-DOTATATE PET/CT, and whole-body diffusion-weighted MR imaging (WB DWI). **Methods:** Nineteen consecutive patients (34–77 y old; mean, 54.3 ± 10.4 y old; 10 men and 9 women) underwent SSRS SPECT/CT, ⁶⁸Ga-DOTATATE PET/CT, and WB DWI. Images were acquired with a maximum interval of 3 mo between them and were analyzed with masking by separate teams. Planar whole-body imaging and SPECT/CT were performed from thorax to pelvis using a double-head 16-slice SPECT/CT scanner 4 h after injection of 111–185 MBq of ^{99m}Tc-HYNIC-octreotide. ⁶⁸Ga-DOTATATE PET/CT was performed from head to feet using a 16-slice PET/CT scanner 45 min after injection of 185 MBq of tracer. WB DWI was performed in the coronal plane using a 1.5-T scanner and a body coil. The standard method of reference for evaluation of image performance was undertaken: consensus among investigators at the end of the study, clinical and imaging follow-up, and biopsy of suggestive lesions. **Results:** McNemar testing was applied to evaluate the detectability of lesions using ⁶⁸Ga-DOTATATE PET/CT in comparison to SSRS SPECT/CT and WB DWI: a significant difference in detectability was noted for pancreas ($P = 0.0455$ and $P = 0.0455$, respectively), gastrointestinal tract ($P = 0.0455$ and $P = 0.0455$), and bones ($P = 0.0082$ and $P = 0.0082$). Two unknown primary lesions were identified solely by ⁶⁸Ga-DOTATATE PET/CT. ⁶⁸Ga-DOTATATE PET/CT, SSRS SPECT/CT, and WB DWI demonstrated, respectively, sensitivities of 0.96, 0.60, and 0.72; specificities of 0.97, 0.99, and 1.00; positive predictive values of 0.94, 0.96, and 1.00; negative predictive values of 0.98, 0.83, and 0.88; and accuracies of 0.97, 0.86, and 0.91. **Conclusion:** ⁶⁸Ga PET/CT seems to be more sensitive for detection of well-differentiated NET lesions, especially for bone and unknown primary lesions. NET can be staged with ⁶⁸Ga-DOTATATE PET/CT. WB DWI is an efficient new method with high accuracy and without ionizing radiation exposure. SSRS SPECT/CT should be used only when ⁶⁸Ga-DOTATATE PET/CT and WB DWI are not available.

Key Words: ⁶⁸Ga-DOTATATE PET/CT; ^{99m}Tc-HYNIC-octreotide SPECT/CT; PET/CT; SPECT/CT; MRI; neuroendocrine tumor

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Neuroendocrine (tumors (NETs) are slow-growing, rare endocrine malignancies with symptoms related to overproduction of bioactive substances or hormones in functioning tumors. However, in nonfunctioning tumors the diagnosis usually occurs at an advanced stage, rendering diagnosis of the primary lesion and detection of metastases difficult. Treatment and prognosis of NETs depend heavily on the stage and the originating organ (1).

Staging and restaging of NETs are performed by tumor marker measurements and by imaging studies to detect small lesions, such as CT of the chest, abdomen, and pelvis; MR imaging of the liver; and contrast-enhanced CT (2). However, these imaging modalities lack the specificity to diagnose malignant involvement (3) or to explain the nature and origin of the malignancy.

NETs are able to express 5 known subtypes of somatostatin receptor (4,5). More than 85% of gastrointestinal and pancreatic NETs have a high affinity for somatostatin receptors 2, 3, and 5 and also bind to octreotide (6,7).

Radiolabeled γ -emitting somatostatin analogs can detect somatostatin receptor-expressing NETs with 67%–100% sensitivity, superior to conventional imaging (8). Although somatostatin receptor scintigraphy (SSRS) is highly efficient for whole-body imaging, detection of lesions is difficult in organs with intense physiologic uptake, with low receptor density, or small size (9). Additionally, the physical characteristics of ¹¹¹In do not make it an ideal tracer for imaging. On the other hand, the development of technetium-labeled tracers such as ^{99m}Tc-hydrazinonicotinamide (HYNIC)-octreotide and others has overcome the limitations of ¹¹¹In for scintigraphic imaging. In addition, hybrid SPECT/CT has higher accuracy and specificity for lesion detection. Therefore, the use of SPECT/CT with SSRS labeled with ^{99m}Tc combines state-of-the-art scintigraphic imaging using the ideal γ -emitting isotope with structural CT information.

PET has a higher spatial resolution than scintigraphy (3–6 mm vs. 10–15 mm, respectively). ⁶⁸Ga-DOTATATE PET/CT is more efficient than SSRS for evaluating small NET lesions. Additionally, the affinity of ⁶⁸Ga-DOTATATE for binding to somatostatin receptor 2 is higher than that of ¹¹¹In-octreotide (2.5 ± 0.5 nM vs. 22 ± 3.6 nM)

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(10,11). ⁶⁸Ga-DOTATATE PET/CT combines state-of-the-art PET imaging with an ideal positron-emitting isotope.

Whole-body diffusion-weighted MR imaging (WB DWI) has recently emerged as a tool for detection of metastasis without intravenous contrast material or radiation exposure that may possibly detect NET lesions in the entire body in a single acquisition. Only a few studies have addressed the value and practicality of WB DWI in staging NETs. The purpose of this study was to compare the detectability of NET lesions among 3 state-of-the-art imaging modalities—SPECT/CT with radiolabeled peptides, PET/CT with radiolabeled peptides, and WB DWI—and to establish the most appropriate work-up for the patient.

MATERIALS AND METHODS

The institutional review board and ethics committee approved this cross-sectional study (no. 2013/283.777). All patients gave written informed consent.

To be included, patients had to be older than 18 y, have a histologic diagnosis of NET, have suspected tumor recurrence, have no prior history of other malignant primary neoplasms, be nonlactating and nonpregnant, sign the informed consent form, undergo all imaging studies within an interval of no more than 3 mo, and receive no intervention or treatment during the imaging period.

Nineteen consecutive patients who met the inclusion criteria underwent staging with SSRS SPECT/CT, ⁶⁸Ga-DOTATATE PET/CT, and WB DWI. Three teams of experienced physicians analyzed the images separately and were masked to the results of the other imaging procedures. In cases of disagreement between 2 physicians, the third expert would be used to reach a consensus.

Patient age ranged from 34 to 77 y (mean ± SD, 54.3 ± 10.4 y); 10 were men and 9 women. Three patients had cancer of unknown primary site. The primary malignancies included tumors of the bronchi (n = 4), pancreas (n = 6), and gut (n = 6). Tumor markers included Ki-67 ranging from 1% to 26% (mean, 9.5% ± 8.4%) and chromogranin A ranging from 1.6 to 901 ng/mL (mean, 151.5 ± 290.9 ng/mL). The mean

TABLE 1
Lesion Detection Capability of SSRS SPECT/CT, ⁶⁸Ga PET/CT, and WB DWI

Variable	N/P	P value	
		⁶⁸ Ga-DOTATATE PET/CT vs. SSRS SPECT/CT	⁶⁸ Ga-DOTATATE PET/CT vs. WB DWI
All solid organs	N	0.0253	0.0833
	P		
Lungs and pleura	N	1.0000	0.1573
	P		
Liver	N	0.1573	0.3173
	P		
Pancreas	N	0.0455	0.0455
	P		
Gastrointestinal tract	N	0.0455	0.0455
	P		
All LNs	N	0.5637	1.0000
	P		
Cervical LNs	N	1.0000	1.0000
	P		
Thoracic LNs	N	0.5637	0.0833
	P		
Abdomen and pelvic LNs	N	0.3137	0.3173
	P		
All skeletal system	N	0.0082	0.0082
	P		
Bones of spine and pelvis	N	0.0143	0.0455
	P		
Thoracic bones	N	0.0143	0.0143
	P		
Bones of limbs	N	0.0253	0.0455
	P		
Skull and skull base	N	0.0455	0.0455
	P		

LNs = lymph nodes; N = negative; P = positive.

interval to perform the 3 studies was 21.8 ± 33.5 d (range, 1–93 d), with a mean clinical follow-up of 4 mo.

SSRS SPECT/CT and ^{68}Ga -DOTATATE PET/CT were scheduled 4 wk after the last treatment with long-acting octreotide (Sandostatin; Novartis) or 24 h after treatment with short-acting analogs.

SSRS SPECT/CT

Images were obtained using a double-head SPECT/CT 16-slice camera (Symbia; Siemens Healthcare Solutions) with low-energy parallel-hole collimators.

Patients were injected with 111–185 MBq (3–5 mCi) of $^{99\text{m}}\text{Tc}$ -HYNIC-octreotide (RPH). Windows were set at 140 keV, a 10 cm/min scan rate was used, and a 195-cm extent was used for acquisition of planar whole-body images. Thoracic, abdominal, and pelvic SPECT/CT images were obtained after 4 h using a 128×128 matrix and 40 s/projection. Images were reconstructed iteratively. CT images were acquired with 130 kV, 15 mAs, a 0.8-s rotation speed, and a 5-mm slice thickness. Appendicular and skull SPECT/CT images were obtained only when suggestive lesions were noted on the planar whole-body images.

^{68}Ga -DOTATATE PET/CT

Images were acquired using a 16-slice PET/CT scanner (Biograph, True V; Siemens Healthcare Solutions). The acquisition began 45 min after injection of 185 MBq (5 mCi) of ^{68}Ga -DOTATATE (IPEN). Images were acquired from the proximal third of the thigh to the head (~6–7 bed positions) at 5 min/bed position. Images were reconstructed iteratively. CT images were acquired with 130 kV, 15 mAs, a 0.8-s rotation speed, and a 2-mm slice thickness.

WB DWI

MR imaging was performed with a 1.5-T whole-body imager. Coronal whole-body images (head to thigh) were obtained using a body coil. Diffusion-weighted, T1-weighted, and short- τ inversion recovery sequences were obtained, and for each, at least 5 continuous stations covering the whole body were acquired. Diffusion encoding was performed in one direction.

Lesions Detected

SSRS SPECT/CT and ^{68}Ga -DOTATATE PET/CT findings were designated as positive when intense focal uptake in comparison to the adjacent tissues was seen in the coronal, transaxial, and sagittal views. Linear and tubular areas of increased uptake in the intestinal tract were described as physiologic and as negative for malignancy.

Lesions seen on WB DWI were analyzed in terms of number, size, location, and signal intensity and were compared with the T1-weighted and short- τ inversion recovery sequences to rule out false-positive findings. Lymph nodes were defined as malignant according to the diameter of the small axis.

In all 3 studies, lesion location was categorized into 3 main regions: organs, lymph nodes, and musculoskeletal system. Organs were further subdivided into lungs/pleura, liver, pancreas, adrenals, and gastrointestinal

tract. Lymph nodes were further subdivided into cervical, thoracic (mediastinal, axillary, and clavicular), and abdominal/pelvic. The musculoskeletal system was further subdivided into spine, thorax (clavicles, ribs, sternum, and scapulae), limbs, skull, and soft tissues. The number of lesions that could clearly be identified as a sole focus was determined by each method in the 15 regions studied.

Confluent or irregular liver lesions were considered as a single lesion. All regions analyzed were considered either negative or positive. In the liver, lymph nodes, and bones, the number of lesions was counted.

Standard Method of Reference

The performance of the 3 imaging methods was evaluated using the following criteria: consensus among investigators at the end of the study evaluating all lesions by all methods, clinical follow-up, and biopsy of suggestive lesions when possible.

Statistical Analysis

Frequency and percentage were calculated for the qualitative variables, and mean, SD, median, minimum and maximum values, and number of valid observations were calculated for the quantitative variables.

McNemar testing was used to compare the qualitative variables of lesion detectability. The nonparametric Wilcoxon test was applied for paired samples of quantitative variables. The level of significance was set at 5% ($P \leq 0.05$).

The sensitivity, specificity, positive and negative predictive values, and accuracy of the 3 imaging modalities were calculated, and the equivalence test was applied to evaluate the difference in performance among the three. The maximum difference in equivalence was set at 0.15 (15%), and the level of significance was set at 5% ($P \leq 0.05$).

RESULTS

When ^{68}Ga -DOTATATE PET/CT was compared with SSRS SPECT/CT and WB DWI, the former detected more lesions in the pancreas ($P = 0.0455$ and $P = 0.0455$; McNemar test) and gastrointestinal tract ($P = 0.0455$ and $P = 0.0455$; McNemar test) (Table 1). ^{68}Ga -DOTATATE PET/CT was the only imaging modality to detect 2 unknown primary lesions and a metastasis in the gastrointestinal tract (Fig. 1). However a false-positive case of marked uptake occurred in the uncinata process.

When ^{68}Ga -DOTATATE PET/CT was compared with SSRS SPECT/CT and WB DWI, all were similar for lung ($P = 1.000$ and $P = 0.1573$; McNemar test) and liver lesions ($P = 0.1573$ and $P = 0.3173$; McNemar test). Lung nodules close to the liver dome were false-negative on ^{68}Ga -DOTATATE PET/CT and SSRS SPECT/CT but not on WB DWI (Fig. 2).

One liver metastasis was not detected by WB DWI after chemotherapy but was positive on ^{68}Ga -DOTATATE PET/CT and SSRS SPECT/CT, showing lack of complete response to treatment (Fig. 3). Subcentimeter hepatic metastases were easily identified on ^{68}Ga -DOTATATE PET/CT but were detected only retrospectively on dedicated MR imaging of the liver (Fig. 4).

When ^{68}Ga -DOTATATE PET/CT was compared with SSRS SPECT/CT and WB DWI, all three were similar for detection of lymph node lesions in the neck ($P = 1.000$ and $P = 1.000$; McNemar test), thorax ($P = 0.5637$ and $P = 0.0833$; McNemar test), and abdomen and pelvis ($P = 0.3137$ and $P = 0.3137$; McNemar

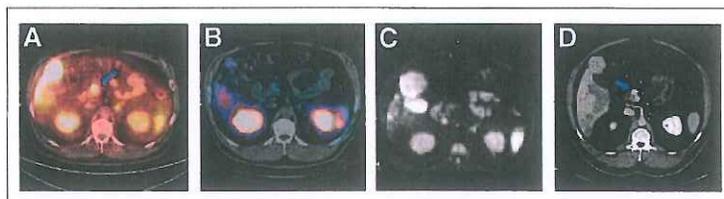


FIGURE 1. A 49-y-old man with NET of unknown origin for over 4 y. ^{68}Ga -DOTATATE PET/CT (A) identified primary pancreatic lesion (arrow), whereas SSRS SPECT/CT (B) and WB DWI (C) did not. This lesion was noted only retrospectively (arrow) on dedicated abdominal CT (D) performed 4 y previously.

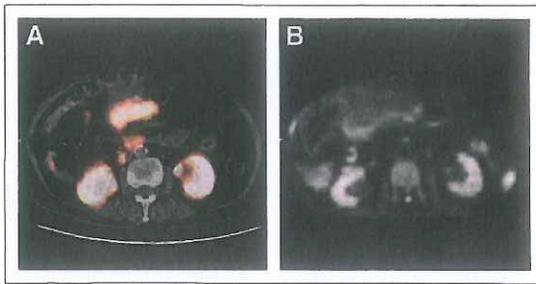


FIGURE 2. A 77-y-old woman with NET of unknown origin. ^{68}Ga -DOTATATE PET/CT (A) showed multiple liver metastases and mesenteric nodule, whereas WB DWI (B) did not identify mesenteric nodule.

test) (Fig. 5). One enlarged hepatogastric lymph node detected on WB DWI was false-negative on ^{68}Ga PET/CT and SSRS SPECT/CT.

^{68}Ga -DOTATATE PET/CT detected more bone metastases overall than did SSRS SPECT/CT and WB DWI ($P = 0.0082$ and $P = 0.0082$; McNemar test). False-negative findings occurred with WB DWI in a wide variety of small bone lesions (Fig. 5). ^{68}Ga -DOTATATE PET/CT had a higher detection rate in pelvic bones ($P = 0.0143$ and $P = 0.0455$; paired Wilcoxon test), thoracic bones ($P = 0.0143$ and $P = 0.0143$; McNemar test), the appendicular skeleton ($P = 0.0253$ and $P = 0.0455$; McNemar test), and the base of the skull ($P = 0.0455$ and $P = 0.0455$; McNemar test).

^{68}Ga -DOTATATE PET/CT and WB DWI performed equally in detecting solid organ lesions overall ($P = 0.0833$; McNemar test) and were better than SSRS SPECT/CT ($P = 0.0253$; McNemar test). The sensitivity, specificity, positive and negative predictive values, and accuracy for overall lesion detection for each imaging modality are listed in Table 2.

DISCUSSION

To our knowledge, this was the first study to evaluate state-of-the-art whole-body diagnostic imaging modalities (SPECT/CT, PET/CT, and WB DWI) in NET tumors. On the basis of our data, a diagnostic algorithm may be recommended to develop the best strategy for management of NETs.

SSRS labeled with ^{111}In has been considered the gold standard for the staging of well- and moderately differentiated NETs, by

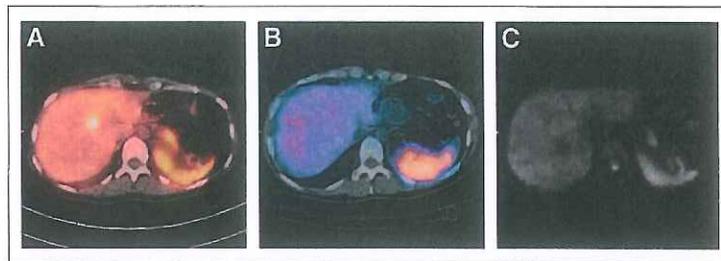


FIGURE 3. A 34-y-old woman with bronchial NET who underwent all 3 studies to evaluate response after chemotherapy. Patient had multiple liver lesions with marked uptake before chemotherapy. After chemotherapy, ^{68}Ga -DOTATATE PET/CT (A) demonstrated marked uptake in one remaining liver metastasis, indicating lack of complete response to treatment, whereas SSRS SPECT/CT (B) and WB DWI (C) did not identify this lesion.

specifically binding to somatostatin receptors 2, 3, and 5, although there is the disadvantage of lack of availability and high cost. $^{99\text{m}}\text{Tc}$ -HYNIC-octreotide is widely available and has a low cost, high specificity, high receptor affinity, low radiation exposure, less delay in acquisition time, and high imaging quality, especially with the current use of SPECT/CT. The uptake of the two tracers is comparable (12). Because of these characteristics, we chose to evaluate these patients with this modality, thus reducing radiation exposure and scanning time and increasing the accuracy and sensitivity of lesion detection. SSRS SPECT/CT, by determining the precise location of lesions and reducing false-positive results, has been shown to be superior to SSRS SPECT, altering clinical management in 26% of patients (13).

Many PET/CT peptide tracers could have been used in this study, such as DOTANOC, DOTALAN, DOTATOC, and even DOPA (although the latter has a different uptake mechanism and kinetics), since there are no definitive data suggesting the superiority of DOTATATE over the others. ^{68}Ga -DOTALAN and ^{68}Ga -DOTATATE have similar kinetics, and the latter has shown superiority in lesion detection due to higher uptake (14). We performed the studies with ^{68}Ga -DOTATATE because it is the only PET peptide tracer available in our country.

^{68}Ga -DOTATATE PET/CT is more convenient for the patient and referring physician than SSRS SPECT/CT. The entire PET/CT procedure can be performed in approximately 2 h (in contrast to 4 h), image acquisition is approximately 20 min (in contrast to 1.5 h), and the labeling can be accomplished with an in-house generator and with costs similar to the SSRS SPECT/CT procedure. The main disadvantage of SSRS and ^{68}Ga -DOTATATE PET/CT is the use of ionizing radiation.

MR imaging takes advantage of the highly vascular nature of NETs; with intravenous contrast material, lesions enhance intensely during the arterial phase and wash out during the delayed phase. On the other hand, since NETs significantly reduce water diffusion compared with normal tissues, in WB DWI the tumor displays a high signal intensity. We previously reported the potential of this novel patient-friendly tool that does not require intravenous contrast material, does not use ionizing radiation, and can be correlated with other T1- and T2-weighted MR imaging acquisitions for better tumor location and characterization (15). WB DWI has a fast acquisition phase and can easily be used as a roadmap to identify small and large NET lesions. Imaging can also be repeated to assess tumor response with morphologic and functional information. WB DWI requires movable table platforms, which are not yet commercially available from all manufacturers. Despite the relatively high cost at the moment, the precise anatomic information and lack of venous contrast material make WB DWI an attractive method that should be further investigated.

All 3 studies performed equally well for detection of lung nodules. However, WB DWI was less sensitive than CT because subcentimeter nodules, although clearly seen on CT, were difficult to detect on coronal WB DWI. Both ^{68}Ga -DOTATATE PET/CT and SSRS SPECT/CT were considered negative if there was no uptake in the lung nodules, even though they were clearly identified and reported as suggestive of metastases because of the CT portion of the studies. Some patients presented marked uptake in subcentimeter nodules. False-negative lung

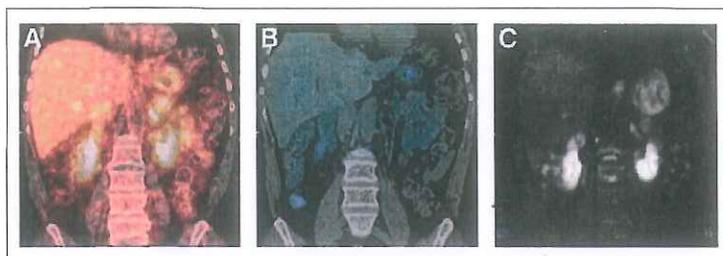


FIGURE 4. A 61-y-old woman with ileum NET. ^{68}Ga -DOTATATE PET/CT (A) easily identified subcentimeter hepatic metastases, whereas SSRS SPECT/CT (B) and WB DWI (C) did not detect these lesions.

nodules on ^{68}Ga -DOTATATE PET/CT and SSRS SPECT/CT occurred in lesions close to the liver dome because of the respiratory motion artifact. Respiratory gating, which was not available at the time of this study, is an important tool to avoid mistakes at the level of diaphragmatic lesions.

Prior studies have stated that there are limitations in the detection of hepatic metastases using ^{68}Ga -DOTATATE PET whereas contrast-enhanced CT and MR imaging seem more valuable in this setting (16). This may have been due to the quality of PET and SPECT equipment in prior studies, since they were not hybrid modalities. In contrast, our study showed that liver metastases were equally and reliably seen with ^{68}Ga -DOTATATE PET/CT and WB DWI and that both were superior to SSRS SPECT/CT. Published data have suggested that the detectability of NET liver metastases on MR imaging is equal to that on ^{18}F -FDG PET/CT (17). This also seems to be the case for ^{68}Ga -DOTATATE PET/CT studies. In our study, subcentimeter hepatic metastases with standardized uptake values in the range of 40–90 (and therefore above the spatial resolution of the equipment) were clearly seen on ^{68}Ga -DOTATATE PET/CT and were only retrospectively detected by dedicated liver MR imaging.

Detection of lymph nodes was virtually the same for both ^{68}Ga -DOTATATE PET/CT and WB DWI. Separating by site, ^{68}Ga -DOTATATE PET/CT detected slightly more thoracic nodes than WB DWI. The latter lacks sensitivity in detecting mediastinal nodes near the heart. In one patient, WB DWI detected an enlarged hepatogastric lymph node that did not take up ^{68}Ga -DOTATATE, possibly because the patient's disease was rapidly progressing and was dis-

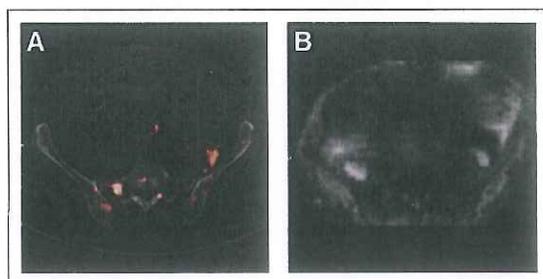


FIGURE 5. A 58-y-old woman with pancreatic NET. A 6-mm sacral metastasis was detected exclusively by ^{68}Ga -DOTATATE PET/CT (A) and was confirmed retrospectively by dedicated MR imaging; WB DWI (B) did not detect this lesion.

seminated, and this lesion possibly had become undifferentiated. The patient died within 7 mo.

The detection of adrenal lesions on ^{68}Ga -DOTATATE PET/CT studies is challenging because of the marked physiologic uptake in this organ. However, there was no difference in detection of lesions in the adrenal gland when all 3 imaging modalities were compared.

On the other hand, although there is physiologic uptake in the gastrointestinal tract, ^{68}Ga -DOTATATE PET/CT detected significantly more lesions than WB DWI and SSRS SPECT/CT. One unknown primary in the duodenum (undetected for years), one gastrointestinal tract metastasis, and other new lesions were detected only with ^{68}Ga -DOTATATE PET/CT.

A striking finding was the capability of ^{68}Ga -DOTATATE PET/CT to detect pancreatic lesions. Physiologic uptake in the uncinate process with DOTATOC and DOTANOC has previously been described (18,19). Marked ^{68}Ga -DOTATATE uptake in the uncinate process, which could be due to a higher cellular somatostatin receptor concentration, led to a false-positive study, and to our knowledge, this phenomenon with this tracer has not previously been described. In contrast, a patient with an unknown primary for years presented with marked focal ^{68}Ga -DOTATATE uptake. Retrospective analysis of the dedicated CT scan demonstrated a 0.4-cm lesion, which is in accordance with the theory that subcentimeter lesions, even when below the spatial resolution of the equipment, may be detected because of the markedly high ^{68}Ga -DOTATATE uptake. In addition, as seen in prior reports (20), there was a significant difference in lesion detectability in the pancreas between ^{68}Ga -DOTATATE PET/CT and WB DWI or SSRS SPECT/CT.

The most significant difference in lesion detection was clearly in the skeletal system, regardless of lesion size. Prior studies have shown higher detection rates of bone lesions with ^{68}Ga -peptides (on dedicated PET) than with ^{111}In -octreotide-SSRS and CT (2,21). In our study, ^{68}Ga -DOTATATE PET/CT detected more bone lesions overall and also by site (skull/skull base, thoracic bones, spine/pelvis, and bones of the limbs) than did WB DWI or SSRS SPECT/CT. On retrospective analysis, these strikingly small lesions detected by ^{68}Ga -DOTATATE PET/CT were identified on WB DWI but not on SSRS SPECT/CT. WB DWI had difficulty in detecting lesions in the rib cage and scapulae (because of the width of these bones), skull and skull base (because of the high signal intensity from the brain), sacrum, and ischium. A 6-mm sacral lesion was detected exclusively on ^{68}Ga -DOTATATE PET/CT and was retrospectively confirmed by dedicated MR imaging. Bone lesions in the femur were detected only on ^{68}Ga -DOTATATE PET/CT. Additional changes in the therapeutic strategy and prognostic information occurred in our patient population because bone metastases require more aggressive treatment.

An interesting finding was that when the ^{68}Ga -DOTATATE PET/CT scan was repeated in some patients (for reevaluation of equivocal findings), an increase in uptake was noted. These patients were asked to discontinue somatostatin analogs for a longer time, which may have increased the sensitivity of the study, revealing equivocal lesions. In one patient, the standardized uptake value of lesions almost doubled and new lesions were identified. Although this finding may have been due to progression

TABLE 2
Performance of SSRS SPECT/CT, ⁶⁸Ga-DOTATATE PET/CT, and WB DWI According to Sites

Organ type	Imaging modality	Percentage				
		Sensitivity	Specificity	PPV	NPV	Accuracy
Overall	SSRS SPECT/CT	0.60	0.99	0.96	0.83	0.86
	⁶⁸ Ga-DOTATATE PET/CT	0.96	0.97	0.94	0.98	0.97
	WB DWI	0.72	1.00	1.00	0.88	0.91
All solid organs	SSRS SPECT/CT	0.75	1.00	1.00	0.43	0.79
	⁶⁸ Ga-DOTATATE PET/CT	1.00	0.67	0.94	1.00	0.95
	WB DWI	0.88	1.00	1.00	0.60	0.89
Lung and pleura	SSRS SPECT/CT	0.50	1.00	1.00	0.88	0.89
	⁶⁸ Ga-DOTATATE PET/CT	0.50	1.00	1.00	0.88	0.89
	WB DWI	1.00	1.00	1.00	1.00	1.00
Liver	SSRS SPECT/CT	0.85	1.00	1.00	0.75	0.89
	⁶⁸ Ga-DOTATATE PET/CT	1.00	1.00	1.00	1.00	1.00
	WB DWI	0.92	1.00	1.00	0.86	0.95
Pancreas	SSRS SPECT/CT	0.75	1.00	1.00	0.94	0.95
	⁶⁸ Ga-DOTATATE PET/CT	1.00	0.80	0.57	1.00	0.84
	WB DWI	0.75	1.00	1.00	0.94	0.95
Gastrointestinal tract	SSRS SPECT/CT	0.50	1.00	1.00	0.94	0.95
	⁶⁸ Ga-DOTATATE PET/CT	1.00	0.82	0.40	1.00	0.84
	WB DWI	0.50	1.00	1.00	0.94	0.95
Lymph nodes	SSRS SPECT/CT	0.85	1.00	1.00	0.75	0.89
	⁶⁸ Ga-DOTATATE PET/CT	0.92	1.00	1.00	0.86	0.95
	WB DWI	1.00	1.00	1.00	1.00	1.00
Musculoskeletal system	SSRS SPECT/CT	0.46	1.00	1.00	0.46	0.63
	⁶⁸ Ga-DOTATATE PET/CT	1.00	1.00	1.00	1.00	1.00
	WB DWI	0.42	1.00	1.00	0.50	0.63

NPV = negative predictive value; PPV = positive predictive value.

of the disease, the time between the studies (<3 mo) in a slow-growing tumor makes this possibility less likely.

The oncologist's choice of image modality will ultimately be based on several factors, including local availability, cost, and insurance coverage. An interesting algorithm would be to perform ⁶⁸Ga-DOTATATE PET/CT on initial staging since it is superior to SSRS SPECT/CT, ¹⁸F-FDG PET/CT, and WB DWI in the detection of NETs (10). ⁶⁸Ga-DOTATATE PET/CT has a higher ability to detect unknown primary tumors, serving as a baseline study before initiation of therapy, a way to evaluate the possibility of SSRS therapy, and a prognostic marker (22). In addition, a study performed on 4,210 NET patients using ⁶⁸Ga-DOTATATE PET/CT was able to detect rare metastases (myocardium, breast, retro-orbital region, uterus, skin, brain, spleen, testes, seminal vesicle, and muscles) not detected by other methods (23).

Other groups have suggested that SSRS SPECT alone should be used for NET staging when ⁶⁸Ga-DOTATATE PET/CT is not available (24). We have shown that even when SPECT/CT is performed and compared with ⁶⁸Ga PET/CT, the latter is superior. Therefore, ⁶⁸Ga-DOTATATE PET/CT should be recommended as a first-line tool for whole-body NET staging.

On the other hand, WB DWI is a method that does not use radiation. Although WB DWI scanning requires approximately

40 min, which is a disadvantage and costly, WB DWI may be used as a follow-up tool. However, it is not known if maintenance of somatostatin analog medication during WB DWI could reduce its accuracy. Furthermore, a differential diagnosis of lesions seen on WB DWI is warranted since these lesions may become undifferentiated and not respond to therapy. We believe that the evaluation of tumor response by WB DWI should be prospectively evaluated further. Therefore, ⁶⁸Ga-DOTATATE PET/CT can also be recommended for patient follow-up when WB DWI findings are equivocal and for evaluation of treatment.

CONCLUSION

Different state-of-the-art imaging modalities can be used to evaluate NETs. ⁶⁸Ga-DOTATATE PET/CT seems to be more sensitive for detection of NET lesions. We propose a diagnostic algorithm that starts with staging of the patient with ⁶⁸Ga-DOTATATE PET/CT. Follow-up studies may be undertaken using either ⁶⁸Ga-DOTATATE PET/CT or WB DWI, although with the latter, the lack of radiation may be insufficient justification for its use in this setting and it is still unclear if there is enough accuracy to evaluate therapy. SSRS SPECT/CT should be used when ⁶⁸Ga-DOTATATE PET/CT is not available. A larger number of patients are necessary to

confirm our findings and to evaluate the impact on patient management and the cost-effectiveness of this algorithm.

DISCLOSURE

The costs of publication of this article were defrayed in part by the payment of page charges. Therefore, and solely to indicate this fact, this article is hereby marked "advertisement" in accordance with 18 USC section 1734. No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGMENT

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REFERENCES

1. Buzaid AC, Costa FP, Hoff PM. Tumores neuroendócrinos. In: Buzaid AC, Hoff PM, eds. *Manual de Oncologia Clínica do Hospital Sírio Libanês*. São Paulo, Brazil: Dendrix Editora; 2008:47-52.
2. Gabriel M, Decristoforo C, Kendler D, et al. ⁶⁸Ga-DOTA-Tyr3-octreotide PET in neuroendocrine tumors: comparison with somatostatin receptor scintigraphy and CT. *J Nucl Med*. 2007;48:508-518.
3. Gabriel M, Hauser F, Bale R, et al. Image fusion analysis of ^{99m}Tc-HYNIC-Tyr3-octreotide SPECT and diagnostic CT using an immobilization device with external markers in patients with endocrine tumours. *Eur J Nucl Med Mol Imaging*. 2005;32:1440-1451.
4. Buchmann I, Henze M, Engelbrecht S, et al. Comparison of ⁶⁸Ga-DOTATOC PET and ¹¹¹In-DTPAOC (Octreoscan) SPECT in patients with neuroendocrine tumours. *Eur J Nucl Med Mol Imaging*. 2007;34:1617-1626.
5. Ueberberg B, Tourne H, Redmann A, et al. Differential expression of the human somatostatin receptor subtypes sst1 to sst5 in various adrenal tumors and normal adrenal gland. *Horm Metab Res*. 2005;37:722-728.
6. Oda Y, Tanaka Y, Naruse T, Sasanabe R, Tsubamoto M, Funahashi H. Expression of somatostatin receptor and effect of somatostatin analogue on pancreatic endocrine tumors. *Surg Today*. 2002;32:690-694.
7. Pupotti M, Bongiovanni M, Volante M, et al. Expression of somatostatin receptor types 1-5 in 81 cases of gastrointestinal and pancreatic endocrine tumors: a correlative immunohistochemical and reverse-transcriptase polymerase chain reaction analysis. *Virchows Arch*. 2002;440:461-475.
8. Kaltsas G, Rockall A, Papadogiorgas D, Reznick R, Grossman AB. Recent advances in radiological and radionuclide imaging and therapy of neuroendocrine tumors. *Eur J Endocrinol*. 2004;151:15-27.
9. Koukouraki S, Strauss LG, Georgoulas V, et al. Comparison of the pharmacokinetics of ⁶⁸Ga-DOTATOC and ¹⁸F-FDG in patients with metastatic neuroen-

10. Reubi JC, Schär JC, Waser B, et al. Affinity profiles for human somatostatin receptor subtypes SST1-SST5 of somatostatin radiotracers selected for scintigraphic and radiotherapeutic use. *Eur J Nucl Med*. 2000;27:273-282.
11. Hofmann M, Maecke H, Borner R, et al. Biokinetics and imaging with the somatostatin receptor PET radioligand ⁶⁸Ga-DOTATOC: preliminary data. *Eur J Nucl Med*. 2001;28:1751-1757.
12. Bangard M, Béhé M, Gulhke S, et al. Detection of somatostatin receptor-positive tumours using the new ^{99m}Tc-tricine-HYNIC-D-Phe¹-Tyr³-octreotide: first results in patients and comparison with ¹¹¹In-DTPA-D-Phe¹-octreotide. *Eur J Nucl Med*. 2000;27:628-637.
13. Castaldi P, Rufini V, Treglia G, et al. Impact of ¹¹¹In-DTPA-octreotide SPECT/CT fusion images in the management of neuroendocrine tumours. *Radiol Med (Torino)*. 2008;113:1056-1067.
14. Demirci E, Ocak M, Kabasakal I, Araman A, Ozsoy Y, Kanmaz B. Comparison of Ga-68 DOTA-TATE and Ga-68 DOTA-LAN PET/CT imaging in the same patient group with neuroendocrine tumours: preliminary results. *Nucl Med Commun*. 2013;34:727-732.
15. Cossetti RJ, Bezerra R, Gunz B, Telles A, Costa F. Whole body diffusion for metastatic disease assessment in neuroendocrine carcinomas: comparison with Octreoscan in two patients. *World J Surg Oncol*. 2012;10:82.
16. Kumbasar B, Kamel JR, Tekes A, Eng J, Fishman EK, Wahl RL. Imaging of neuroendocrine tumors: accuracy of helical CT versus SRS. *Abdom Imaging*. 2004;29:696-702.
17. Armbruster M, Zech CJ, Sourbron S, et al. Diagnostic accuracy of dynamic gadoteric-acid-enhanced MRI and PET/CT compared in patients with liver metastases from neuroendocrine neoplasms. *J Magn Reson Imaging*. 2014;40:457-466.
18. Jacobsson H, Larsson P, Jonsson C, Jussing E, Grybäck P. Normal uptake of ⁶⁸Ga-DOTA-TOC by the pancreas uncinate process mimicking malignancy at somatostatin receptor PET. *Clin Nucl Med*. 2012;37:362-365.
19. Krausz Y, Rubinstein R, Appelbaum L, et al. Ga-68 DOTA-NOC uptake in the pancreas: pathological and physiological patterns. *Clin Nucl Med*. 2012;37:57-62.
20. Schmid-Tannwald C, Schmid-Tannwald CM, Morelli JN, et al. Comparison of abdominal MRI with diffusion-weighted imaging to ⁶⁸Ga-DOTATATE PET/CT in detection of neuroendocrine tumors of the pancreas. *Eur J Nucl Med Mol Imaging*. 2013;40:897-907.
21. Putzer D, Gabriel M, Henninger B, et al. Bone metastases in patients with neuroendocrine tumor: ⁶⁸Ga-DOTA-Tyr3-octreotide PET in comparison to CT and bone scintigraphy. *J Nucl Med*. 2009;50:1214-1221.
22. Koch W, Auenhammer CJ, Geisler J, et al. Treatment with octreotide in patients with well-differentiated neuroendocrine tumors of the ileum: prognostic stratification with Ga-68-DOTA-TATE positron emission tomography. *Mol Imaging*. 2014;16:1-10.
23. Carreras C, Kulkarni HR, Baum RP. Rare metastases detected by ⁶⁸Ga-somatostatin receptor PET/CT in patients with neuroendocrine tumors. *Recent Results Cancer Res*. 2013;194:379-384.
24. Hofman MS, Kong G, Neels O, Eu P, Hong E, Hicks R. High management impact of Ga-68 DOTATATE (GaTate) PET/CT for imaging neuroendocrine and other somatostatin expressing tumours. *J Med Imaging Radiat Oncol*. 2012;56:40-47.



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^{68}Ga -DOTATATE PET/CT, $^{99\text{m}}\text{Tc}$ -HYNIC-Octreotide SPECT/CT, and Whole-Body MR Imaging in Detection of Neuroendocrine Tumors: A Prospective Trial

Elba Cristina Sá de Camargo Etchebehere, Allan de Oliveira Santos, Brenda Gumz, Andreia Vicente, Paulo Ghem Hoff, Gustavo Corradi, Wilson André Ichiki, José Geraldo de Almeida Filho, Saulo Cantoni, Edwaldo Eduardo Camargo and Frederico Perego Costa

J Nucl Med. 2014;55:1598-1604.
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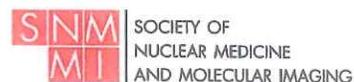
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Attachments
Letters of Support



October 20, 2015

State of Connecticut
Department of Public Health
Office of Health Care Division
410 Capital Avenue
Hartford, CT 06134

RE: Certificate of Need Application to Acquire and Operate a SPECT/CT Camera System at St. Vincent's Medical Center in Bridgeport, CT

To Whom it May Concern:

I am writing in support of the St. Vincent's Medical Center CON application to replace one of its current nuclear cameras with a new, updated SPECT/CT camera system. The Hospital is proposing to replace its existing nuclear camera with an upgraded unit – the GE Optima NM/CT 640 SPECT/CT Camera System.

The upgraded technology combines SPECT and CT technology which provides nuclear medicine physicians with a valuable tool in diagnosis and treatment planning through the combination of anatomic and functional images into a single registered dataset acquired in a single imaging session.

These combined datasets provide increased levels of confidence not only in locating abnormal radiopharmaceutical distributions but also in differentiating between abnormal and normal uptake in body regions of complex anatomy. In addition, the combination of SPECT and CT provides the capability for accurate attenuation correction of measured radiopharmaceutical distributions.

With the upgrade in technology, and the addition of CT attenuation correction, the GE Optima Camera will provide superior image quality with shorter acquisition times and less radiation exposure to patients and staff than the existing GE Millenium MPR/MPS that it will replace.

Given the prevalence of cardiovascular diseases and cancer in St. Vincent's service area, it is imperative that patients have access to efficient and accurate diagnostic services and I therefore fully support the Hospital's CON application to acquire and operate a SPECT/CT camera system.

Please feel free to contact me should further discussion be required.

Respectfully,

A handwritten signature in black ink, appearing to read "Anthony Demestihis".

Anthony Demestihis, MD FACS

2800 Main Street • Bridgeport, Connecticut 06606 • (203) 576-6000 • www.stvincents.org



St. Vincent's
Medical Center



30 October 2015

State of Connecticut
Department of Public Health
Office of Health Care Division
410 Capitol Avenue
Hartford, CT 06134

RE: Certificate of Need Application to Acquire and Operate a SPECT/CT Camera System at St. Vincent's Medical Center in Bridgeport, CT

To Whom It May Concern:

I am writing in support of the St. Vincent's Medical Center CON application to replace one of its current nuclear cameras with a new, updated SPECT/CT camera system. The hospital is proposing to replace its existing nuclear camera with an upgraded unit – the GE Optima NM/CT 640 SPECT/CT Camera System.

This new technology will be vital in improving the care to our patients in the Bridgeport area. There is no technology like this in our catchment. This technology will vastly improve our diagnostic capabilities as therapeutic treatments become increasingly complex.

Given the prevalence of cardiovascular diseases and cancer in St. Vincent's service area, it is imperative that patients have access to efficient and accurate diagnostic services and I therefore fully support the hospital's CON application to acquire and operate a SPECT/CT camera system.

Please feel free to contact me should further discussion be required.

Respectfully,

Thomas J. DiBartholomeo MD

2800 Main Street • Bridgeport, Connecticut 06606 • (203) 576-6000 • www.stvincents.org





November 2, 2015

State of Connecticut
Department of Public Health
Office of Health Care Division
410 Capitol Avenue
Hartford, CT 06134

RE: Certificate of Need Application to Acquire and Operate a SPECT/CT Camera System at St. Vincent's Medical Center in Bridgeport, CT

To Whom It May Concern:

I am writing in support of the St. Vincent's Medical Center CON application to replace one of its current nuclear cameras with a new, updated SPECT/CT camera system. The hospital is proposing to replace its existing nuclear camera with an upgraded unit – the GE Optima NM/CT 640 SPECT/CT Camera System.

The upgraded technology combines SPECT and CT technology which provides nuclear medicine physicians with a valuable tool in diagnosis through the combination of anatomic and functional images into a single registered dataset acquired in a single imaging session.

Like PET/CT, these combined datasets provide increased levels of confidence in anatomically localizing abnormal radiopharmaceutical distributions. In addition, the combination of SPECT and CT provides the capability for accurate attenuation correction of measured radiopharmaceutical distributions.

Also like PET/CT, SPECT imaging without CT has become "old technology" to the point where some companies no longer offer SPECT systems without CT.

The GE Millennium MPR/MPS system being replaced at St. Vincent's is beyond the manufacturer's "end of life". The GE Optima Camera will provide superior image quality with shorter acquisition times than the existing unit.

This upgrade will improve patient care. As an incidental benefit, I suspect SPECT/CT will actually decrease medical expenses. Like PET/CT, it will increase diagnostic confidence of the interpreting physician, decreasing the need to recommend additional tests (CT or MRI) to anatomically localize abnormal activity detected with SPECT alone.

St. Vincent's Medical Center is now the primary teaching hospital for the Frank H. Netter School of Medicine of Quinnipiac University, training medical students and residents, many of whom will stay on to practice in Connecticut. We want to train them well. I doubt that many other academic institutions in the country lack SPECT/CT.

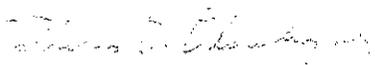
I fully support the hospital's CON application to acquire and operate a SPECT/CT camera system.

Please feel free to contact me should further discussion be required.

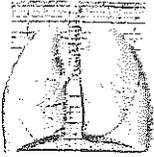
2800 Main Street • Bridgeport, Connecticut 06606 • (203) 576-6000 • www.stvincents.org



Respectfully,



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Attending Radiologist
Section Chief, Nuclear Medicine,
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Diplomate American Board of Internal Medicine
Diplomate American Board of Pulmonary Diseases
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November 2, 2015

State of Connecticut
Department of Public Health
Office of Health Care Division
410 Capital Avenue
Hartford, CT 06134

RE: Certificate of Need Application to Acquire and Operate a SPECT/CT Camera System at St. Vincent's Medical Center in Bridgeport, CT

To Whom it May Concern:

I am writing in support of the St. Vincent's Medical Center CON application to replace one of its current nuclear cameras with a new, updated SPECT/CT camera system. This upgraded unit will greatly enhance the level of care to my patients.

As a pulmonologist, I am most interested in the unit's ability to provide myocardial perfusion imaging with CT AC, aid in assessing the significance of coronary artery lesions and calcification, and pulmonary artery imaging for assessment of pulmonary embolisms.

The upgraded technology combines SPECT and CT technology which provides nuclear medicine physicians with a valuable tool in diagnosis and treatment planning through the combination of anatomic and functional images into a single registered dataset acquired in a single imaging session.

Given the prevalence of cardiovascular diseases and cancer in St. Vincent's service area, it is imperative that patients have access to efficient and accurate diagnostic services and I therefore fully support the Hospital's CON application to acquire and operate a SPECT/CT camera system.

Please feel free to contact me should further discussion be required.

Respectfully,

Philip Simkovitz, M.D.

Attachments

Protocols



Technical Publications

**Direction 5432121-1EN
Rev. 2**



Optima NM/CT 640 Nuclear Medicine Imaging Systems Factory Protocols Reference Guide

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Users exchanging files and media should beware of the risk of software viruses.

The original manual was written in English.



Before You Start



WARNING

Before any attempt is made to use/service the system, the operator and service personnel must be trained, and must read and be acquainted with all **safety-related documents**, accessible in all documents via the **Safety...** bookmark or via **Safety**  in the **How To** (Main Menu).

This will prepare all users to operate the equipment safely and correctly in order to ensure the well-being of the patient, operator and service personnel.

IMPORTANT

- See *MM600 System Description and Safety Manual for Operators* for a full list of documents provided with the system.
- The images in this manual are for demonstration only. There may be minor differences that do not affect functionality.



Safety Indications in This Document

This manual uses three safety severity classifications:

	 <p>DANGER</p> <p>Danger is used to identify conditions or actions for which a specific hazard is known to exist, which will cause severe or fatal personal injury or substantial property damage if the instructions are ignored.</p>
---	---

	 <p>WARNING</p> <p>Warnings are used to identify conditions or actions for which a specific hazard is known to exist, which may cause severe or fatal personal injury or substantial property damage if the instructions are ignored.</p>
---	--

	 <p>CAUTION</p> <p>Cautions are used to identify conditions or actions for which a potential hazard may exist, which may cause minor personal injury or property damage if the instructions are ignored.</p>
---	---



Conventions in This Document

IMPORTANT

Calls attention to important comments.

NOTE

Contains tips and general comments.

The following conventions are used throughout the manual:

Description	Example
Keys on the operator keyboard, hand-held controller and gantry	<SET>, <Ctrl>
Software interface buttons	[OK], [Apply], [Cancel]
Names of items in the graphical interface including:	
<ul style="list-style-type: none"> ■ Names of dialog boxes, windows, tabs, areas and lists ■ Menu items ■ Field and icon labels 	<p>Configuration tab; To Do List File menu Gantry icon; Properties field</p>
System messages	Press Y to continue.
System parameters whose actual values must be defined by the user	Type-in the <i>Patient ID</i>
Hyperlinks	Figure 3-1
Paths	root/opt/tacqdb/manuals
References to other documents	<i>Operator Manual</i>
End of a procedure	◆



Overview (relevant for all NM 600 Series cameras)



WARNING

It is the user's responsibility to adhere to the restrictions laid out by local regulatory and healthcare providers regarding doses, scan procedures and scan parameters.

- The provided list of scans and scan parameters are suggestions for the implementation of specific clinical protocols, as proposed by published professional guidelines or literature.
- In many cases, the provided protocols contain several variants for the same procedure. The user is advised to utilize these suggestions as a starting point (as examples) for defining her/his own protocols, in order to best answer the local clinical needs while complying with the local country/institution regulations.
- Care should be applied when deciding to change inter-related parameters like doses, collimator, scan time parameters, etc.
- Always remember to modify the parameters of copied scans as necessary.

The System Acquisition Protocols provided in this manual are divided into the following categories:

- **Bone**
- **Brain**
- **Cardiology**
- **Endocrine**
- **Gastro-Intestinal**
- **Infection**
- **Lungs**
- **Oncology**
- **Renal**
- **Vascular**

Legend

- The first column of the protocol documentation includes headings as shown in Table 1.

Table 1: Protocol Headings

▪ Protocol name
▪ Scan names & order
▪ Name of the Protocol
▪ Name of the scan

- Additional columns provide the values for the main parameters, see Table 2 "Column Headings (Parameter Names) and Values Used to Describe Parameters".
- **D670 & D640** : See also Table 3 "Notes Related to & Hybrid (SPECT-CT) Protocols".

Table 2: Column Headings (Parameter Names) and Values Used to Describe Parameters

Scan Parameters													
Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det. Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Position	Processing protocol within study	Processing Protocol on study completed
Static Dynamic MUGA Tomographic Gated Tomographic Whole Body	Usual Pharmaceutical involved in the scan	Isotope Name or Energy Session name Center Line / Window left, right limit as percent from Center Line e.g. Tc99m, 140/10 Standards for the Energy window 140 keV \pm 10%, i.e. [126, 154 V]	Typical adult dose in MBq 1 mCi = 37 MBq	Collimator name e.g. LEHR MEGP	Detectors involved and view name (if any) e.g. 1, ANT 2, POST	Acquisition specific parameters, mainly stop condition (time in seconds or counts in kilo-counts) and orbit parameters S&S = Step and shoot CONT = Continuous CW = Clockwise CCW = Counter-Clockwise F&B = Forth & Back BC = Body Contour checked BCoff = BC not selected (set as default, if BC not present) Arc = Total angular range s/fr = seconds per frame (view) step - View angle	Matrix size (pixels) e.g. 256	Acq. zoom e.g. 1.3	The effective NM scan imaging time (in minutes) The total NM scan acquisition time also includes detector motion and operator activity time.	Position of the patient on the table. FFS = Feet First Supine FFP = Feet First Prone HFS = Head First Supine HFP = Head First Prone	Default gantry (detector) start position Detector Mode* (L or H), rot = gantry rotation (Start angle)	Suggested Xeleris processing protocol per specific scan or protocol phase	Suggested Xeleris processing procedure for the completed protocol

* 0615 Radial; L- or H-mode not relevant.

Table 3: Notes Related to 0670 & 0640 Hybrid (SPECT-CT) Protocols

Name of hybrid scan	Tomographic	Structure of the NM scan parameters, as indicated above. NM-CT inter-connection: NM or CT First, Full CT range or Partial CT range, Set-up on Emission or Set-up on Scout, reference name for the CT parameter sets (as used in the table on next page)
	CT	Main parameters of the CT scan sequence (for average body mass patients)*. The purpose of the scan is indicated (for example: Scout, Attenuation Correction (AC), Anatomic Localization (AL) Scan).
IMPORTANT When handling hybrid protocols, pay special attention to matching CT scan parameter values to patient's body mass in view of reducing radiation dose and taking into account the clinical aims of the exam.		

* 0670 Data relates to 16-slice system configuration. On the 8-slice system configuration, certain parameter values will be automatically modified by the system to obtain a similar image quality (e.g. Pitch 0.625:1, Table speed 12.5, etc.); CT/DiVoi value will also change accordingly.

0640 Data relates to a 1 second rotation time configuration. On systems where only a 2 second rotation time configuration is available, certain parameter values will be automatically modified by the system to obtain similar mA x s values (depending on the parameter values supported by this configuration), see 0640 specifications in the *NIM600 System Overview and Safety Manual for Operators*.

System Acquisition Protocols – Summary of CT Parameter Sets

IMPORTANT

In order to facilitate identification and usage of various sets of CT parameter values, a unique CT-related name has been attached to each set. Note that this CT-related name is not reflected in the system user interface. The default values provided for the CT scan parameters used by factory protocols correspond to a typical average body mass adult, unless the protocols is dedicated to a special group of patients (for example, children, adults with large body mass, etc.). The dose estimation uses the defined Body Part (Admin Parameters) to determine which phantom to use for dose calculations.

CT parameter sets Reference Name and Usage		Type	View	Rotation time (sec)	Voltage (kV)	Current (mA)	Table Direction	Range (cm)	From (cm)	To (cm)	Kernel	Matrix	CTDIvol (mGy)	Scan Conditions
Scout	Use for scan limit selection on CT scout	Scout	180		120 (fixed)	10 (fixed)	In or Out of gantry	Derived from From and To values	Type value or set interactively				0.13	Use Breath-hold when necessary
CTACL Low Dose	Generic usage – average body/habitus adult	Helical	1.25	1	120	20	In or Out of gantry	2.5	2.5	50	Standard	512	2.01	Use for Attenuation Correction and Localization. Use Breath-hold when necessary.
Cardiac AC Low Dose	Generic usage – average body/habitus adult	Helical	1.25	1	120	10	In or Out of gantry	5	5	50	Standard	512	1	Use for Myocardial SPECT Attenuation Correction. Use Breath-hold when necessary.
Suggestion for additional Parameter Sets														
CTACL Low Dose Pediatric	Pediatric usage	Helical	1.25	1	120	10	In or Out of gantry	2.5	2.5	50	Standard	512	1	Use for Attenuation Correction and Localization. Use Breath-hold when necessary.
CTACL Low Dose Bariatric	Generic usage – large body habitus adult	Helical	0.75	1	120	30	In or Out of gantry	2.5	2.5	50	Standard	512	5.01	Use for Attenuation Correction and Localization. Use Breath-hold when necessary.

Scan Parameters
It is the user's responsibility to adhere to the restrictions laid out by local regulatory and healthcare providers regarding doses, scan procedures and scan parameters.

Parameter sets explicitly used by factory protocols

Section 1: Bone Acquisition Protocols

System Acquisition Protocols – Bone														
Scan Parameters														
Clinical Protocol Name / Scan Names & Order	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Three Phase Bone														
FLOW	Dynamic	MDP	Tc99m, 140/10	800	LEHR	1, Flow ANT 2, Flow POST	1s/fr, 60 frames	128	1	1 min	FFS	H		WB & Spots Bone review
Bloodpool	Static	MDP	Tc99m, 140/10	800	LEHR	1, BP ANT 2, BP POST	120 s	256	1	2 min	FFS	H		
WB	Whole Body	MDP	Tc99m.15, 140/7.5	800	LEHR	1, ANT 2, POST	S&S 180s /step (Cont: 13.5 cm/min), BC, From 185 to 0	256 x 1024	0.92	15 min	FFS	H		
WB like Infinitia	Whole Body	MDP	Tc99m, 140/10	800	LEHR	1, ANT 2, POST	S&S 180s /step (Cont: 13.5 cm/min), BC, From 185 to 0	256 x 1024	1	15 min	FFS	H		
SPOT	Static	MDP	Tc99m, 140/10	800	LEHR	1, ANT 2, POST	500k counts	256	1	~3 min/view	FFS	H		
Bone Spot Views	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Multiple Views:	Static	MDP	Tc99m, 140/10	800	LEHR	1, 2	500k counts	256	1	~3 min/view	FFS	H		WB & Spots Bone review
ANT CHEST/ POST CHEST, ANT PELVIS/ POST PELVIS, ANT FEMURS/ POST FEMURS, ANT KNEES/ POST KNEES, PLANTAR, ANT FEET/ POST FEET, ANT SKULL/ POST SKULL, LLAT SKULL/ RLAT SKULL														
Whole Body Bone	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
WB	Whole Body	MDP	Tc99m.15, 140/7.5	800	LEHR	1, ANT 2, POST	S&S 180s /step (Cont: 13.5 cm/min), BC, From 185 to 0	256 x 1024	0.92	15 min	FFS	H		
WB like Infinitia	Whole Body	MDP	Tc99m, 140/10	800	LEHR	1, ANT 2, POST	S&S 180s /step (Cont: 13.5 cm/min), BC, From 185 to 0	256 x 1024	1	15 min	FFS	H		WB & Spots Bone review
Evolution2D	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
WB	Whole Body	MDP	Tc99m.15, 140/7.5	800	LEHR	1, ANT 2, POST	S&S 90s /step (Cont: 27 cm/min), BC, From 185 to 0	256 x 1024	0.92	8 min	FFS	H		WB & Spots Bone review + ASM/NL

Section 1: Bone Acquisition Protocols

Evolution2D Low Dose	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
WB	Whole Body	MDP	Tc99m, 15, 140/7.5	500	LEHR	1, ANT 2, POST	S&S, 180s /step (Cont: 13.5 cm/min), BC, From 185 to 0	256 x 1024	0.92	15 min	FFS	H		WB & Spots Bone review - ASM/NL
Bone TOMO														
	Tommo	MDP	Tc99m, 140/10	800	LEHR	1, 2	S&S, Arc 360, step 3, CW, BC, 15 s/fr	128	1	15 min	FFS	H, rot=0	Processing protocol within study	Processing Protocol - study completed
	Tommo L	MDP	Tc99m, 140/10	800	LEHR	1, 2	S&S, Arc 180, step 3, CW, BC, 30 s/fr	128	1	15 min	FFS	L, rot=135	Volumetrix MI	
Bone Scan														
	Dynamic	MDP	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
FLOW	Dynamic	MDP	Tc99m, 140/10	800	LEHR	1, Flow ANT 2, Flow POST	1s/fr, 60 frames	128	1	1 min	FFS	H	WB & Spots Bone review	
Bloodpool	Static	MDP	Tc99m, 140/10	800	LEHR	1, BP ANT 2, BP POST	120 s	256	1	2 min	FFS	H		
WB	Whole Body	MDP	Tc99m, 15, 140/7.5	800	LEHR	1, ANT 2, POST	S&S, 180s /step (Cont: 13.5 cm/min), BC, From 185 to 0	256 x 1024	0.92	15 min	FFS	H		
WB like Infinia	Whole Body	MDP	Tc99m, 140/10	800	LEHR	1, ANT 2, POST	S&S, 180s /step (Cont: 13.5 cm/min), BC, From 185 to 0	256 x 1024	1	15 min	FFS	H		
SPOT	Static	MDP	Tc99m, 140/10	800	LEHR	1, ANT 2, POST	500k counts	256	1	~3 min/view	FFS	H		
Tommo H	Tommo	MDP	Tc99m, 140/10	800	LEHR	1, 2	S&S, Arc 360, step 3, CW, BC, 15 s/fr	128	1	15 min	FFS	H, rot=0	Volumetrix MI	
Tommo L	Tommo	MDP	Tc99m, 140/10	800	LEHR	1, 2	S&S, Arc 180, step 3, CW, BC, 30 s/fr	128	1	15 min	FFS	L, rot=135	Volumetrix MI	
WB Bone SPECT														
	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Tommo WB	Tommo	MDP	Tc99m, 140/10	800	LEHR	1, 2	S&S, Arc 360, step 3, F&B, BC, 15 s/fr	128	1	45 min	FFS	H, 3 steps, rot=0		Volumetrix MI

Section 1: Bone Acquisition Protocols

Evolution Bone Scan	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
FLOW	Dynamic	MDP	Tc99m, 140/10	800	LEHR	1, Flow ANT 2, Flow POST	1s/fr, 60 frames	128	1	1 min	FFS	H	WB & Spots Bone review with ASM/NL for WB	
Bloodpool	Static	MDP	Tc99m, 140/10	800	LEHR	1, BP ANT 2, BP POST	120 s	256	1	2 min	FFS	H		
WB	Whole Body	MDP	Tc99m, 15, 140/7.5	800	LEHR	1, ANT 2, POST	S&S 90s /step (Cont: 27 cm/min), BC, From 185 to 0	256 x 1024	0.92	8 min	FFS	H		
SPOT	Static	MDP	Tc99m, 140/10	800	LEHR	1, ANT 2, POST	500k counts	256	1	~3 min/view	FFS	H		
Tomo H	Tomo	MDP	Tc99m, 140/10	800	LEHR	1,2	S&S, Arc 360, step 6, CW, BC, 16 s/fr	128	1	8 min	FFS	H, rot=0	Volumetrix MI Evolution for Bone	
Tomo L	Tomo	MDP	Tc99m, 140/10	800	LEHR	1,2	S&S, Arc 180, step 3, CW, BC, 16 s/fr	128	1	8 min	FFS	L, rot=135	Volumetrix MI Evolution for Bone	
Evolution Bone SPECT	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Tomo	Tomo	MDP	Tc99m, 140/10	800	LEHR	1,2	S&S, Arc 360, step 6, CW, BC, 16 s/fr	128	1	8 min	FFS	H, rot=0		Volumetrix MI Evolution for Bone
Evolution Bone SPECT Low Dose	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Tomo	Tomo	MDP	Tc99m, 140/10	500	LEHR	1,2	S&S, Arc 360, step 6, CW, BC, 30 s/fr	128	1	15 min	FFS	H, rot=0		Volumetrix MI Evolution for Bone
Evolution WB Bone SPECT	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Tomo WB	Tomo	MDP	Tc99m, 140/10	800	LEHR	1,2	S&S, Arc 360, step 6, F&B, BC, 16 s/fr	128	1	24 min	FFS	H, 3 steps, rot=0		Volumetrix MI Evolution for Bone

Section 1: Bone Acquisition Protocols

Hybrid Protocols													
Bone TOMO ACL	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
Tomo	Tomo	MDP	Tc99mSC, 140/10, 120/5	800	LEHR	1,2	S&S, Arc 360, step 3, CW, BC, 15 s/fr	128	1	15 min	FFS	H, rot=0	Volumetric MI
	CT	AC/AL Scan: Helical Pitch 1.25:1. Rot.time 1sec. Voltage 120 kV. Current 20 mA. Recon: SI.Thick. 2.5 mm. SI.Spacing 2.5 mm. DFOV 50 cm. Kernel Std. Matrix 512. CTDIvol 2.01 mGy Emission First, CT range Partial. Select on Emission, CT parameters reference name: CTACL Low Dose											
Evolution Bone ACL	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
	Tomo	MDP	Tc99mSC, 140/10, 120/5	800	LEHR	1,2	S&S, Arc 360, step 6, CW, BC, 16 s/fr	128	1	8 min	FFS	H, rot=0	Volumetric MI Evolution for Bone
Evolution WB Bone ACL	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
	Tomo	MDP	Tc99mSC, 140/10, 120/5	800	LEHR	1,2	S&S, Arc 360, step 6, F&B, BC, 16 s/fr	128	1	24 min	FFS	H, 3 steps, rot=0	Volumetric MI Evolution for Bone
Tomo WB	CT	AC/AL Scan: Helical Pitch 1.25:1. Rot.time 1sec. Voltage 120 kV. Current 20 mA. Recon: SI.Thick. 2.5 mm. SI.Spacing 2.5 mm. DFOV 50 cm. Kernel Std. Matrix 512. CTDIvol 2.01 mGy Emission First, CT range Full. Select on Emission, CT parameters reference name: CTACL Low Dose											

Section 2: Brain Acquisition Protocols

System Acquisition Protocols – Brain														
Scan Parameters														
Clinical Protocol Name / Scan Names & Order	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Brain Tomo Tc99m	Tomo	HMPAO or ECD	Tc99m, 140/10	740	LEHR	1,2	S&S, Arc 360, step 3, CW, BCoff, 20 s/fr	128	1.5 PanY=-20	20 min	HFS	H, Head Rest, no BC, rot=0	Processing protocol within study	Brain SPECT
Brain FB Tc99m	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
TOMO	Tomo	HMPAO or ECD	Tc99m, 140/10	740	FAN-BEAM	1,2	S&S, Arc 360 (each det), step 3, CW, BCoff, 10 s/fr	128	1.0 PanY=-20	20 min	HFS	H, Head Rest, no BC, equal radii, rot=0	Processing protocol within study	Brain SPECT
Brain Tomo 1123	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
TOMO	Tomo	IMP	1123, 159/10	148	LEHR	1,2	S&S, Arc 360, step 6, CW, BCoff, 40 s/fr	128	1.5 PanY=-20	20 min	HFS	H, Head Rest, no BC, rot=0	Processing protocol within study	Brain SPECT
Diamox 1 Day	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
EARLY	Tomo	HMPAO or ECD	Tc99m, 140/10	370	LEHR	1,2	S&S, Arc 360, step 3, CW, BCoff, 15 s/fr	128	1.5 PanY=-20	15 min	HFS	H, Head Rest, no BC, rot=0	Processing protocol within study	Brain SPECT
LATE	Tomo		Tc99m, 140/10	740	LEHR	1,2	S&S, Arc 360, step 3, CW, BCoff, 15 s/fr	128	1.5 PanY=-20	15 min	HFS	H, Head Rest, no BC, rot=0	Processing protocol within study	Processing Protocol - study completed
Diamox 2 Day	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
EARLY	Tomo	HMPAO or ECD	Tc99m, 140/10	740	LEHR	1,2	S&S, Arc 360, step 3, CW, BCoff, 20 s/fr	128	1.5 PanY=-20	20 min	HFS	H, Head Rest, no BC, rot=0	Processing protocol within study	Brain SPECT
LATE	Tomo	HMPAO or ECD	Tc99m, 140/10	740	LEHR	1,2	S&S, Arc 360, step 3, CW, BCoff, 20 s/fr	128	1.5 PanY=-20	20 min	HFS	H, Head Rest, no BC, rot=0	Processing protocol within study	Processing Protocol - study completed

Section 2: Brain Acquisition Protocols

Protocol Name	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
DatSCAN 1123														
TOMO	Tomo	DATSCAN	1123, 159/10	148	LEHR	1, 2	S&S, Arc 360, step 3, CW, BCof, 30 s/fr	128	1.25 PanY=-20	30 min	HFS	H, Head Rest, no BC, rot=0		Brain SPECT
Cysternography	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
STATIC	Static	DTPA	In111, 171/10,245/10	55	MEGP	1, 2	120 s	128	1	2 min/ view	HFS	Manual		Load to New
Multiple Views POST_2H, ANT_2H, RLAT_2H, LLAT_2H, ANT_9H, RLAT_9H, LLAT_9H, ANT_24H, RLAT_24H, LLAT_24H, ANT_48H, RLAT_48H, LLAT_48H														
Hybrid Protocols														
Brain Tc99m ACL	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
Tomo	Tomo	HMPAO or ECD	Tc99mSC 120/5, 140/10	740	LEHR	1, 2	S&S, Arc 360, step 3, CW, BCof, 20 s/fr	128	1.5 PanY=-20	20 min	HFS	H, Head Rest, no BC, rot=0		Volumetric MI
	CT		Emission First, CT range Partial, Select on Emission, CT parameters reference name: CTAACL Low Dose AC/AL Scan: Helical Pitch 1.25:1, Rot time 1sec, Voltage 120 kV, Current 20 mA, Recon: SI.Thick. 2.5 mm, SI.Spacing 2.5 mm, DFOV 50 cm, Kernel Std, Matrix 512, CTDIvol 4.19 mGy											

Section 3: Cardiology Acquisition Protocols

System Acquisition Protocols – Cardiology														
Scan Parameters														
Clinical Protocol Name / Scan Names & Order	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
One Day	REST	Tc99m Mibi	Tc99m, 140/10	296	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCof, 25 s/r	64	1.3	13 min	FFS	L, rot=0		Myovation
	SGATE	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCof, 20 s/r, 8 bins, PVC 20%, Time mode	64	1.3	10 min	FFS	L, rot=0		
	STRESS	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCof, 20 s/r	64	1.3	10 min	FFS	L, rot=0		
	SPOT	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, LLAT 2, ANT	300 s	128	1	5 min	FFS	L		
Two Day	SGATE	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCof, 20 s/r, 8 bins, PVC 20%, Time mode	64	1.3	10 min	FFS	L, rot=0		Processing Protocol - study completed
	STRESS	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCof, 20 s/r	64	1.3	10 min	FFS	L, rot=0		
	REST	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCof, 20 s/r	64	1.3	10 min	FFS	L, rot=0		
	RGATE	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCof, 20 s/r, 8 bins, PVC 20%, Time mode	64	1.3	10 min	FFS	L, rot=0		
	PRONE STRESS	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCof, 20 s/r	64	1.3	10 min	FFP	L, rot=180		
	PRONE REST	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCof, 20 s/r	64	1.3	10 min	FFP	L, rot=180		
	SPOT	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, LLAT 2, ANT	300 s	128	1	5 min	FFS	L		

Section 3: Cardiology Acquisition Protocols

One Day EIC	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol- study completed
REST	Tomo	Tc99m Mibi	Tc99m, 140/10	296	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCof, 15 s/rr	64	1.3	8 min	FFS	L, rot=0		Myovation Evolution
SGATE	Gated Tomo	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCof, 10 s/rr, 8 bins, PVC 20%, Time mode	64	1.3	5 min	FFS	L, rot=0		
STRESS	Tomo	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCof, 10 s/rr	64	1.3	5 min	FFS	L, rot=0		
SPOT	Static	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, LLAT 2, ANT	300 s	128	1	5 min	FFS	L		
One Day EIC Low Dose	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol- study completed
REST	Tomo	Tc99m Mibi	Tc99m, 140/10	154	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCof, 25 s/rr	64	1.3	13 min	FFS	L, rot=0		Myovation Evolution
SGATE	Gated Tomo	Tc99m Mibi	Tc99m, 140/10	481	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCof, 20 s/rr, 8 bins, PVC 20%, Time mode	64	1.3	10 min	FFS	L, rot=0		
STRESS	Tomo	Tc99m Mibi	Tc99m, 140/10	481	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCof, 20 s/rr	64	1.3	10 min	FFS	L, rot=0		
SPOT	Static	Tc99m Mibi	Tc99m, 140/10	481	LEHR	1, LLAT 2, ANT	600 s	128	1	10 min	FFS	L		
Tetrofosmin	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol- study completed
STRESS	Tomo	Tc99m Tetrofosmin	Tc99m, 140/10	296	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCof, 25 s/rr	64	1.3	13 min	FFS	L, rot=0		Myovation
RGATE	Gated Tomo	Tc99m Tetrofosmin	Tc99m, 140/10	925	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCof, 20 s/rr, 8 bins, PVC 20%, Time mode	64	1.3	10 min	FFS	L, rot=0		
REST	Tomo	Tc99m Tetrofosmin	Tc99m, 140/10	925	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCof, 20 s/rr	64	1.3	10 min	FFS	L, rot=0		
SPOT	Static	Tc99m Tetrofosmin	Tc99m, 140/10	925	LEHR	1, LLAT 2, ANT	300 s	128	1	5 min	FFS	L		

Section 3: Cardiology Acquisition Protocols

Dual Isotope	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Centry Pos.	Processing protocol within study	Processing Protocol - study completed
REST	Tomo	Thallous Chloride	Tl 201, 70/15, 167/10	92.5	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCoff, 25 s/ffr	64	1.3	13 min	FFS	L, rot=0		Myovation
SGATE	Gated Tomo	Tc99m Pharma	Tc99m, 140/10	740	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCoff, 20 s/ffr, 8 bins, PVC 20%, Time mode	64	1.3	10 min	FFS	L, rot=0		
STRESS	Tomo	Tc99m Pharma	Tc99m, 140/10	740	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCoff, 20 s/ffr	64	1.3	10 min	FFS	L, rot=0		
SPOT	Static	Tc99m Pharma	Tc99m, 140/10	740	LEHR	1, LLAT 2, ANT	300 s	128	1	5 min	FFS	L		
Tl201 Stress	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Centry Pos.	Processing protocol within study	Processing Protocol - study completed
STRESS	Tomo	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1,2	S&S, Arc 180, step 6, CCW, BCoff, 60 s/ffr	64	1.3	15 min	FFS	L, rot=0		Myovation
DELAY	Tomo	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1,2	S&S, Arc 180, step 6, CCW, BCoff, 60 s/ffr	64	1.3	15 min	FFS	L, rot=0		
DELAY_24H	Tomo	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1,2	S&S, Arc 180, step 6, CCW, BCoff, 60 s/ffr	64	1.3	15 min	FFS	L, rot=0		
SGATE	Gated Tomo	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1,2	S&S, Arc 180, step 6, CCW, BCoff, 60 s/ffr, 8 bins, PVC 20%, time mode	64	1.3	15 min	FFS	L, rot=0		
LUNG	Static	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1, LLAT 2, ANT	800 s	128	1	13 min	FFS	L		

Section 3: Cardiology Acquisition Protocols

T1201 Viability	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
IMMEDIATE	Tomo	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1,2	S&S, Arc 180, step 6, CCW, BCofr, 60 s/fr	64	1.3	15 min	FFS	L, rot=0		Myovation
DELAY	Tomo	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1,2	S&S, Arc 180, step 6, CCW, BCofr, 60 s/fr	64	1.3	15 min	FFS	L, rot=0		
DELAY_24H	Tomo	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1,2	S&S, Arc 180, step 6, CCW, BCofr, 60 s/fr	64	1.3	15 min	FFS	L, rot=0		
RGATE	Gated Tomo	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1,2	S&S, Arc 180, step 6, CCW, BCofr, 60 s/fr, 8 bins, PVC 20%, time mode	64	1.3	15 min	FFS	L, rot=0		
LUNG	Static	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1, LLAT 2, ANT	800 s	128	1	13 min	FFS	L		
Planar Tl 201	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
SPOT	Static	Thallous Chloride	Tl 201, 70/15, 167/10	111	LEHR	1,	1000 s	128	2	16 min / view	FFS	L		Load to New
Multiple Views: ST ANT, ST LAO45, ST LAO70, DL ANT, DL LAO45, DL LAO70														
Shunt	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
FLOW	Dynamic	DTPA	Tc99m, 140/10	555	ELEGP	1, FLOW	0.5 s/fr, 200 frames	64	1.3	100 s	FFS	H		L-R shunt
Fast Bolus	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
FLOW	Dynamic	DTPA	Tc99m, 140/10	555	ELEGP	1, FLOW	0.03 s/fr, 900 frames	64	1.3	27 s	FFS	H		

Section 3: Cardiology Acquisition Protocols

Planar Gated EF	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
IMUGA	MUGA	RBC	Tc99m 140/10	925	LEHR	1, LAO45	3500 Kcts, 24 frames/cycle, Time Mode, PVC 15%	64	2.57	~ 8 min	FFS	L	EF analysis	
LAO-RAO	MUGA	RBC	Tc99m 140/10	925	LEHR	1, LAO45 2, RAO45	3500 Kcts, 24 frames/cycle, Time Mode, PVC 15%	64	2.57	~ 8 min	FFS	L, rot=0	EF analysis	
LLAT-ANT	MUGA	RBC	Tc99m 140/10	925	LEHR	1, LLAT 2, ANT	3500 Kcts, 24 frames/cycle, Time Mode, PVC 15%	64	2.57	~ 8 min	FFS	L, rot=315	EF analysis	
BP Gated Tomo	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
REST Gated Tomo		RBC	Tc99m, 140/10	925	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCoff, 30 s/fr, 16 bins Time Mode, PVC 15%	64	1.3	15 min	FFS	L, rot=0		Myovation
Myocard Infarct	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
SPOT	Static	PYP	Tc99m, 140/10	925	LEHR	1, ...	1000 kc	128	1.5	~3 min / view	FFS	L	Load to New	
Multiple Views: ANT, LAO45, LAO70														
TOMO	Tomo	PYP	Tc99m, 140/10	925	LEHR	1, 2	S&S, Arc 180, step 3, CCW, BCoff, 25 s/fr	64	1.3	13 min	FFS	L, rot=0	Myovation	

Section 3: Cardiology Acquisition Protocols

Hybrid Protocols														
One Day AC	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
REST	Tomo	Tc99m Mibi	Tc99mSC, 140/10, 120/5	296	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCoff, 25 s/rr	64	1.3	13 min	FFS	L, rot=0		
	CT	Emission First, CT range Partial, Select on Emission, CT parameters reference name: Cardiac AC Low Dose AC Scan: Helical Pitch 1.25:1, Rot.time 1sec, Voltage 120 kV, Current 10 mA, Recon: SI.Thick, 5.0 mm, SI.Spacing 5.0 mm, DFOV 50 cm, Kernel Std, Matrix 512, CTDIvol 1.0 mGy												
SGATE	Gated Tomo	Tc99m Mibi	Tc99mSC, 140/10, 120/5	925	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCoff, 20 s/rr, 8 bins, PVC 20%, Time mode	64	1.3	10 min	FFS	L, rot=0		Myovation
	CT	Emission First, CT range Partial, Select on Emission, CT parameters reference name: Cardiac AC Low Dose See details on CT Protocol parameters with the REST scan												
STRESS	Tomo	Tc99m Mibi	Tc99mSC, 140/10, 120/5	925	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCoff, 20 s/rr	64	1.3	10 min	FFS	L, rot=0		
	CT	Emission First, CT range Partial, Select on Emission, CT parameters reference name: Cardiac AC Low Dose See details on CT Protocol parameters with the REST scan												
SPOT	Static	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, LLAT 2, ANT	300 s	128	1	5 min	FFS	L		
	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
One Day EFC AC	Tomo	Tc99m Mibi	Tc99mSC, 140/10, 120/5	296	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCoff, 15 s/rr	64	1.3	8 min	FFS	L, rot=0		
	CT	Emission First, CT range Partial, Select on Emission, CT parameters reference name: Cardiac AC Low Dose AC Scan: Helical Pitch 1.25:1, Rot.time 1sec, Voltage 120 kV, Current 10 mA, Recon: SI.Thick, 5.0 mm, SI.Spacing 5.0 mm, DFOV 50 cm, Kernel Std, Matrix 512, CTDIvol 1.0 mGy												
REST	Gated Tomo	Tc99m Mibi	Tc99mSC, 140/10, 120/5	925	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCoff, 10 s/rr, 8 bins, PVC 20%, Time mode	64	1.3	5 min	FFS	L, rot=0		Myovation Evolution
	CT	Emission First, CT range Partial, Select on Emission, CT parameters reference name: Cardiac AC Low Dose See details on CT Protocol parameters with the REST scan												
STRESS	Tomo	Tc99m Mibi	Tc99mSC, 140/10, 120/5	925	LEHR	1,2	S&S, Arc 180, step 3, CCW, BCoff, 10 s/rr	64	1.3	5 min	FFS	L, rot=0		
	CT	Emission First, CT range Partial, Select on Emission, CT parameters reference name: Cardiac AC Low Dose See details on CT Protocol parameters with the REST scan												
SPOT	Static	Tc99m Mibi	Tc99m, 140/10	925	LEHR	1, LLAT 2, ANT	300 s	128	1	5 min	FFS	L		

Section 4: Endocrine Acquisition Protocols

System Acquisition Protocols – Endocrine														
Clinical Protocol Name / Scan Names & Order	Scan Parameters													
	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Tc Thyroid scan														
ANT	Static	Pertechneta	Tc99m, 140/10	185	LEHR	1, ANT	200 kc	128	2.57		HFS	Manual		
MARKER	Static		Tc99m, 140/10		LEHR	1, MARKER	200 kc	128	2.57		HFS	Manual		
LAO	Static		Tc99m, 140/10		LEHR	1, LAO	200 kc	128	2.57		HFS	Manual		Load to New
RAO	Static		Tc99m, 140/10		LEHR	1, RAO	200 kc	128	2.57		HFS	Manual		
Tc Thyroid Uptk LEHR														
FULL Syringe	Static	Pertechneta	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
	Static		Tc99m, 140/10	185	LEHR	1, FULL Syringe	30 s	128	2.57	1 min	HFS	Manual		
EMPTY Syringe	Static		Tc99m, 140/10		LEHR	1, EMPTY Syringe	30 s	128	2.57	1 min	HFS	Manual		
THYROID	Static		Tc99m, 140/10		LEHR	1, THYROID	300 s	128	2.57	5 min	HFS	Manual		Thyroid Uptake Index
INJECTION Site	Static		Tc99m, 140/10		LEHR	1, INJECTION	300 s	128	2.57	5 min	HFS	Manual		
MARKER	Static		Tc99m, 140/10		LEHR	1, MARKER	30 s	128	2.57	1 min	HFS	Manual		
Tc Thyroid Uptk PinHole														
FULL Syringe	Static	Pertechneta	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
	Static		Tc99m, 140/10	185	PinHole	1, FULL Syringe	30 s	128	2	1 min	HFS	Manual		
EMPTY Syringe	Static		Tc99m, 140/10		PinHole	1, EMPTY Syringe	30 s	128	2	1 min	HFS	Manual		
THYROID	Static		Tc99m, 140/10		PinHole	1, THYROID	300 s	128	2	5 min	HFS	Manual		Thyroid Uptake Index
INJECTION Site	Static		Tc99m, 140/10		PinHole	1, INJECTION	300 s	128	2	5 min	HFS	Manual		
MARKER	Static		Tc99m, 140/10		PinHole	1, MARKER	30 s	128	2	1 min	HFS	Manual		

Section 4: Endocrine Acquisition Protocols

1123 Thyroid	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
ANT	Static	Sodium Iodide	1123, 159/10	18.5	LEHR	1, ANT	100 kc	128	2.57		HFS	Manual		
MARKER	Static		1123, 159/10		LEHR	1, MARKER	100 kc	128	2.57		HFS	Manual		
LAO	Static		1123, 159/10		LEHR	1, LAO	100 kc	128	2.57		HFS	Manual		Load to New
RAO	Static		1123, 159/10		LEHR	1, RAO	100 kc	128	2.57		HFS	Manual		
1123 Thyroid Uptk LEHR	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
THYROID	Static	Sodium Iodide	1123, 159/10	4.5	LEHR	1, THYROID	300 s	128	2.57	5 min	HFS	Manual	Thyroid Uptake Index	
CALIB FACTOR	Static	Sodium Iodide	1123, 159/10	4.5	LEHR	1, CALIB FACTOR	300 s	128	2.57	5 min	HFS	Manual	Load to New	
1123 Thyroid Uptk PinHole	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
THYROID	Static	Sodium Iodide	1123, 159/10	4.5	PinHole	1, THYROID	120 s	128	2	2 min	HFS	Manual	Thyroid Uptake Index	
CALIB FACTOR	Static	Sodium Iodide	1123, 159/10	4.5	PinHole	1, CALIB FACTOR	120 s	128	2	2 min	HFS	Manual	Load to New	
1123 Thyroid Uptk PinHole Dose	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
STANDARD	Static	Sodium Iodide	1123, 159/10	4.5	PinHole	1, STANDARD	120 s	128	2	2 min	HFS	Manual		Thyroid Uptake Index
ROOM BKG	Static		1123, 159/10		PinHole	1, ROOM BKG	120 s	128	2	2 min	HFS	Manual		
THYROID	Static		1123, 159/10		PinHole	1, THYROID	120 s	128	2	2 min	HFS	Manual		

Section 4: Endocrine Acquisition Protocols

Thyroid Tomo	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det. Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol within study	Processing Protocol - study completed
TOMO	Tomo	Pertechnetate	Tc99m, 140/10	185	LEHR	1, 2	S&S, Arc 360, step 6, CW, BC, 30 s/fr	128	1.5	15 min	HFS	H, rot=0		Volumetrix MI
I131 Survey	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det. Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol within study	Processing Protocol - study completed
Spot	Static	Sodium Iodide	I131, 364/10	37	HEGP	1, ANT 2, POST	600 s	256	1	10 min	FFS	Manual	WB & Spots Onc. Review	
WB	Whole Body	Sodium Iodide	I131, 364/10	37	HEGP	1, ANT 2, POST	S&S 450 s /step (Cont: 5.3 cm/min), BC, From 110 to 0	256 x1024	1	23 min	FFS	H		
Co57 MARKER	Static		Co57, 122/10		HEGP	1, MARKER	30 s	256	1	1 min	FFS	Manual		
TOMO	Tomo	Sodium Iodide	I131, 364/10	37	HEGP	1, 2	S&S, Arc 360, step 6, CW, BC, 30 s/fr	64	1	15 min	FFS	H, rot=0	Volumetrix MI	Processing Protocol within study
Parathy: MIBI	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det. Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol within study	Processing Protocol - study completed
Early	Static	Mibi	Tc99m, 140/10	740	LEHR	1, Early ANT	600 s	128	2.57	10 min	HFS	Manual		
Late	Static	Mibi	Tc99m, 140/10		LEHR	1, Late ANT	600 s	128	2.57	10 min	HFS	Manual	Parathyroid Imaging	
Chest Survey	Static	Mibi	Tc99m, 140/10		LEHR	1, 2, Survey ANT / POST	600 s	128	1	10 min	HFS	Manual		
TOMO	Tomo	Mibi	Tc99m, 140/10		LEHR	1, 2	S&S, Arc 360, step 6, CW, BC, 30 s/fr	128	1	15 min	HFS	H, rot=0	Volumetrix MI	Volumetrix MI

Section 4: Endocrine Acquisition Protocols

Parathyroid Tl Tc	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol within study	Processing Protocol - study completed
Tl201	Static	Thallous Chloride	Tl 201, 70/15, 167/10	74	LEHR	1, Tl201 ANT	900 s	128	2.57	15 min	HFS	H		
Tc99m	Static	Per technetate	Tc99m, 140/10	74	LEHR	1, Tc99m ANT	600 s	128	2.57	10 min	HFS	H		Parathyroid Imaging
Chest Survey	Static	Per technetate	Tl 201, 70/15, 167/10		LEHR	1, Survey ANT 2, Survey POST	600 s	128	1	10 min	HFS	H		
1123 mIBG	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol within study	Processing Protocol - study completed
TOMO	Tomo	1123 mIBG	1123, 159/10	400	LEHR	1, 2	S&S, A/c 360, step 3, CW, BC, 20 s/fr	64	1	20 min	FFS	H, rot=0	Volumetric MI	
WB	Whole Body	1123 mIBG	1123, 159/10	400	LEHR	1, ANT 2, POST	S&S 480 s /step (Cont: 5. cm/min), BC, From 110 to 0	256 x1024	1	24 min	FFS	H	WB & Spots Onc. Review	
Spot	Static	1123 mIBG	1123, 159/10	400	LEHR	1, ANT 2, POST	600 s	256	1	10 min	FFS	Manual		

Section 4: Endocrine Acquisition Protocols

Hybrid Protocols														
1131 Survey ACL	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol within study	Processing Protocol - study completed
TOMO	Tomo	Sodium Iodide	1131, 364/10	37	HEGP	1, 2	S&S, Arc 360, step 6, CW, BC, 30 s/fr	128	1	15 min	FFS	H, rot=0	Volume/rix MI	
	CT	Emission First, CT range Partial, Select on Emission, CT parameters reference name: CTACL Low Dose												
WB	Whole Body	Sodium Iodide	1131, 364/10	37	HEGP	1, ANT 2, POST	S&S 450 s /step (Cont: 5.3 cm/min), BC, From 110 to 0	256 x1024	1	23 min	FFS	H	WB & Spots Onc. Review	
	Spot	Sodium Iodide	1131, 364/10	37	HEGP	1, ANT 2, POST	600 s	256	1	10 min	FFS	Manual		
Parathyroid ACL	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol within study	Processing Protocol - study completed
	Tomo	Mibi	Tc99mSC, 140/10, 120/5	740	LEHR	1, 2	S&S, Arc 360, step 6, CW, BC, 30 s/fr	128	1	15 min	HFS	H, rot=0		Volume/rix MI
TOMO	CT	Emission First, CT range Partial, Select on Emission, CT parameters reference name: CTACL Low Dose												
	AC/AL Scan: Helical Pitch 1.25:1, Rot.time 1sec, Voltage 120 kV, Current 20 mA, Recon: SI.Thick, 2.5 mm, SI.Spacing 2.5 mm, DFOV 50 cm, Kernel Std. Matrix 512, CTDivel 2.01 mGy													
1123 mIBG ACL	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol within study	Processing Protocol - study completed
	Tomo	I123 mIBG	I123SC, 159/10, 130/10	400	LEHR	1, 2	S&S, Arc 360, step 3, CW, BC, 20 s/fr	64	1	20 min	FFS	H, rot=0		
TOMO	CT	Emission First, CT range Partial, Select on Emission, CT parameters reference name: CTACL Low Dose												
	AC/AL Scan: Helical Pitch 1.25:1, Rot.time 1sec, Voltage 120 kV, Current 20 mA, Recon: SI.Thick, 2.5 mm, SI.Spacing 2.5 mm, DFOV 50 cm, Kernel Std. Matrix 512, CTDivel 2.01 mGy													
WB	Whole Body	I123 mIBG	I123, 159/10	400	LEHR	1, ANT 2, POST	S&S 480 s /step (Cont: 5. cm/min), BC, From 110 to 0	256 x1024	1	24 min	FFS	H	WB & Spots Onc. Review	
	Spot	I123 mIBG	I123, 159/10	400	LEHR	1, ANT 2, POST	600 s	256	1	10 min	FFS	Manual		

Section 5: Gastro-Intestinal Acquisition Protocols

System Acquisition Protocols – Gastro Intestinal													
Scan Parameters													
Clinical Protocol Name / Scan Names & Order	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing Protocol - study within study
Liver Statics	Static	Colloid	Tc99m, 140/10	180	LEHR	1, 2	1000 kc	256	1	5 min/ view	FFS	H	Processing Protocol - study completed
SPOT Multiple Views													Load to New
ANTIPOST, ANT MARKER, LAORPO, LLATRLAT, LPOIRAO													
Liver Tomo	Tomo	Colloid	Tc99m, 140/10	180	LEHR	1, 2	S&S, Arc 360, step 6, CW, BC, 30 s/fr	128	1	17 min	FFS	H, rot=0	Processing Protocol - study completed
Liver Hemangioma	Dynamic	RBC	Tc99m, 140/10	500	LEHR	1, FLOW	1 s/fr, 60 frames	128	1	1 min	FFS	H	Volumetric MI
ANT POST	Static	RBC	Tc99m, 140/10	500	LEHR	1, ANT, 2, POST	1000 kc	256	1	5 min/ view	FFS	H	Processing Protocol - study completed
LLAT RLAT	Static	RBC	Tc99m, 140/10	500	LEHR	1, RLAT 2, LLAT	1000 kc	256	1	5 min/ view	FFS	H	Processing Protocol - study completed
TOMO	Tomo	RBC	Tc99m, 140/10	500	LEHR	1, 2	S&S, Arc 360, step 3, CW, BC, 15 s/fr	128	1	15 min	FFS	H, rot=0	Processing Protocol - study completed
GB EF	Dynamic	HIDA	Tc99m, 140/10	111	LEHR	1, FLOW	60 s/fr, 60 frames	128	1	32 min	FFS	H	Processing Protocol - study completed
GB Ref	Static	HIDA	Tc99m, 140/10	111	LEHR	1, Gb Ref	60 s	128	1	1 min	FFS	H	Gallbladder EF
GB Time1	Static	HIDA	Tc99m, 140/10	111	LEHR	1, Gb Time1	60 s	128	1	1 min	FFS	H	
GB Time2	Static	HIDA	Tc99m, 140/10	111	LEHR	1, Gb Time2	60 s	128	1	1 min	FFS	H	
GB Time3	Static	HIDA	Tc99m, 140/10	111	LEHR	1, Gb Time3	60 s	128	1	1 min	FFS	H	

Section 5: Gastro-Intestinal Acquisition Protocols

Hepatobiliary	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study within study	Processing Protocol - study completed
FLOW	Dynamic	HIDA	Tc99m, 140/10	111	LEHR	1, FLOW	60 s/fr, 60 frames	128	1	60 min	FFS	H		Load to New
	Static	HIDA	Tc99m, 140/10	111	LEHR	1,	300 s	256	1	5 min/ view	FFS	H		
Multiple Views Immed, 5 min, 10 min, 15 min, 30 min, 45 min, 60 min														
Esophageal Scan	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study within study	Processing Protocol - study completed
	Dynamic	Colloid	Tc99m, 140/10	10	LEHR	1, ETT	15 s/fr, 240 frames	128	1	60 min	FFS	H		Esophageal Motility Analysis
Gastric Emptying	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study within study	Processing Protocol - study completed
	Dynamic	Colloid	Tc99m, 140/10	37	LEHR	1, ANT/DYN 2, POSTDYN	60 s/fr, 60 frames	128	1	60 min	FFS	H		Gastric Emptying
FLOW	Dynamic	Colloid	Tc99m, 140/10	37	LEHR	1, 2	60 s	128	1	1 min/ view	FFS	H		
	Static	Colloid	Tc99m, 140/10	37	LEHR	1, 2	60 s	128	1	1 min/ view	FFS	H		
Multiple Views ANT1/POST1, ANT2/POST2 ... ANT12/POST12														
Meckel Diverticle	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study within study	Processing Protocol - study completed
	Static	Perfchneta	Tc99m, 140/10	200	LEHR	1, ANT	300 s	128	1	5 min / view	FFS	H		Load to New
Multiple Views ANT1, ANT2, ANT3, ... ANT8														
Gastric Bleeding	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study within study	Processing Protocol - study completed
	Dynamic	RBC	Tc99m, 140/10	750	LEHR	1, FLOW	1 s/fr, 60 frames 60 s/fr, 60 frames	128	1	60 min	FFS	H		Load to New
Salivary Glands	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study within study	Processing Protocol - study completed
	Dynamic	Perfchneta	Tc99m, 140/10	100	LEHR	1, FLOW	30 s/fr, 60 frames	128	2	30 min	FFS	H		Load to New

Section 6: Infection Acquisition Protocols

System Acquisition Protocols – Infection														
Scan Parameters														
Clinical Protocol Name / Scan Names & Order	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s) Del Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Ga 67 Infection	Static	Ga67	Ga67, 93/13, 184/10, 300/10	150	MEGP	1, ANT 2, POST	600 s	256	1	10 min/ view	FFS	H	WB & Spots Onc. Review	
SPOT														
WB Whole Body							S&S 240 s/ step (Cont 10 cm/min), BC, From 110 to 0	256 x 1024	1	12 min	FFS	H		
Tomo							S&S, Arc 360, step 6, CW, BC, 40 s/ft	64	1	20 min	FFS	H, rot=0	Volumetric MI	
Ga 67 Late Infection	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s) Del Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
SPOT	Static	Ga67	Ga67, 93/13, 184/10, 300/10	150	MEGP	1, ANT 2, POST	600 s	256	1	10 min/ view	FFS	H	WB & Spots Onc. Review	
WB Whole Body							S&S 360 s/ step (Cont 6.6 cm/min), BC, From 110 to 0	256 x 1024	1	18 min	FFS	H		
Tomo							S&S, Arc 360, step 6, CW, BC, 50 s/ft	64	1	25 min	FFS	H, rot=0	Volumetric MI	
In111 Leucocyte	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s) Del Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
SPOT Early	Static	WBC	In111, 171/10, 245/10	30	MEGP	1, ANT 2, POST	200 kc	128	1		FFS	H		Load to New
SPOT Late	Static	WBC	In111, 171/10, 245/10	30	MEGP	1, ANT 2, POST	200 kc	128	1		FFS	H		
HMPAO Leucocyte	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s) Del Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing protocol within study	Processing Protocol - study completed
SPOT Early	Static	HMPAO	Tc99m, 140/10	500	LEHR	1, ANT 2, POST	500 kc	256	1		FFS	H	Load to New	
SPOT Late	Static	HMPAO	Tc99m, 140/10	500	LEHR	1, ANT 2, POST	500 kc	256	1		FFS	H		
TOMO	Tomo	HMPAO or ECD	Tc99m, 140/10	500	LEHR	1, 2	S&S, Arc 360, step 6, CW, BC, 30 s/ft	128	1	15 min	FFS	H, rot=0	Volumetric MI	

Section 6: Infection Acquisition Protocols

Hybrid Protocols														
HIMPAO ACL	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gentry Pos	Processing Protocol within study	Processing Protocol - study completed
SPOT Early	Static	HMPAO	Tc99m, 140/10	500	LEHR	1, ANT 2, POST	500 kc	256	1		FFS	H	Load to New	
SPOT Late	Static	HMPAO	Tc99m, 140/10	500	LEHR	1, ANT 2, POST	500 kc	256	1		FFS	H		
TOMO	Tomo	HMPAO or ECD	Tc99mSC 120/5, 140/10	500	LEHR	1, 2	S&S, Arc 360, step 6, CW, BC, 30 s/fr	128	1	15 min	FFS	H, rot=0		
		Emission First, CT range Full, Select on Emission, CT parameters reference name: CTACL Low Dose												
	CT	AC/AL Scan: Helical Pitch 1.25:1, Rot.time 1sec, Voltage 120 kV, Current 20 mA, Recon: Sl.Thick. 2.5 mm, Sl.Spacing 2.5 mm, DFOV 60 cm, Kernel Std, Matrix 512, CTDivol 2.01 mGy												

Section 7: Lungs Acquisition Protocols

System Acquisition Protocols – Lungs														
Scan Parameters														
Clinical Protocol Name / Scan Names & Order	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing Protocol within study	Processing Protocol - study completed
Aerosol VP VENT Multiple Views	Static	Aerosol	Tc99m, 140/10	30	LEHR	1,2	200 kc	256	1	~ 15 min	FFS	H		Lung analysis
	ANT_V/ POST_V, RAO_V/ LPO_V, RLAT_V/ LLAT_V, RPO_V/ LAO_V													
PERF Multiple Views	Static	MAA	Tc99m, 140/10	100	LEHR	1,2	500 kc	256	1	~15 min	FFS	H		
	ANT_P/ POST_P, RAO_P/ LPO_P, RLAT_P/ LLAT_P, RPO_P/ LAO_P													
Kr81m VP VENT Multiple Views	Static	Kr81m	Kr81m, 190/10	100	LEHR	1,2	200 kc	256	1	~15 min	FFS	H		Lung analysis
	ANT_V/ POST_V, RAO_V/ LPO_V, RLAT_V/ LLAT_V, RPO_V/ LAO_V													
PERF Multiple Views	Static	MAA	Tc99m, 140/10	100	LEHR	1,2	500 kc	256	1	~ 15 min	FFS	H		
	ANT_P/ POST_P, RAO_P/ LPO_P, RLAT_P/ LLAT_P, RPO_P/ LAO_P													

Section 7: Lungs Acquisition Protocols

Xe133 VP	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Initial	Static	Xe133	Xe133, 81/15	200	LEHR	2 POST_initial	5 sec	256	1.2	1 min	FFS	H		Lung analysis
Equilib	Static	Xe133	Xe133, 81/15	200	LEHR	2 POST_Equilib	5 sec	256	1.2	1 min	FFS	H		
Washout	Dynamic	Xe133	Xe133, 81/15	200	LEHR	2 POST_Washout	15 s/fr, 24 frames	128 (256)	1.2	6 min	FFS	H		
Static	Static	MAA	Tc99m, 140/10	100	LEHR	1.2	500 Kcounts	256	1.2	2-3 min/view	FFS	H		
ANT_PI/POST_P, RAO_P/LPO_P, RLAT_P/LLAT_P, RPO_P/LAO_P														
AUTO SPOT VP	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Ventilation	Tomo	DTPA Aerosol	Tc99m, 140/10	30	LEHR	1,2	S&S, Arc 360, step 45, CCW, BC, 60 s	128	1	6 min	FFS	H, rot=0		Load to New
Perfusion	Tomo	MAA	Tc99m, 140/10	100	LEHR	1,2	S&S, Arc 360, step 45, CCW, BC, 30 s	128	1	3 min	FFS	H, rot=0		
Lungs Tomo	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
TOMO	Tomo	MAA	Tc99m, 140/10	100	LEHR	1,2	S&S, Arc 360, step 6, CCW, BC, 30 s/fr	128	1	17 min	FFS	H, rot=0		Volumetric MI

Section 8: Oncology Acquisition Protocols

System Acquisition Protocols – Oncology													
Clinical Protocol Name / Scan Names & Order		Scan Parameters											
	Acquisition Type	Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s) Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
Ga67 Oncology	Spot	Ga67	Ga67, 93/13, 184/10, 300/10	222	MEGP	1, ANT 2, POST	360 s	256	1	6 min	FFS	H	Processing Protocol within study WB & Spots Onc. Review
	WB	Ga67	Ga67, 93/13, 184/10, 300/10	222	MEGP	1, ANT 2, POST	S&S 240 s/ step (Cont 10 cm/min), BC, From 110 to 0	256 x1024	1	12 min	FFS	H, rot=0	
	Tomogram	Ga67	Ga67, 93/13, 184/10, 300/10	222	MEGP	1, 2	S&S, Arc 360, step 6, CW, BC, 40 s/fr	64	1	20 min	FFS	H, rot=0	Volumetric MI Processing Protocol within study Volumetric MI
Ga67 Late Oncology	Spot	Pharma Ga67	Isotope / Energy Ga67, 93/13, 184/10, 300/10	Usual Dose 222	Collimator MEGP	Detector(s) Label(s) 1, ANT 2, POST	Acq. Parameters 480 s	Matrix 256	Zoom 1	Acquisition Time 8 min	Patient Position FFS	Default Gantry Pos. H	Processing Protocol within study WB & Spots Onc. Review
	WB	Pharma Ga67	Isotope / Energy Ga67, 93/13, 184/10, 300/10	Usual Dose 222	Collimator MEGP	Detector(s) Label(s) 1, ANT 2, POST	Acq. Parameters S&S 360 s/ step (Cont 6.6 cm/min), BC, From 110 to 0	Matrix 256 x1024	Zoom 1	Acquisition Time 18 min	Patient Position FFS	Default Gantry Pos. H, rot=0	
	Tomogram	Pharma Ga67	Isotope / Energy Ga67, 93/13, 184/10, 300/10	Usual Dose 222	Collimator MEGP	Detector(s) Label(s) 1, 2	Acq. Parameters S&S, Arc 360, step 6, CW, BC, 50 s/fr	Matrix 64	Zoom 1	Acquisition Time 25 min	Patient Position FFS	Default Gantry Pos. H, rot=0	Volumetric MI Processing Protocol within study Volumetric MI
Ga67 WB Tomogram	WB Tomogram	Pharma Ga67	Isotope / Energy Ga67, 93/13, 184/10, 300/10	Usual Dose 222	Collimator MEGP	Detector(s) Label(s) 1, 2	Acq. Parameters S&S, Arc 360, step 6, F&B, BC, 40 s/fr	Matrix 64	Zoom 1	Acquisition Time 60 min	Patient Position FFS	Default Gantry Pos. H, 3 steps rot=0	Processing Protocol within study Volumetric MI
	WB Tomogram	Usual Pharma	Isotope / Energy In111, 177/10, 245/10	Usual Dose 222	Collimator MEGP	Detector(s) Label(s) 1, 2	Acq. Parameters S&S, Arc 360, step 6, F&B, BC, 40 s/fr	Matrix 64	Zoom 1	Acquisition Time 40 min	Patient Position FFS	Default Gantry Pos. H, 2 steps rot=0	Processing Protocol within study Volumetric MI

Section 8: Oncology Acquisition Protocols

In111 Oncology	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Spot	Static	Octreoscan	In111, 171/10, 245/10	222	MEGP	1, ANT 2, POST	900 s	256	1	15 min	FFS	H	WB & Spots Onc. Review	
WB	Whole Body	Octreoscan	In111, 171/10, 245/10	222	MEGP	1, ANT 2, POST	S&S 360 s/ step (Cont 6.6 cm/min), BC, From 110 to 0	256 x1024	1	18 min	FFS	H		
Tomato	Tomato	Octreoscan	In111, 171/10, 245/10	222	MEGP	1, 2	S&S, Arc 360, step 6, CW, BC, 40 s/rr	64	1	22 min	FFS	H, rot=0	Volumetrix MI	
ProstaScint	Acquisition Type	Usual Pharma	Isotope / Energy <td>Usual Dose</td> <td>Collimator</td> <td>Detector(s)/ Det Label(s)</td> <td>Acq Parameters</td> <td>Matrix</td> <td>Zoom</td> <td>Acquisition Time</td> <td>Patient Position</td> <td>Default Gantry Pos.</td> <td>Processing protocol within study</td> <td>Processing Protocol - study completed</td>	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Tomato Early	Tomato	ProstaScint	In111, 171/10, 245/10	185	MEGP	1, 2	S&S, Arc 360, step 3, CW, BC, 30 s/rr	128	1	15 min	FFS	H, rot=0	Volumetrix MI	
Spot Late	Static	ProstaScint	In111, 171/10, 245/10	185	MEGP	1, ANT 2, POST	600 s	256	1	10 min	FFS	H	WB & Spots Onc. Review	
Tomato Late	Tomato	ProstaScint	In111, 171/10, 245/10	185	MEGP	1, 2	S&S, Arc 360, step 3, CW, BC, 50 s/rr	128	1	25 min	FFS	H, rot=0	Volumetrix MI	
WB Late	Whole Body	ProstaScint	In111, 171/10, 245/10	185	MEGP	1, ANT 2, POST	S&S 450 s/ step (Cont 5.3 cm/min), BC, From 110 to 0	256 x1024	1	23 min	FFS	H	WB & Spots Onc. Review	
Tl201 Oncology	Acquisition Type	Pharma	Isotope / Energy <td>Usual Dose</td> <td>Collimator</td> <td>Detector(s) Label(s)</td> <td>Acq Parameters</td> <td>Matrix</td> <td>Zoom</td> <td>Acquisition Time</td> <td>Patient Position</td> <td>Default Gantry Pos.</td> <td>Processing protocol within study</td> <td>Processing Protocol - study completed</td>	Usual Dose	Collimator	Detector(s) Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Spot	Static	Thallous Chloride	Tl 201, 70/15, 167/10	111	ELEGP	1, ANT 2, POST	300 kc	256	1	~ 10 min	HFS	H	WB & Spots Onc. Review	
Tomato	Tomato	Thallous Chloride	Tl 201, 70/15, 167/10	111	ELEGP	1, 2	S&S, Arc 360, step 6, CW, BC, 30 s/rr	64	1	15 min	HFS	H, rot=0	Volumetrix MI	
MIBI Breast	Acquisition Type	Pharma	Isotope / Energy <td>Usual Dose</td> <td>Collimator</td> <td>Detector(s) Label(s)</td> <td>Acq Parameters</td> <td>Matrix</td> <td>Zoom</td> <td>Acquisition Time</td> <td>Patient Position</td> <td>Default Gantry Pos.</td> <td>Processing protocol within study</td> <td>Processing Protocol - study completed</td>	Usual Dose	Collimator	Detector(s) Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed
Spot	Static	Mibi	MIBI, Tc99m, 140/10	740	LEHR	1, ANT 2, POST	800 kc	256	1	~ 6 min	FFS	H	WB & Spots Onc. Review	
Tomato	Tomato	Mibi	MIBI, Tc99m, 140/10	740	LEHR	1, 2	S&S, Arc 360, step 3, CW, BC, 15 s/rr	128	1	15 min	FFS	H, rot=0	Volumetrix MI	

Section 8: Oncology Acquisition Protocols

Hybrid Protocols												
Acquisition Type	Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s) Label(s)	Acq. Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
Ga 67 Onco ACL	Ga67	Ga67SC, 75/17, 93/13, 184/10,300/10	222	MEGP	1,2	S&S, A/c: 360, step 6, CW, BC, 40 s/fr	64	1	20 min	FFS	H, rot=0	Processing Protocol - study completed
Emission First, CT range Full, Select on Emission, CT parameters reference name: CTACL Low Dose												
TOMO												Volumetric MI
AC/AL Scan: Helical Pitch 1.25:1, Rot.time 1sec, Voltage 120 kV, Current 20 mA, Recon: SI,Thick. 2.5 mm, SI.Spacing 2.5 mm, DFOV 50 cm, Kernel Std, Matrix 512, CTDivol 2.01 mGy												
In111 WB ACL	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
	Octreoscan	In111SC, 140/9, 171/10, 245/10	222	MEGP	1,2	S&S, A/c: 360, step 6, F&B, BC, 40 s/fr	128	1	45 min	FFS	H, 2 steps, rot=0	Processing Protocol - study completed
Emission First, CT range Full, Select on Emission, CT parameters reference name: CTACL Low Dose												
Tomo WB												Volumetric MI
AC/AL Scan: Helical Pitch 1.25:1, Rot.time 1sec, Voltage 120 kV, Current 20 mA, Recon: SI,Thick. 2.5 mm, SI.Spacing 2.5 mm, DFOV 50 cm, Kernel Std, Matrix 512, CTDivol 2.01 mGy												

Section 9: Renal Acquisition Protocols

System Acquisition Protocols – Renal													
Scan Parameters													
Clinical Protocol Name / Scan Names & Order	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
DMSA Static	Static	DMSA	Tc99m, 140/10	185	LEHR	2, PRE SYR	10 s	256	1	1 min	FFS	H	DMSA
FULL													
DMSA	Static	DMSA	Tc99m, 140/10		LEHR	1,2 ANT/POST	600 kc	256	1	~ 10 min	FFS	H	
INJ Site	Static	DMSA	Tc99m, 140/10		LEHR	2, INJ SITE	20 s	256	1	1 min	FFS	H	
EMPTY	Static	DMSA	Tc99m, 140/10		LEHR	2, POST SYR	20 s	256	1	1 min	FFS	H	
DMSA Tomo	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
TOMO	Tomo	DMSA	Tc99m, 140/10	185	LEHR	1,2	S&S, A/c 360, step 3, CW, BC, 15 s/fr	128	1	15 min	FFS	H, rot=0	Volumetric MI
Gates 1 Phase	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
FULL	Static	DTPA	Tc99m, 140/10		LEHR	2, PRE SYR	10 s	128	1	1 min	FFS	H	Renal Analysis
FLOW	Dynamic	DTPA	Tc99m, 140/10	370	LEHR	2, POST	15 s/fr, 24 frames	64	1	6 min	FFS	H	
INJECTION	Static	DTPA	Tc99m, 140/10		LEHR	2, INJ SITE	30 s	128	1	1 min	FFS	H	
EMPTY	Static	DTPA	Tc99m, 140/10		LEHR	2, POST SYR	10 s	128	1	1 min	FFS	H	
Gates 2 Phase	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
FULL	Static	DTPA	Tc99m, 140/10		LEHR	2, PRE SYR	10 s	128	1	1 min	FFS	H	Renal Analysis
FLOW	Dynamic	DTPA	Tc99m, 140/10	370	LEHR	2, POST	2s/fr, 30 frames 15 s/fr, 20 frames	64	1	6 min	FFS	H	
INJECTION	Static	DTPA	Tc99m, 140/10		LEHR	2, INJ SITE	30 s	128	1	1 min	FFS	H	
EMPTY	Static	DTPA	Tc99m, 140/10		LEHR	2, POST SYR	10 s	128	1	1 min	FFS	H	

Section 9: Renal Acquisition Protocols

DTPA Renogram	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s) / Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
FULL	Static	DTPA	Tc99m, 140/10		LEHR	2, PRE SYR	10 s	128	1	1 min	FFS	H	Renal Analysis
FLOW 30 MIN	Dynamic	DTPA	Tc99m, 140/10	370	LEHR	2, POST	2 s/fr, 30 frames 15 s/fr, 120 frames	64	1	30 min	FFS	H	
FLOW 45 MIN	Dynamic	DTPA	Tc99m, 140/10	370	LEHR	2, POST	2 s/fr, 30 frames 15 s/fr, 180 frames	64	1	45 min	FFS	H	
INJECTION	Static	DTPA	Tc99m, 140/10		LEHR	2, INJ SITE	30 s	128	1	1 min	FFS	H	
EMPTY	Static	DTPA	Tc99m, 140/10		LEHR	2, POST SYR	10 s	128	1	1 min	FFS	H	
LASIX	Dynamic	DTPA	Tc99m, 140/10		LEHR	2, LASIX	10 s/fr, 120 frames	64	1	20 min	FFS	H	
QuantEM 45 min	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s) / Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing Protocol - study completed
FULL	Static	MAG3	Tc99m, 140/10		LEHR	2, PRE SYR	20	128	1	20 s	FFS	H	Renal Analysis
FLOW	Dynamic	MAG3	Tc99m, 140/10	370	LEHR	2, MAG3 FLW	2 s/fr, 120 frames 15 s/fr, 60 frames 30 s/fr, 42 frames	128	1	45 min	FFS	H	
POST VOID	Static	MAG3	Tc99m, 140/10		LEHR	2, POSTVOID	60 s	128	1	1 min	FFS	H	
INJECTION	Static	MAG3	Tc99m, 140/10		LEHR	2, INJ SITE	30	128	1	30 s	FFS	H	
EMPTY	Static	MAG3	Tc99m, 140/10		LEHR	2, POST SYR	20	128	1	20 s	FFS	H	
LASIX	Dynamic	MAG3	Tc99m, 140/10		LEHR	2, LASIX	30 s/fr, 90 frames	128	1	45 min	FFS	H	

Section 9: Renal Acquisition Protocols

QuantEM 24 min	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing Protocol within study	Processing Protocol - study completed
FULL	Static	MAG3	Tc99m, 140/10		LEHR	2, PRE SYR	20 s	128	1	20 s	FFS	H		Renal Analysis
FLOW	Dynamic	MAG3	Tc99m, 140/10	370	LEHR	2, MAG3 FLW	2 s/fr, 120 frames 15 s/fr, 80 frames	128	1	25 min	FFS	H		
POST VOID	Static	MAG3	Tc99m, 140/10		LEHR	2, POSTVOID	60 s	128	1	1 min	FFS	H		
INJECTION	Static	MAG3	Tc99m, 140/10		LEHR	2, INJ SITE	30 s	128	1	30 s	FFS	H		
EMPTY	Static	MAG3	Tc99m, 140/10		LEHR	2, POST SYR	20 s	128	1	20 s	FFS	H		
PREVOID	Static	MAG3	Tc99m, 140/10		LEHR	1, APREVOID	20 s	128	1	20 s	FFS	H		
POSTVOID	Static	MAG3	Tc99m, 140/10		LEHR	1, APOSTVOID	20 s	128	1	20 s	FFS	H		
LASIX	Dynamic	MAG3	Tc99m, 140/10		LEHR	2, LASIX	30 s/fr, 40 frames	128	1	20 min	FFS	H		
QuantEM 4 min	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing Protocol within study	Processing Protocol - study completed
FULL	Static	MAG3	Tc99m, 140/10		LEHR	2, PRE SYR	20 s	128	1	20 s	FFS	H		Renal Analysis
FLOW	Dynamic	MAG3	Tc99m, 140/10	370	LEHR	2, MAG3 FLW	2 s/fr, 120 frames	128	1	4 min	FFS	H		
INJECTION	Static	MAG3	Tc99m, 140/10		LEHR	2, INJ SITE	30 s	128	1	30 s	FFS	H		
EMPTY	Static	MAG3	Tc99m, 140/10		LEHR	2, POST SYR	20 s	128	1	20 s	FFS	H		
Testicular Scan	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos	Processing Protocol within study	Processing Protocol - study completed
FLOW	Dynamic	Pertechneta	Tc99m, 140/10	555	LEHR	1, FLOW	1 s/fr, 60 frames	64	1	1 min	FFS	H		Load to New
SPOT	Static	Pertechneta	Tc99m, 140/10	555	LEHR	1,	60 s	256	1	1 min/ view	FFS	H		
Multiple View	IMMED, 5 Min, 10 Min, 15 Min, 20 Min													

Section 10: Vascular Acquisition Protocols

System Acquisition Protocols – Vascular															
Scan Parameters															
Clinical Protocol Name / Scan Names & Order	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed	
Bone Flow	Dynamic	MDP	Tc99m, 140/10	740	ELEGP	1, FLOW ANT	2 s/fr, 120 frames	128	1	4 min	FFS	H		Load to New	
Muscle Perfusion	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed	
	Static	Mibi	Tc99m, 140/10	750	ELEGP	1, 2	300 s	256	1	5 min/View	FFS	H		WB & spots Bone review	
Multiple Views:															
ANT LOWER LEG/ POST LOWER LEG, ANT UPPER LEG/ POST UPPER LEG															
WB	Whole Body	Mibi	Tc99m, 140/10	750	ELEGP	1, ANT 2, POST	Cont 10cm/min or S&S 240 s, From 150 to 0, BC	256 x 1024	1	16 min	FFS	H			
Phleboscintigram	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed	
	Static	MAA	Tc99m, 140/10	80	ELEGP	1, 2	180 s	256	1	3 min	HFS	H		WB & spots Bone review	
Multiple Views:															
ANT LOWER LEG/ POST LOWER LEG, ANT UPPER LEG/ POST UPPER LEG, ANT HIPS/ POST HIPS															
WB	Whole Body	MAA	Tc99m, 140/10	80	ELEGP	1, ANT 2, POST	Cont 10cm/min or S&S 240 s, From 150 to 0, BC	256 x 1024	1	16 min	FFS	H			
Lymph Spot Views	Acquisition Type	Usual Pharma	Isotope / Energy	Usual Dose	Collimator	Detector(s)/ Det.Label(s)	Acq Parameters	Matrix	Zoom	Acquisition Time	Patient Position	Default Gantry Pos.	Processing protocol within study	Processing Protocol - study completed	
	Dynamic	Nanocoll	Tc99m, 140/10	10 Mbq/inj	ELEGP	1, FLOW	30 s/fr, 90 frames	128	1	45 min	FFS	H		Load to New	
EARLY UP LIMB	Static	Nanocoll	Tc99m, 140/10	10 Mbq/inj	ELEGP	1, EARLY UP LIMB	300 s	256	1	5 min	FFS	H			
EARLY LOW LIMB	Static	Nanocoll	Tc99m, 140/10	10 Mbq/inj	ELEGP	1, EARLY LOW LIMB	300 s	256	1	5 min	FFS	H			
LATE UP LIMB	Static	Nanocoll	Tc99m, 140/10	10 Mbq/inj	ELEGP	1, LATE UP LIMB	300 s	256	1	5 min	FFS	H			
LATE LOW LIMB	Static	Nanocoll	Tc99m, 140/10	10 Mbq/inj	ELEGP	1, LATE LOW LIMB	300 s	256	1	5 min	FFS	H			

Attachments

Quotations

Quotation Number: PR10-C53635 V 2

St Vincents Medical Center
2800 Main St
Bridgeport CT 06606-4201

Attn: John Hackett
2800 Main St Bridgeport
CT 06606-4201

Date: 09-18-2015

Item No.	Qty	Catalog No.	Description
1	1	S0640NA	Optima NM/CT 640 O640 3.8 EXCEL X3.1
2	1	H2506TB	GE NM 600 Series LEHR Collimators (2) with Cart
3	1	H2506TC	GE NM 600 Series MEGP Collimators (2) with Cart
4	1	H3100PE	D670/630 & B615 QC Point Source Holder
5	1	H3100PF	D670/630 & B615 QC Flood Source Holder Kit
6	1	H3602SL	QA COR Source Holder
7	1	H3100PL	NM 600 SERIES BARPHANTOM
8	1	H3100YY	O640 FIXTURES 4 UPS 480V
9	1	B77292CA	CT Service Cabinet
10	1	H2506TR	NM600 DETECTORS DISMOUNT
11	1	S8006ST	Xeieris 3 23" Dual LCD Monitor & License
12	1	W0310NM	8 Days Onsite plus 10 Hours TVA
13	1	W0002NM	2 Days NM TIP Onsite Training
14	1	E4502JJ	6 KVA UPS for Nuclear Medicine
15	1	E8500NB	Patient Arm Support System for Nuclear, PET/CT, MRI
16	1	E8500NC	Patient Leg Rest for Nuclear, PET/CT, MRI
17	1	E8007DC	Ivy 7600 Cardiac Trigger Monitor Kit - No Recorder, Americas Labeling. For GEHC Nuclear Med.
18	1	R12022AC	SVC PACK A2 WARRANTY
19	1		Rigging Rigging



GE Healthcare

QUOTATION

Quotation Number: PR10-C53635 V 2

Item No.	Qty	Catalog No.	Description
----------	-----	-------------	-------------

Quote Summary:

Trade In Millenium MPR

Total Quote Net Selling Price

\$547,796.50

(Quoted prices do not reflect state and local taxes if applicable)

If you would like to place an order for this equipment, a formal contract document will be prepared for your consideration. This quote is for budgetary use only; only a GE contract can become a binding order.

2/3



PO Box 414, Milwaukee, WI 53201-0404
General Electric Company
General Electric Company, GE Medical Systems

0167

Quotation Number: PR10-C53635 V 2

Options

(These items are not included in the total quotation amount)

Item No.	Qty	Catalog No.	Description	
			Optima NM/CT 640	
20	1	H2506TE	GE NM 600 Series HEGP Collimators (2) with Cart	X_____
21	1	H2506TF	GE NM 600 Series PINHOLE Collimator (1) W/CART	X_____
22	1	H3100NW	Axial Head Holder	X_____
23	1	H3100YR	600 Series PT Entertainment System	X_____
24	1	H3901CB	X3.1 VIEW ADDITIONAL	X_____
25	1	S8006SC	EFC X3 W/ 1 CAMERA LIC	X_____
26	1	S8006SL	EV TOOLKIT X3 1 CAMERA LI	X_____
27	1	H3900MA	Xfl Client (1st Per Srv)	X_____
28	1	H3901KK	XELERIS3 SERVER LICENSE	X_____
29	1	H3901KL	XFL REMOTE OFFICE	X_____
30	1	W3001HC	TIP HQ Class NM Workstation - Full Service	X_____

(Quoted prices do not reflect state and local taxes if applicable)



Attachments

Financials

**ST. VINCENT'S HEALTH SERVICES
CORPORATION AND SUBSIDIARIES**

*MEMBER OF ASCENSION HEALTH, A SUBSIDIARY OF ASCENSION HEALTH ALLIANCE,
D/B/A ASCENSION*

**CONSOLIDATED FINANCIAL STATEMENTS
YEARS ENDED SEPTEMBER 30, 2014 AND 2013**



INDEPENDENT AUDITORS' REPORT

To the Board of Directors
St. Vincent's Health Services Corporation

We have audited the accompanying consolidated financial statements of St. Vincent's Health Services Corporation and Subsidiaries (the Corporation), which comprise the consolidated balance sheet as of September 30, 2014, and the related consolidated statements of operations and changes in net assets and cash flows for the year then ended, and the related notes to the consolidated financial statements.

Management's Responsibility for the Consolidated Financial Statements

Management is responsible for the preparation and fair presentation of these consolidated financial statements in accordance with accounting principles generally accepted in the United States of America; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditors' Responsibility

Our responsibility is to express an opinion on these consolidated financial statements based on our audit. We conducted our audit in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditors' judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.



Opinion

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the consolidated financial position of the Corporation as of September 30, 2014, and the consolidated results of their operations and changes in net assets and their cash flows for the year then ended in accordance with accounting principles generally accepted in the United States of America.

Other Matter

The consolidated financial statements of St. Vincent's Health Services Corporation and Subsidiaries for the year ended September 30, 2013, were audited by other auditors whose report dated February 21, 2014 included an emphasis-of-matter paragraph that described the change in the Corporation's presentation of the provision for bad debts, and expressed an unmodified opinion on those consolidated financial statements.

Marcum LLP

Hartford, CT
February 19, 2015

**ST. VINCENT'S HEALTH SERVICES
CORPORATION AND SUBSIDIARIES**

CONSOLIDATED BALANCE SHEETS
(Dollars in Thousands)

SEPTEMBER 30, 2014 AND 2013

	2014	2013
Assets		
Current Assets		
Cash and cash equivalents	\$ 3,300	\$ 5,001
Accounts receivable, less allowance for uncollectible accounts (\$26,400 in 2014 and \$26,326 in 2013)	67,589	56,043
Inventories and other current assets	21,577	20,969
Total Current Assets	92,466	82,013
Interest in Investments Held by Ascension	385,447	375,348
Board-Designated Investments and Assets Limited as to Use		
Noncurrent pledges receivable, net	771	1,231
Other board-designated investments	14,206	13,380
Temporarily or permanently restricted	28,513	27,068
Total Board-Designated Investments and Assets Limited as to Use	43,490	41,679
Property and Equipment		
Land and improvements	14,544	14,584
Buildings, leasehold improvements and equipment	466,204	456,093
Construction in progress	2,391	3,172
	483,139	473,849
Less accumulated depreciation	(275,790)	(253,094)
Total Property and Equipment, net	207,349	220,755
Capitalized Software Costs, net	26,300	14,399
Other Assets	12,797	10,836
Pension Asset	3,995	--
Total Assets	\$ 771,844	\$ 745,030

The accompanying notes are an integral part of these consolidated financial statements.

**ST. VINCENT'S HEALTH SERVICES
CORPORATION AND SUBSIDIARIES**

CONSOLIDATED BALANCE SHEETS (CONTINUED)
(Dollars in Thousands)

SEPTEMBER 30, 2014 AND 2013

	2014	2013
Liabilities and Net Assets		
Current Liabilities		
Accounts payable and accrued liabilities	\$ 55,277	\$ 60,416
Current portion of long-term debt	885	988
Current portion of note payable, other	--	1,075
Due to System, net	4,483	2,247
Estimated third-party payor settlements	10,642	5,681
Other current liabilities	335	340
Total Current Liabilities	71,622	70,747
Noncurrent Liabilities		
Long-term debt	56,503	57,238
Self-insurance liabilities	3,701	3,499
Pension and other postretirement liabilities	5,194	8,531
Other liabilities	9,906	8,892
Total Noncurrent Liabilities	75,304	78,160
Total Liabilities	146,926	148,907
Net Assets		
Unrestricted	596,405	569,055
Temporarily restricted	15,750	14,844
Permanently restricted	12,763	12,224
Total Net Assets	624,918	596,123
Total Liabilities and Net Assets	\$ 771,844	\$ 745,030

The accompanying notes are an integral part of these consolidated financial statements.

**ST. VINCENT'S HEALTH SERVICES
CORPORATION AND SUBSIDIARIES**

CONSOLIDATED STATEMENTS OF OPERATIONS AND CHANGES IN NET ASSETS
(Dollars in Thousands)

FOR THE YEARS ENDED SEPTEMBER 30, 2014 AND 2013

	2014	2013
Operating Revenues		
Net patient service revenue	\$ 465,800	\$ 461,036
Less provision for doubtful accounts	<u>34,098</u>	<u>27,679</u>
Net patient service revenue, less provision for doubtful accounts	431,702	433,357
Other revenues	47,142	39,575
Net assets released from restrictions for operations	<u>1,614</u>	<u>1,685</u>
Total Operating Revenues	<u>480,458</u>	<u>474,617</u>
Operating Expenses		
Salaries and wages	209,778	212,347
Employee benefits	54,192	55,142
Purchased services	46,969	37,145
Professional fees	22,745	19,519
Supplies	57,457	57,058
Insurance	5,956	5,349
Interest	1,818	1,954
Depreciation and amortization	28,822	26,417
Other	<u>35,374</u>	<u>32,749</u>
Total Operating Expenses Before Non-Recurring Losses	<u>463,111</u>	<u>447,680</u>
Income from Operations Before Non-Recurring Losses	17,347	26,937
Non-Recurring Losses	<u>(946)</u>	<u>(9,021)</u>
Income from Operations	<u>16,401</u>	<u>17,916</u>
Nonoperating Gains (Losses)		
Investment returns, net	26,670	28,742
Other	<u>(1,630)</u>	<u>(1,563)</u>
Total Nonoperating Gains, net	<u>25,040</u>	<u>27,179</u>
Excess of Revenues and Gains Over Expenses and Losses	<u>41,441</u>	<u>45,095</u>

The accompanying notes are an integral part of these consolidated financial statements.

**ST. VINCENT'S HEALTH SERVICES
CORPORATION AND SUBSIDIARIES**

**CONSOLIDATED STATEMENTS OF OPERATIONS AND CHANGES IN NET ASSETS
(CONTINUED)**
(Dollars in Thousands)

FOR THE YEARS ENDED SEPTEMBER 30, 2014 AND 2013

	2014	2013
Unrestricted Net Assets		
Excess of revenues and gains over expenses and losses	\$ 41,441	\$ 45,095
Transfers to System	(14,970)	(18,527)
Net assets released from restrictions for property acquisitions	646	4,210
Pension and other postretirement liability adjustments	202	1,082
Transfers from temporarily restricted net assets, net	31	8
Increase in Unrestricted Net Assets	<u>27,350</u>	<u>31,868</u>
Temporarily Restricted Net Assets		
Contributions	1,903	5,135
Investment return	1,455	821
Net change in unrealized gains on investments	279	1,204
Net assets released from restrictions	(2,260)	(5,895)
Transfers to unrestricted and permanently restricted net assets, net	(31)	(157)
Other	(440)	(1,423)
Increase (Decrease) in Temporarily Restricted Net Assets	<u>906</u>	<u>(315)</u>
Permanently Restricted Net Assets		
Contributions	539	95
Transfers from temporarily restricted net assets, net	--	149
Increase in Permanently Restricted Net Assets	<u>539</u>	<u>244</u>
Increase in Net Assets	28,795	31,797
Net Assets - Beginning	<u>596,123</u>	<u>564,326</u>
Net Assets - Ending	<u>\$ 624,918</u>	<u>\$ 596,123</u>

The accompanying notes are an integral part of these consolidated financial statements.

**ST. VINCENT'S HEALTH SERVICES
CORPORATION AND SUBSIDIARIES**

CONSOLIDATED STATEMENTS OF CASH FLOWS
(Dollars in Thousands)

FOR THE YEARS ENDED SEPTEMBER 30, 2014 AND 2013

	2014	2013
Cash Flows from Operating Activities		
Increase in net assets	\$ 28,795	\$ 31,797
Adjustments to reconcile net assets to net cash provided by operating activities:		
Depreciation and amortization	28,822	26,417
Loss on sale of property and equipment	--	234
Pension and other postretirement liability adjustments	(202)	(1,082)
Restricted contributions and net investment return	(3,897)	(5,956)
Net change in unrealized gains on investments	(7,706)	(16,745)
Transfers to System, net	14,970	18,527
Changes in operating assets and liabilities:		
Interest in investments held by Ascension	(2,945)	(596)
Accounts receivable, net	(11,546)	(1,597)
Inventories and other current assets	(608)	(6,695)
Accounts payable and accrued liabilities	(5,139)	(4,203)
Estimated third-party payor settlements	4,961	(6,319)
Other noncurrent liabilities	(5)	(121)
Pension and other postretirement liabilities	(7,130)	(2,616)
Other liabilities	1,216	1,505
Net Cash Provided by Operating Activities	39,586	32,550
Cash Flows from Investing Activities		
Property and equipment additions	(9,670)	(14,992)
Software in development	(17,647)	(4,056)
(Increase) decrease in assets limited as to use - restricted	(1,259)	1,525
Increase in other assets	(1,961)	(5,105)
Net Cash Used in Investing Activities	(30,537)	(22,628)

The accompanying notes are an integral part of these consolidated financial statements.

**ST. VINCENT'S HEALTH SERVICES
CORPORATION AND SUBSIDIARIES**

CONSOLIDATED STATEMENTS OF CASH FLOWS
(Dollars in Thousands)

FOR THE YEARS ENDED SEPTEMBER 30, 2014 AND 2013

	2014	2013
Cash Flows from Financing Activities		
Transfers to System, net	\$ (12,734)	\$ (16,783)
Repayment of long-term debt	(1,913)	(1,510)
Restricted contributions and net investment return	3,897	5,956
Net Cash Used in Financing Activities	(10,750)	(12,337)
Net Change in Cash and Cash Equivalents	(1,701)	(2,415)
Cash and Cash Equivalents - Beginning	5,001	7,416
Cash and Cash Equivalents - Ending	\$ 3,300	\$ 5,001

The accompanying notes are an integral part of these consolidated financial statements.



**INDEPENDENT AUDITORS' REPORT
ON SUPPLEMENTARY INFORMATION**

To the Board of Directors
St. Vincent's Health Services Corporation

We have audited the 2014 consolidated financial statements of St. Vincent's Health Services Corporation as of and for the year ended September 30, 2014, and have issued our report thereon dated February 19, 2015, which contains an unmodified opinion on those consolidated financial statements and which appears on page 1. Our audit was performed for the purpose of forming an opinion on the 2014 consolidated financial statements as a whole. The 2014 consolidating balance sheet, the 2014 consolidating statement of operations and changes in unrestricted net assets, and the 2014 schedule of net cost of providing care of persons living in poverty and community benefit programs are presented for the purpose of additional analysis and are not a required part of the consolidated financial statements. Such information is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the 2014 consolidated financial statements. The 2014 information has been subjected to the auditing procedures applied in the audit of the 2014 consolidated financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the 2014 consolidated financial statements or to the 2014 consolidated financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United States of America. In our opinion, the 2014 information is fairly stated in all material respects in relation to the 2014 consolidated financial statements taken as a whole.

The 2013 consolidating balance sheet and the 2013 consolidating statement of operations and changes in unrestricted net assets were derived from the Corporation's 2013 consolidated financial statements that were audited by other auditors, whose report dated February 21, 2014, reported that the 2013 information was fairly stated in all material respects in relation to the 2013 consolidated financial statements as a whole.

Marcum LLP

Hartford, CT
February 19, 2015



ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE I – CONSOLIDATING BALANCE SHEET (CONTINUED)

(Dollars in Thousands)

SEPTEMBER 30, 2014

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Eliminations	Total
Assets							
Current Assets							
Cash and cash equivalents	\$ --	\$ 2,477	\$ 662	\$ 37	\$ 124	\$ --	\$ 3,300
Accounts receivable, less allowances for uncollectible accounts of \$26,400	--	67,589	--	--	--	--	67,589
Due from System, parent and affiliated entities, net	--	1,127	(5,149)	3,337	(77)	762	--
Inventories and other current assets	--	14,802	707	2,190	157	3,721	21,577
Total Current Assets	--	85,995	(3,780)	5,564	204	4,483	92,466
Interest in Investments Held by Ascension	--	363,112	--	20,377	1,758	--	385,447
Board-Designated Investments and Assets Limited as to Use							
Noncurrent pledges receivable, net	--	--	771	--	--	--	771
Other board-designated investments	--	--	14,206	--	--	--	14,206
Temporarily or permanently restricted	--	329	28,176	8	--	--	28,513
Temporarily or permanently restricted interest in The St. Vincent's Medical Center Foundation, Inc.	--	25,909	--	2,333	--	(28,242)	--
Total Board-Designated Investments and Assets Limited as to Use	--	26,238	43,153	2,341	--	(28,242)	43,490
Interest in The St. Vincent's Medical Center Foundation, Inc.	1,563	312	--	484	--	(2,359)	--

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE I – CONSOLIDATING BALANCE SHEET (CONTINUED)

(Dollars in Thousands)

SEPTEMBER 30, 2014

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Eliminations	Total
Property and Equipment							
Land and improvements	\$ --	\$ 8,883	\$ 105	\$ 871	\$ 4,685	\$ --	\$ 14,544
Buildings, leasehold improvements and equipment	--	431,816	617	17,228	16,543	--	466,204
Construction in progress	--	2,275	--	25	91	--	2,391
Less accumulated depreciation	--	442,974	722	18,124	21,319	--	483,139
	--	(260,440)	(264)	(8,545)	(6,541)	--	(275,790)
Total Property and Equipment, net	--	182,534	458	9,579	14,778	--	207,349
Capitalized Software Costs, net	--	26,298	2	--	--	--	26,300
Other Assets	--	11,959	799	15	24	--	12,797
Pension Asset	--	5,722	--	(1,727)	--	--	3,995
Total Assets	\$ 1,563	\$ 702,170	\$ 40,632	\$ 36,833	\$ 16,764	\$ (26,118)	\$ 771,844

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE I – CONSOLIDATING BALANCE SHEET (CONTINUED)
(Dollars in Thousands)

SEPTEMBER 30, 2014

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Eliminations	Total
Liabilities and Net Assets							
Current Liabilities							
Accounts payable and accrued liabilities	\$ --	\$ 53,113	\$ 289	\$ 1,669	\$ 206	\$ --	\$ 55,277
Current portion of long-term debt	--	885	--	--	--	--	885
Due to System, net	--	--	--	--	--	4,483	4,483
Estimated third-party payor settlements	--	10,642	--	--	--	--	10,642
Other current liabilities	--	--	2	323	10	--	335
Total Current Liabilities	--	64,640	291	1,992	216	4,483	71,622
Noncurrent Liabilities							
Long-term debt	--	56,503	--	--	--	--	56,503
Self-insurance liabilities	--	3,701	--	--	--	--	3,701
Pension and other postretirement liabilities	--	5,194	--	--	--	--	5,194
Other liabilities	--	9,631	24	--	251	--	9,906
Total Noncurrent Liabilities	--	75,029	24	--	251	--	75,304
Total Liabilities	--	139,669	315	1,992	467	4,483	146,926
Net Assets							
Unrestricted	1,563	536,263	12,141	32,500	16,297	(2,359)	596,405
Temporarily restricted	--	14,185	15,481	1,631	--	(15,547)	15,750
Permanently restricted	--	12,053	12,695	710	--	(12,695)	12,763
Total Net Assets	1,563	562,501	40,317	34,841	16,297	(30,601)	624,918
Total Liabilities and Net Assets	\$ 1,563	\$ 702,170	\$ 40,632	\$ 36,833	\$ 16,764	\$ (26,118)	\$ 771,844

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE II - CONSOLIDATING BALANCE SHEET
(Dollars in Thousands)

SEPTEMBER 30, 2013

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Eliminations	Total
Assets							
Current Assets							
Cash and cash equivalents	\$ --	\$ 3,775	\$ 567	\$ 531	\$ 128	\$ --	\$ 5,001
Accounts receivable, less allowances for uncollectible accounts of \$26,326	--	56,043	--	--	--	--	56,043
Due from System, parent and affiliated entities, net	--	1,545	(5,261)	51	501	3,164	--
Inventories and other current assets	--	19,298	857	1,605	126	(917)	20,969
Total Current Assets	--	80,661	(3,837)	2,187	755	2,247	82,013
Interest in Investments Held by Ascension	--	333,820	--	20,247	1,281	--	375,348
Board-Designated Investments and Assets Limited as to Use							
Noncurrent pledges receivable, net	--	--	1,231	--	--	--	1,231
Other board-designated investments	--	--	13,380	--	--	--	13,380
Temporarily or permanently restricted	--	363	26,697	8	--	--	27,068
Temporarily or permanently restricted interest in The St. Vincent's Medical Center Foundation, Inc.	--	23,929	--	2,833	--	(26,762)	--
Total Board-Designated Investments and Assets Limited as to Use	--	24,292	41,308	2,841	--	(26,762)	41,679
Interest in The St. Vincent's Medical Center Foundation, Inc.	1,563	312	--	494	--	(2,369)	--

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE II - CONSOLIDATING BALANCE SHEET (CONTINUED)
(Dollars in Thousands)

SEPTEMBER 30, 2013

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Eliminations	Total
Property and Equipment							
Land and improvements	\$ --	\$ 8,923	\$ 105	\$ 871	\$ 4,685	\$ --	\$ 14,584
Buildings, leasehold improvements and equipment	--	423,481	617	16,131	15,864	--	456,093
Construction in progress	--	2,567	--	256	349	--	3,172
Less accumulated depreciation	--	434,971	722	17,258	20,898	--	473,849
	--	(238,875)	(232)	(8,159)	(5,828)	--	(253,094)
Total Property and Equipment, net	--	196,096	490	9,099	15,070	--	220,755
Capitalized Software Costs, net	--	14,395	4	--	--	--	14,399
Other Assets	--	9,991	806	15	24	--	10,836
Total Assets	\$ 1,563	\$ 679,567	\$ 38,771	\$ 34,883	\$ 17,130	\$ (26,884)	\$ 745,030

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE II – CONSOLIDATING BALANCE SHEET (CONTINUED)
(Dollars in Thousands)

SEPTEMBER 30, 2013

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Eliminations	Total
Liabilities and Net Assets							
Current Liabilities							
Accounts payable and accrued liabilities	\$ --	\$ 57,554	\$ 204	\$ 2,053	\$ 605	\$ --	\$ 60,416
Current portion of long-term debt	--	988	--	--	--	--	988
Current portion of note payable	--	1,075	--	--	--	--	1,075
Due to System, net	--	--	--	--	--	2,247	2,247
Estimated third-party payor settlements	--	5,681	--	--	--	--	5,681
Other current liabilities	--	--	7	323	10	--	340
Total Current Liabilities	--	<u>65,298</u>	<u>211</u>	<u>2,376</u>	<u>615</u>	<u>2,247</u>	<u>70,747</u>
Noncurrent Liabilities							
Long-term debt	--	57,238	--	--	--	--	57,238
Self-insurance liabilities	--	3,499	--	--	--	--	3,499
Pension and other postretirement liabilities	--	7,062	--	1,469	--	--	8,531
Other liabilities	--	8,702	29	--	161	--	8,892
Total Noncurrent Liabilities	--	<u>76,501</u>	<u>29</u>	<u>1,469</u>	<u>161</u>	<u>--</u>	<u>78,160</u>
Total Liabilities	--	<u>141,799</u>	<u>240</u>	<u>3,845</u>	<u>776</u>	<u>2,247</u>	<u>148,907</u>
Net Assets							
Unrestricted	1,563	513,476	11,834	28,197	16,354	(2,369)	569,055
Temporarily restricted	--	12,778	14,541	2,131	--	(14,606)	14,844
Permanently restricted	--	11,514	12,156	710	--	(12,156)	12,224
Total Net Assets	<u>1,563</u>	<u>537,768</u>	<u>38,531</u>	<u>31,038</u>	<u>16,354</u>	<u>(29,131)</u>	<u>596,123</u>
Total Liabilities and Net Assets	<u>\$ 1,563</u>	<u>\$ 679,567</u>	<u>\$ 38,771</u>	<u>\$ 34,883</u>	<u>\$ 17,130</u>	<u>\$ (26,884)</u>	<u>\$ 745,030</u>

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

**SCHEDULE III - CONSOLIDATING STATEMENT OF OPERATIONS
AND CHANGES IN UNRESTRICTED NET ASSETS**

(Dollars in Thousands)

FOR THE YEAR ENDED SEPTEMBER 30, 2014

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Eliminations	Total
Operating Revenues							
Net patient service revenue	\$ --	\$ 465,800	\$ --	\$ --	\$ --	\$ --	\$ 465,800
Less provision for doubtful accounts	--	34,098	--	--	--	--	34,098
Net patient service revenue, less provision for doubtful accounts	--	431,702	--	--	--	--	431,702
Other revenues	--	24,175	550	23,198	3,647	(4,428)	47,142
Net assets released from restrictions for operations	--	1,481	--	133	--	--	1,614
Total Operating Revenues	--	457,358	550	23,331	3,647	(4,428)	480,458
Operating Expenses							
Salaries and wages	--	197,629	66	12,083	--	--	209,778
Employee benefits	--	49,928	14	4,250	--	--	54,192
Purchased services	--	47,757	--	1,216	1,489	(3,493)	46,969
Professional fees	--	22,437	--	185	166	(43)	22,745
Supplies	--	56,765	1	675	16	--	57,457
Insurance	--	5,760	--	178	18	--	5,956
Interest	--	1,818	--	--	--	--	1,818
Depreciation and amortization	--	27,483	3	738	598	--	28,822
Other	--	32,356	197	2,125	1,588	(892)	35,374
Total Operating Expenses Before Non-Recurring (Losses)	--	441,933	281	21,450	3,875	(4,428)	463,111
Income (Loss) from Operations Before Non-Recurring (Losses)	--	15,425	269	1,881	(228)	--	17,347
Non-Recurring (Losses)	--	(946)	--	--	--	--	(946)
Income (Loss) from Operations	--	14,479	269	1,881	(228)	--	16,401

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE III -- CONSOLIDATING STATEMENT OF OPERATIONS
AND CHANGES IN UNRESTRICTED NET ASSETS (CONTINUED)

(Dollars in Thousands)

FOR THE YEAR ENDED SEPTEMBER 30, 2014

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Eliminations	Total
Nonoperating Gains (Losses)							
Investment returns, net	--	\$ 22,642	\$ 1,763	\$ 2,194	\$ 71	\$ --	\$ 26,670
Other	--	--	(1,630)	--	--	--	(1,630)
Total Nonoperating Gains, net	--	22,642	133	2,194	71	--	25,040
Excess (Deficiency) of Revenue and Gains Over Expenses and Losses	--	37,121	402	4,075	(157)	--	41,441
Unrestricted Net Assets							
Excess (deficiency) of revenue and gains over expenses and losses	--	37,121	402	4,075	(157)	--	41,441
Transfers (to) from System, net	--	(14,257)	(126)	(697)	100	10	(14,970)
Net assets released from restrictions for property acquisitions	--	(275)	--	921	--	--	646
Pension and other postretirement liability adjustments	--	198	--	4	--	--	202
Transfer from temporarily and permanently restricted net assets	--	--	31	--	--	--	31
Increase (Decrease) in Unrestricted Net Assets	--	22,787	307	4,303	(57)	10	27,350

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE III - CONSOLIDATING STATEMENT OF OPERATIONS
AND CHANGES IN UNRESTRICTED NET ASSETS (CONTINUED)

(Dollars in Thousands)

FOR THE YEAR ENDED SEPTEMBER 30, 2014

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Eliminations	Total
Temporarily Restricted Net Assets							
Contributions	\$ --	\$ 1,215	\$ 1,894	\$ 1,054	\$ --	\$ (2,260)	\$ 1,903
Investment return	--	--	1,455	--	--	--	1,455
Net change in unrealized gains on investments	--	--	279	--	--	--	279
Net assets released from restrictions	--	(1,206)	(2,657)	(1,054)	--	2,260	(2,657)
Transfers to unrestricted and permanently restricted net assets	--	--	(31)	--	--	--	(31)
Change in interest in The St. Vincent's Medical Center Foundation, Inc.	--	1,441	--	(500)	--	(941)	--
Other	--	(43)	--	--	--	--	(43)
(Decrease) Increase in Temporarily Restricted Net Assets	--	1,407	940	(500)	--	(941)	906
Permanently Restricted Net Assets							
Contributions	--	--	539	--	--	--	539
Change in interest in The St. Vincent's Medical Center Foundation, Inc.	--	539	--	--	--	(539)	--
Increase in Permanently Restricted Net Assets	--	539	539	--	--	(539)	539
Increase (Decrease) in Net Assets	--	24,733	1,786	3,803	(57)	(1,470)	28,795
Net Assets - Beginning	1,563	537,768	38,531	31,038	16,354	(29,131)	596,123
Net Assets - Ending	\$ 1,563	\$ 562,501	\$ 40,317	\$ 34,841	\$ 16,297	\$ (30,601)	\$ 624,918

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE IV – CONSOLIDATING STATEMENT OF OPERATIONS
AND CHANGES IN UNRESTRICTED NET ASSETS
(Dollars in Thousands)

FOR THE YEAR ENDED SEPTEMBER 30, 2013

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Hall-Brooke Behavioral Health Services, Inc.	Eliminations	Total
Operating Revenues								
Net patient service revenue	\$ --	\$ 461,036	\$ --	\$ --	\$ --	\$ --	\$ --	\$ 461,036
Less provision for doubtful accounts	--	27,679	--	--	--	--	--	27,679
Net patient service revenue, less provision for doubtful accounts	--	433,357	--	--	--	--	--	433,357
Other revenue	--	15,292	554	21,800	3,306	3,069	(4,446)	39,575
Net assets released from restrictions for operations	--	1,419	--	174	--	92	--	1,685
Total Operating Revenues	--	450,068	554	21,974	3,306	3,161	(4,446)	474,617
Operating Expenses								
Salaries and wages	--	199,026	73	11,973	--	1,275	--	212,347
Employee benefits	--	50,785	8	3,901	--	448	--	55,142
Purchased services	--	37,389	--	1,336	1,284	395	(3,259)	37,145
Professional fees	--	19,054	--	247	154	64	--	19,519
Supplies	--	56,503	8	528	3	16	--	57,058
Insurance	--	4,873	--	452	14	10	--	5,349
Interest	--	1,954	--	--	--	--	--	1,954
Depreciation and amortization	--	25,145	3	623	546	100	--	26,417
Other	--	28,859	260	2,210	1,576	892	(1,048)	32,749
Total Operating Expenses Before Non-Recurring (Losses) and Curtailment Gain, net	--	423,588	352	21,270	3,577	3,200	(4,307)	447,680
Income (Loss) from Operations Before Non-Recurring (Losses) and Curtailment Gain, net	--	26,480	202	704	(271)	(39)	(139)	26,937
Non-Recurring (Losses) and Curtailment Gain, net	--	(8,727)	--	--	--	(294)	--	(9,021)
Income (Loss) from Operations	--	17,753	202	704	(271)	(333)	(139)	17,916

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE IV – CONSOLIDATING STATEMENT OF OPERATIONS
AND CHANGES IN UNRESTRICTED NET ASSETS (CONTINUED)

(Dollars in Thousands)

FOR THE YEAR ENDED SEPTEMBER 30, 2013

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	The St. Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Hall-Brooke Behavioral Health Services, Inc.	Eliminations	Total
Nonoperating Gains (Losses)								
Investment returns, net	\$ --	\$ 24,905	\$ 2,256	\$ 1,383	\$ 54	\$ 144	\$ --	\$ 28,742
Other	--	(51)	(1,651)	--	--	--	139	(1,563)
Total Nonoperating Gains, net	--	24,854	605	1,383	54	144	139	27,179
Excess (Deficiency) of Revenue and Gains Over Expenses and Losses	--	42,607	807	2,087	(217)	(189)	--	45,095
Unrestricted Net Assets								
Excess (deficiency) of revenue and gains over expenses and losses	--	42,607	807	2,087	(217)	(189)	--	45,095
Transfers (to) from System, net	--	(13,880)	(2,370)	(353)	4,023	(5,947)	--	(18,527)
Net assets released from restrictions for property acquisitions	--	3,831	--	379	--	--	--	4,210
Pension and other postretirement liability adjustments	--	989	--	93	--	--	--	1,082
Transfer from temporarily and permanently restricted net assets	--	--	8	--	--	--	--	8
Change in interest in The St. Vincent's Medical Center Foundation, Inc.	(2,200)	--	--	--	--	(3)	2,203	--
Increase (Decrease) in Unrestricted Net Assets	(2,200)	33,547	(1,555)	2,206	3,806	(6,139)	2,203	31,868

See independent auditors' report on supplementary information.

ST. VINCENT'S HEALTH SERVICES CORPORATION AND SUBSIDIARIES

SCHEDULE IV – CONSOLIDATING STATEMENT OF OPERATIONS
AND CHANGES IN UNRESTRICTED NET ASSETS (CONTINUED)

(Dollars in Thousands)

FOR THE YEAR ENDED SEPTEMBER 30, 2013

	St. Vincent's Health Services Corporation	The St. Vincent's Medical Center	Vincent's Medical Center Foundation, Inc.	The St. Vincent's Special Needs Center	St. Vincent's Development Corporation	Hall-Brooke Behavioral Health Services, Inc.	Eliminations	Total
Temporarily Restricted Net Assets								
Contributions	\$ --	\$ 5,237	\$ 2,882	\$ 553	\$ --	\$ 92	\$ (3,629)	\$ 5,135
Interest return	--	--	821	--	--	--	--	821
Net change in unrealized gains on investments	--	--	1,204	--	--	--	--	1,204
Net assets released from restrictions	--	(5,250)	(5,052)	(553)	--	(92)	3,629	(7,318)
Transfer to unrestricted and permanently restricted net assets	--	--	(157)	--	--	--	--	(157)
Change in interest in The St. Vincent's Medical Center Foundation, Inc.	--	22	--	87	--	(77)	(32)	--
Other	--	--	--	--	--	(117)	117	--
(Decrease) Increase in Temporarily Restricted Net Assets	--	9	(302)	87	--	(194)	85	(315)
Permanently Restricted Net Assets								
Contributions	--	--	95	--	--	--	--	95
Transfer from unrestricted and permanently restricted net assets	--	--	149	--	--	--	--	149
Change in interest in The St. Vincent's Medical Center Foundation, Inc.	--	245	--	--	--	--	(245)	--
Increase in Permanently Restricted Net Assets	--	245	244	--	--	--	(245)	244
Increase (Decrease) in Net Assets	(2,200)	33,801	(1,613)	2,293	3,806	(6,333)	2,043	31,797
Net Assets - Beginning	3,763	503,967	40,144	28,745	12,548	6,333	(31,174)	564,326
Net Assets - Ending	\$ 1,563	\$ 537,768	\$ 38,531	\$ 31,038	\$ 16,354	\$ --	\$ (29,131)	\$ 596,123

See independent auditors' report on supplementary information.

**ST. VINCENT'S HEALTH SERVICES
CORPORATION AND SUBSIDIARIES**

**SCHEDULE V – NET COST OF PROVIDING CARE OF PERSONS
LIVING IN POVERTY AND COMMUNITY BENEFIT PROGRAMS**
(Dollars in Thousands)

FOR THE YEAR ENDED SEPTEMBER 30, 2014

The net cost to the Corporation, excluding the provision for bad debt expense, of providing care of persons living in poverty and other community benefit programs is as follows:

Traditional charity care provided	\$	5,600
Unpaid cost of public programs for persons living in poverty		23,850
Other programs for persons living in poverty and other vulnerable persons		4,443
Community benefit programs		<u>6,484</u>
Care of persons living in poverty and community benefit programs	\$	<u>40,377</u>

See independent auditors' report on supplementary information.

Greer, Leslie

From: Schaeffer-Helmecki, Jessica
Sent: Tuesday, January 19, 2016 8:45 AM
To: 'kurt.bassett@stvincents.org'
Cc: Greer, Leslie; Fernandes, David
Subject: FW: 15-32056-CON: Completeness Questions
Attachments: 15-32056 St. Vincent Completeness Questions.docx

Mr Bassett:

I just realized I forgot to include instructions for filing responses electronically. They are as follows:

Repeat each question before providing your response and paginate and date your response, i.e., each page in its entirety. Information filed after the initial CON application submission (e.g., completeness response letter, prefile testimony, late file submissions and the like) must be numbered sequentially from the Applicant's document preceding it. Please begin your submission using **Page 139** and reference "**Docket Number: 15-32056-CON.**"

Please submit responses as both a word and pdf attachment.

My apologies for any confusion.

Thank you,

Jessica

From: Schaeffer-Helmecki, Jessica
Sent: Friday, January 15, 2016 2:08 PM
To: 'kurt.bassett@stvincents.org'
Cc: Fernandes, David; Riggott, Kaila; Greer, Leslie
Subject: 15-32056-CON: Completeness Questions

Mr Bassett:

Attached please find Completeness Questions regarding CON Docket No. 15-32056 to acquire a SPECT-CT. Responses will be due by March 15, 2015.

Please let us know if you have any questions or need any assistance.

Have a great long weekend,

Jessica Schaeffer-Helmecki

Office of Health Care Access

Connecticut Department of Public Health

410 Capitol Avenue, MS #13 HCA, Hartford, Connecticut 06134

P: (860) 509-8075 | F: (860) 418-7053 | E: jessica.schaeffer-helmecki@ct.gov





STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

January 15, 2016

VIA EMAIL ONLY

Mr. Kurt Bassett
Director of Strategic Planning
St. Vincent's Medical Center
2800 Main Street
Bridgeport, CT 06606

RE: Certificate of Need Application; Docket Number: 15-32056-CON
Acquisition of a Single Photon Emission Computed Tomography/Computed Tomography
("SPECT/CT") Camera

Dear Mr. Bassett:

On December 24, 2015, the Office of Health Care Access received a Certificate of Need application filing on behalf of St. Vincent's Medical Center to acquire a SPECT/CT camera to replace an existing SPECT camera at 2800 Main Street, Bridgeport CT. OHCA requests additional information pursuant to Connecticut General Statutes §19a-639a(c). *Please electronically confirm receipt of this email as soon as you receive it.* Provide responses to the questions below in both a Word document and PDF format at the earliest convenience as an attachment to a responding email.

Pursuant to Section 19a-639a(c) of the Connecticut General Statutes, you must submit your response to this request for additional information no later than sixty days after the date this request was transmitted. Therefore, please provide your written responses to OHCA no later than **March 15, 2016**, otherwise your application will be automatically considered withdrawn.

OHCA has reviewed the CON application pursuant to Connecticut General Statutes §19a-639a(c) and requests the following additional information:

1. The Applicant states it intends to dispose of its SPECT camera. Does it intend to keep its existing CT camera? If so, is that utilization included in your projections?
2. How will the GE Millennium SPECT camera be disposed of?
3. On page 9, the Applicant states that there are no other cameras with similar capabilities in the service area. How did you arrive at this conclusion?
4. Will there be any gap in services during the period of the new camera's installation?

An Equal Opportunity Provider

(If you require aid/accommodation to participate fully and fairly, contact us either by phone, fax or email)

410 Capitol Ave., MS#13HCA, P.O.Box 340308, Hartford, CT 06134-0308
Telephone: (860) 418-7001 Fax: (860) 418-7053 Email: OHCA@ct.gov

5. Will the days and hours of operation of the new SPECT/CT camera remain the same as the previous SPECT camera?
6. Explain the following statement found on page 11, question 10, "The installation of this equipment will reduce. . . multiple test locations thereby improving the on-site care coordination." It is stated throughout the application that there is no other SPECT/CT service provided within the applicant's service area. In addition, the applicant only has one SPECT camera which is housed in the Radiology Department. What is it meant by "multiple test locations?"
7. The applicant has projected losses in operations for the next three years. When is the applicant anticipating a gain in operations?
8. Provide the most recently completed fiscal year's (FY) payer mix as well as the projected payer mix for the current FY (2016).
9. For Table 5 on page 19 of the application, please provide actual volume and identify the months on which the annualized figure (for the column labeled CFY Volume) was based.
10. Page 26 of the application indicates that the decline in volume will level off with the acquisition of a new SPECT/CT. Provide an explanation for the decline in volume for the past three years and why a continued decline is not anticipated with the acquisition of the SPECT/CT.
11. Page 6 of the application states the acquisition of the SPECT/CT will be "plug and go" and that there would not be any additional electrical, mechanical or technological upgrades. Explain the need for construction/renovation costs associated with the proposed capital expenditure as indicated on Table 3.
12. As there is a construction/renovation cost associated with the proposed capital expenditure, provide the following:
 - a. a description of the proposed building work, including the gross square feet;
 - b. existing and proposed floor plans;
 - c. commencement date for the construction/renovation;
 - d. completion date of the construction/renovation; and
 - e. commencement of operations date.
13. Reconcile Table 4's total operating expenses with Financial Worksheet A.
14. Please define "capital dollars" as used on page 12.

15. Please provide historical SPECT volume in the table below:

Service	Actual Volume (Last 3 Completed FYs)			Current FY Volume
	FY 13	FY 14	FY 15	FY16*
Oncology				
Cardiology				
GI				
Orthopedics				
Chronic Illness				
Total				

* If period is less than six months, include actual data. If annualizing, please indicate the number of months upon which the projection is based

If you have any questions concerning this letter, please feel free to contact either me at (860) 418-7032 or Jessica Schaeffer-Helmecki at (860) 509-8075.

Sincerely,

David Fernandes

David Fernandes
 Planning Analyst (CCT)

Greer, Leslie

From: Bassett, Kurt <Kurt.Bassett@stvincents.org>
Sent: Tuesday, March 01, 2016 11:53 AM
To: Schaeffer-Helmecki, Jessica
Cc: Greer, Leslie; Fernandes, David
Subject: RE: 15-32056-CON: Completeness Questions
Attachments: 15-32056 St. Vincent Completeness Questions.docx; 15-32056 St. Vincent Completeness Questions.pdf

Please see attached for response to Docket Number 15-32056-CON. Please let me know if you have any further questions or clarifications.

Note: Original application ended with page 193, so our question responses begin with page number 194.

Thank you for your consideration,

Kurt Bassett

Director – Strategic Planning
St. Vincent's Health Services
2800 Main Street
Bridgeport, CT 06606
Office: 203-576-6264

From: Schaeffer-Helmecki, Jessica [<mailto:Jessica.Schaeffer-Helmecki@ct.gov>]
Sent: Tuesday, January 19, 2016 8:45 AM
To: Bassett, Kurt
Cc: Greer, Leslie; Fernandes, David
Subject: FW: 15-32056-CON: Completeness Questions

Mr Bassett:

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Jessica Schaeffer-Helmecki

Office of Health Care Access

Connecticut Department of Public Health

410 Capitol Avenue, MS #13 HCA, Hartford, Connecticut 06134

P: (860) 509-8075 | F: (860) 418-7053 | E: jessica.schaeffer-helmecki@ct.gov



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STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
Office of Health Care Access

January 15, 2016

VIA EMAIL ONLY

Mr. Kurt Bassett
Director of Strategic Planning
St. Vincent's Medical Center
2800 Main Street
Bridgeport, CT 06606

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Dear Mr. Bassett:

On December 24, 2015, the Office of Health Care Access received a Certificate of Need application filing on behalf of St. Vincent's Medical Center to acquire a SPECT/CT camera to replace an existing SPECT camera at 2800 Main Street, Bridgeport CT. OHCA requests additional information pursuant to Connecticut General Statutes §19a-639a(c). *Please electronically confirm receipt of this email as soon as you receive it.* Provide responses to the questions below in both a Word document and PDF format at the earliest convenience as an attachment to a responding email.

Pursuant to Section 19a-639a(c) of the Connecticut General Statutes, you must submit your response to this request for additional information no later than sixty days after the date this request was transmitted. Therefore, please provide your written responses to OHCA no later than **March 15, 2016**, otherwise your application will be automatically considered withdrawn.

OHCA has reviewed the CON application pursuant to Connecticut General Statutes §19a-639a(c) and requests the following additional information:

1. The Applicant states it intends to dispose of its SPECT camera. Does it intend to keep its existing CT camera? If so, is that utilization included in your projections?
Yes, SVMC will keep its existing CT camera. The existing CT camera projections are included in our nuclear imaging numbers, but not specific for SPECT.
2. How will the GE Millennium SPECT camera be disposed of?
GE will dispose of the old camera according to accepted guidelines when it delivers and installs the new camera.

An Equal Opportunity Provider

(If you require aid/accommodation to participate fully and fairly, contact us either by phone, fax or email)

410 Capitol Ave., MS#13HCA, P.O.Box 340308, Hartford, CT 06134-0308
Telephone: (860) 418-7001 Fax: (860) 418-7053 Email: OHCA@ct.gov

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3. On page 9, the Applicant states that there are no other cameras with similar capabilities in the service area. How did you arrive at this conclusion?

Through an extensive internet search including hospital sites and also CON fillings and competed applications. A search was also done using the CHA list serve tool.

4. Will there be any gap in services during the period of the new camera's installation?

There will be no gap in service as the new equipment will be placed in a new location so the existing camera can be utilized until the new camera is in place and functional.

5. Will the days and hours of operation of the new SPECT/CT camera remain the same as the previous SPECT camera?

Yes, the hospital will maintain the same operating hours.

6. Explain the following statement found on page 11, question 10, "The installation of this equipment will reduce. . . multiple test locations thereby improving the on-site care coordination." It is stated throughout the application that there is no other SPECT/CT service provided within the applicant's service area. In addition, the applicant only has one SPECT camera which is housed in the Radiology Department. What is it meant by "multiple test locations?"

These scans cannot be completed at our current location and often multiple tests are needed in order to obtain proper accuracy. That will no longer be the case with the new equipment. In addition patients will not need to travel to other sites to have access to the SPECT-CT technology, meaning have a scan at the hospital and then need to travel outside our area to another location to have a SPECT-CT image taken.

7. The applicant has projected losses in operations for the next three years. When is the applicant anticipating a gain in operations?

The last financial estimates were created as part of our three year strategic plan. Due to the changing environment in CT and the "hospital tax" imposed by the state, these were the best estimates. The hospital is continually adjusting budgets and forecasts and is currently in the process of creating its next three year strategic plan which will include a break even budget.

8. Provide the most recently completed fiscal year's (FY) payer mix as well as the projected payer mix for the current FY (2016).

Payer	Actual FY15		Estimated FY16	
	Discharges	%	Discharges	%
Medicare*	418	46%	405	45%
Medicaid*	218	24%	207	23%
CHAMPUS & Tricare	0	0%	0	0%
Total Gov.	636	70%	612	68%
Commercial	228	25%	243	27%
Uninsured	41	4.5%	40	4.5%
Workers Comp.	5	0.5%	5	0.5%
Total Non-Gov.	274	30%	288	32%
Total Mix	910		900	

9. For Table 5 on page 19 of the application, please provide actual volume and identify the months on which the annualized figure (for the column labeled CFY Volume) was based.
Actual volume through November 2015 was 373, annualized amount for the remaining 7 months (Dec. 2015 - June 2016) is estimated at 527.

10. Page 26 of the application indicates that the decline in volume will level off with the acquisition of a new SPECT/CT. Provide an explanation for the decline in volume for the past three years and why a continued decline is not anticipated with the acquisition of the SPECT/CT.

Volume has declined due to the age and quality of the current equipment. Physicians have reduced the use of the old machine as the quality has declined. We estimate that the decrease in use will no longer continue with the new machine since quality will be greatly improved.

11. Page 6 of the application states the acquisition of the SPECT/CT will be "plug and go" and that there would not be any additional electrical, mechanical or technological upgrades. Explain the need for construction/renovation costs associated with the proposed capital expenditure as indicated on Table 3.

The current model is described by the vendor as "plug and go", so there is no need to upgrade your current electrical connections and there is no need for additional technology upgrades to accommodate the new machine. The capital expenditure is to create a larger new location to house the new equipment. It will create a new state of the art facility to house the new equipment.

12. As there is a construction/renovation cost associated with the proposed capital expenditure, provide the following:

- a. a description of the proposed building work, including the gross square feet;
Create a new space for SPECT-CT encompassing 600 square feet, Remove and relocate walls, relocated electrical, relocate doors, replace ceiling and floor and finish entire area.
- b. existing and proposed floor plans;
See attachment "Floor Plan", note existing floor plan is not included as this equipment will be located in a different area.
- c. commencement date for the construction/renovation;
Construction will commence 2-3 months after final approval is received for CON. No construction can begin without approval. This represents time needed for plans, permits and approvals.
- d. completion date of the construction/renovation; and
Construction will be completed within 2 months of start date. (Total 4-5 months from CON approval)
- e. commencement of operations date.
Operation will commence 1 month after construction is complete which includes time for installation, staff training and DPH review. (Total 5-6 months from CON approval)

13. Reconcile Table 4's total operating expenses with Financial Worksheet A.

	FY 2017*	FY 2018*	FY 2019*
Revenue from Operations	\$0	\$0	\$0
Total Operating Expenses	\$123	\$123	\$123
Gain/Loss from Operations	(\$123)	(\$123)	(\$123)

14. Please define "capital dollars" as used on page 12.

St. Vincent's maintains additional cash and investments on its balance sheet. Each year a certain portion of that cash is allocated for "capital" improvements based on hospital needs. This project has been approved by the capital committee for using these capital dollars to fully fund the project, so there is no need for additional funding or funding the project from current operations.

15. Please provide historical SPECT volume in the table below:

SPECT Service	Actual Volume (Last 3 Completed FYs)			Current FY Volume
	FY 13	FY 14	FY 15	FY16*
Oncology	111	73	99	69
Cardiology	156	121	265	176
GI	244	145	165	107
Orthopedics	155	291	91	90
Chronic Illness	488	460	290	63
Total	1154	1090	910	505

* Actual for 7 months July 2015 – Jan 2016

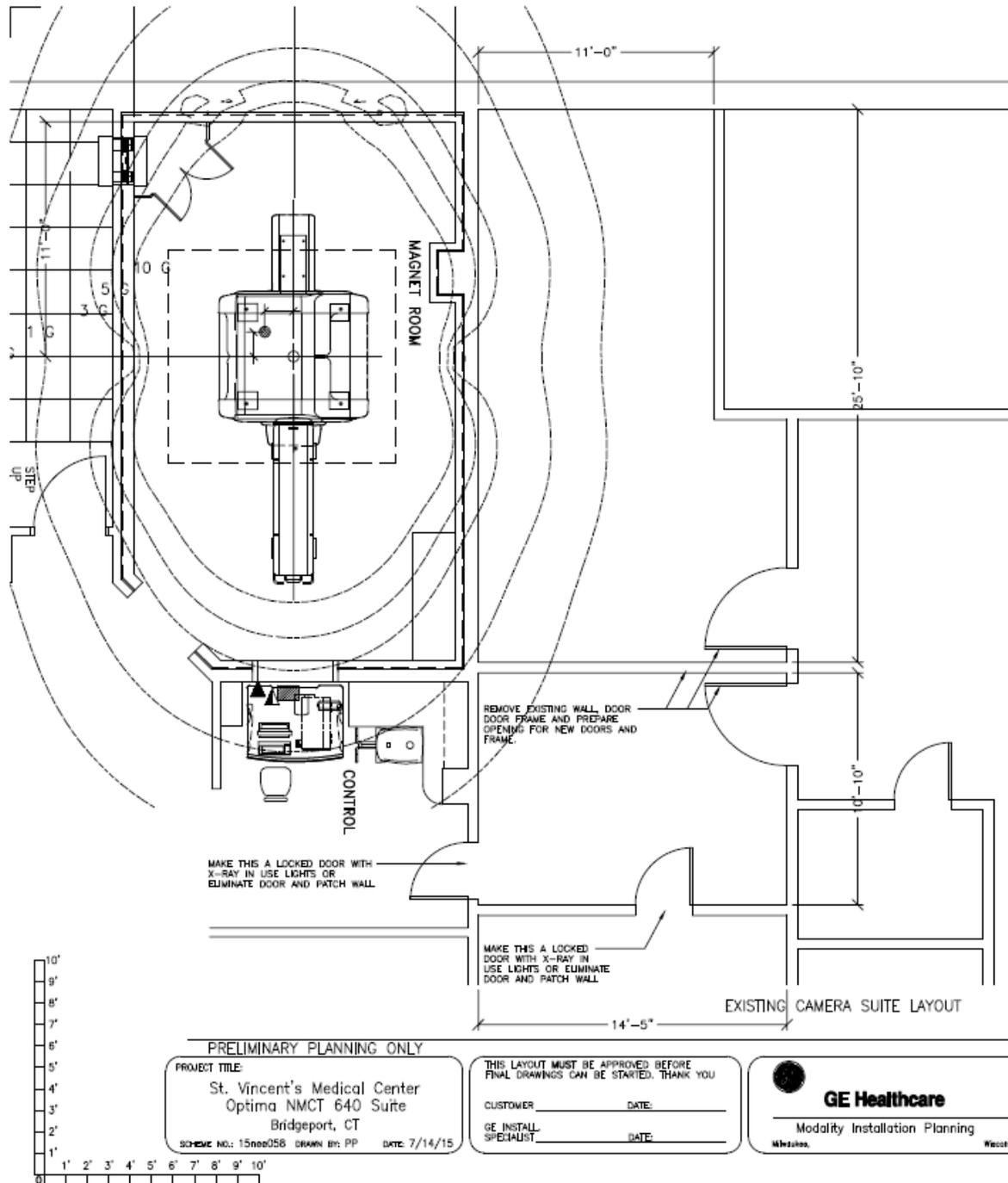
If you have any questions concerning this letter, please feel free to contact either me at (860) 418-7032 or Jessica Schaeffer-Helmecki at (860) 509-8075.

Sincerely,

David Fernandes

David Fernandes
Planning Analyst (CCT)

Attachment Floor Plan:



Greer, Leslie

From: Fernandes, David
Sent: Monday, March 21, 2016 3:21 PM
To: kurt.bassett@stvincents.org
Cc: Riggott, Kaila; Schaeffer-Helmecki, Jessica; Greer, Leslie
Subject: 16-32056-CON Deemed Complete as of 3/21/16
Attachments: 15-32056-CON Notification of Application Deemed Complete.docx

Mr. Bassett,

Please see the attached letter deeming complete the above referenced application.

Thanks,

David Fernandes

Office of Health Care Access

Connecticut Department of Public Health

410 Capitol Avenue, Hartford, Connecticut 06134

P: (860) 418-7032 | F: (860) 418-7053 | E: David.Fernandes@ct.gov



STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Raul Pino, M.D., M.P.H.
Commissioner



Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

Office of Health Care Access

March 21, 2016

Via Email Only

Kurt.bassett@stvincents.org

Mr. Kurt Bassett
Director of Strategic Planning
St. Vincent's Medical Center
2800 Main Street
Bridgeport, CT 06606

RE: Certificate of Need Application; Docket Number: 15-32056-CON
Acquisition of a Single Photon Emission Computed Tomography/Computed Tomography
("SPECT/CT") Camera

Dear Mr. Bassett:

This letter is to inform you that, pursuant to Section 19a-639a (d) of the Connecticut General Statutes, the Office of Health Care Access has deemed the above-referenced application complete as of March 21, 2016.

If you have any questions concerning this letter, please feel free to contact either me at (860) 418-7032 or Jessica Schaeffer-Helmecki at (860) 509-8075.

Sincerely,

David Fernandes

David Fernandes
Planning Analyst (CCT)



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Affirmative Action/Equal Opportunity Employer

Greer, Leslie

From: Greer, Leslie
Sent: Friday, May 20, 2016 11:28 AM
To: 'kurt.bassett@stvincents.org'
Cc: Schaeffer-Helmecki, Jessica; Fernandes, David
Subject: St. Vincent's Medical Center Final Decision
Attachments: 32056_201605201115.pdf

Tracking:	Recipient	Delivery
	'kurt.bassett@stvincents.org'	
	Schaeffer-Helmecki, Jessica	Delivered: 5/20/2016 11:28 AM
	Fernandes, David	Delivered: 5/20/2016 11:28 AM

Mr. Bassett,
Attached is the Final Decision for St. Vincent's Medical Center's Certificate of Need application.

Leslie M. Greer
Office of Health Care Access
Connecticut Department of Public Health
410 Capitol Avenue, MS#13HCA, Hartford, CT 06134
Phone: (860) 418-7013 Fax: (860) 418-7053
Website: www.ct.gov/ohca



STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

Raul Pino, M.D., M.P.H.
Commissioner



Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

Office of Health Care Access

Certificate of Need

Final Decision

Applicant: St. Vincent's Medical Center
2800 Main Street
Bridgeport, Connecticut 06606

Docket Number: 15-32056-CON

Project Title: Acquisition of a Single Photon Emission Computed Tomography-Computed Tomography Camera

Project Description: St. Vincent's Medical Center ("Hospital" or "Applicant") is seeking approval for the acquisition of a Single Photon Emission Computed Tomography-Computed Tomography ("SPECT-CT") camera to replace a nuclear camera.

Procedural History: On December 24, 2015, the Office of Health Care Access ("OHCA") received the initial Certificate of Need ("CON") application from the Applicant for the above-referenced project. The Applicant published notice of its intent to file the CON Application in *The Connecticut Post* (Bridgeport) on November 4, 5 and 6, 2015. The application was deemed complete on March 21, 2016. OHCA received no responses from the public concerning the Hospital's proposal and no hearing requests were received from the public per Connecticut General Statutes § 19a-639a(e). Deputy Commissioner Brancifort considered the entire record in this matter.



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Findings of Fact and Conclusions of Law

1. The Applicant is a 473¹ bed not-for-profit general hospital located at 2800 Main Street, Bridgeport, Connecticut. Exhibit A, p. 42.
2. The Applicant currently operates one nuclear camera at its main hospital campus.

Provider and Location	Equipment	Hours of Operation	Utilization FY15
St. Vincent's Medical Center 2800 Main St. Bridgeport, CT 06606	GE Millennium MPR/MPS SPECT	M-F 7 AM to 5 PM Sat., Sun. and evenings on call	910

Exhibit A, pp. 5, 17, 19.

3. The GE Millennium, located at the Applicant's main hospital campus, is more than nine years old and nearing the end of its useful life. The Applicant proposes replacing it with a 4-slice GE Optima NM/CT 640 SPECT-CT. Exhibit A, pp. 5, 6, 24.
4. There are no other cameras with similar CT-capabilities located in the Applicant's service area, which includes Bridgeport, Fairfield, Easton, Monroe, Trumbull, Shelton and Stratford. Exhibit A, pp. 8, 9.
5. The proposed SPECT-CT will offer a more reliable way to accurately diagnose functional abnormalities. Exhibit A, p. 6.
6. A SPECT-CT camera will allow for faster diagnosis, more accurate anatomical localization and attenuation correction while decreasing radiation exposure, leading to improved quality of patient care. A study comparing the benefits of a SPECT-CT over a SPECT resulted in decreased false positives (21% vs. 58%) and increased true positive results (63% vs. 22%). Exhibit A, pp. 8, 11; Nicholas Patchett, et. al., New Generation General-Purpose SPECT/CT Myocardial Perfusion Imaging Improves Diagnostic Accuracy and Reduces Radiation Exposure Compared to Traditional SPECT, Section of Cardiovascular Medicine. Exhibit A, p. 93.
7. SPECT-CT increases image accuracy while decreasing the need for additional exams in different test locations, thus reducing patient wait times, travel and out of network costs. Exhibit A, p. 11; Exhibit C, p. 195.
8. SPECT, in combination with CT, enables a direct correlation of anatomic information and functional information, resulting in better localization and definition of scintigraphic findings and a reduction in indeterminate findings. The superiority of SPECT-CT over SPECT has been demonstrated for the imaging of benign and malignant skeletal diseases, thyroid cancer, neuroendocrine cancer, parathyroid adenoma and mapping of sentinel lymph nodes in the head, neck and pelvic region. SPECT-CT in cardiac imaging improves upon diagnosis as well as illustrative visualization. Furthermore, it may be beneficial in identifying candidates for more intensive prevention or risk factor modification strategies

¹ Excludes 47 bassinets.

and those who would benefit from coronary angiography and revascularization. Andreas K. Buck, et. al., *SPECT/CT*, J NUCL MED 49, 8. Exhibit A, pp. 95-106.

9. The proposed SPECT-CT will serve the oncology, cardiology and the gastroenterology departments, as well as provide diagnostics for conditions such as thyroid disorders, brain disorders and inflammations and infections. Exhibit A, p. 8.
10. The Hospital's Community Health Needs Assessment identified cardiovascular disease and cancer to be among the leading causes of death in the Hospital's service area Exhibit A, p. 9.
11. The Hospital's primary service area includes Bridgeport, the state's most impoverished and diverse urban center. The Statewide Health Care Facilities and Services Plan notes that Black non-Hispanics and Hispanics are more likely than non-Hispanics to have a potentially preventable hospitalization or avoidable ED visit. As the leading causes of emergency department admissions are heart and digestive diseases, the proposed SPECT-CT will allow the area's underserved minority population access to clinical testing that may prevent hospitalizations or ED visits through providing more accurate diagnoses. Exhibit A, pp. 8-9.
12. Despite a decline in volume since FY2013, the Applicant projects volume to level off with the acquisition of the SPECT-CT, due to its improved image quality.

**TABLE 1
APPLICANT'S HISTORIC AND PROJECTED UTILIZATION**

	Actual			Projected			
	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019
Proposed GE Optima	n/a	n/a	n/a	n/a	900	900	900
Existing GE Millennium	1154	1090	910	900	n/a	n/a	n/a
Total	1154	1090	910	900	900	900	900

Volume has declined due to the age of the existing equipment along with diminished quality in imaging. Exhibit A, pp. 19, 26.

13. The cost for diagnostic imaging for patients will remain the same as on the existing camera. Exhibit A, p. 11.
14. The costs related to the proposed project have been approved by the Applicant's capital committee to fully fund the project with capital dollars. Additional funding through fundraising, the incurring of debt or through current operations will not be necessary.

**TABLE 3
APPLICANT'S CAPITAL EXPENDITURE**

Medical Equipment Purchase	\$547,797
Construction/Renovation	\$204,552
Total Capital Expenditure (TCE)	\$752,349

Exhibit A, pp. 12, 18; Exhibit C, p. 197.

15. Incremental losses are projected in each of the three fiscal years (FY) following implementation of the proposal, due to depreciation.

TABLE 4
APPLICANT'S PROJECTED INCREMENTAL REVENUES AND EXPENSES

	FY 2017	FY 2018	FY 2019
Revenue from Operations	-	-	-
Total Operating Expenses*	\$123,000	\$123,000	\$123,000
Gain/(Loss) from Operations	(\$123,000)	(\$123,000)	(\$123,000)

*Operating expenses represent the change in depreciation amount, which is a non-cash expense.
Exhibit A, p. 193; Exhibit C, p. 197.

16. The new SPECT-CT will serve the same patient population as the SPECT camera being replaced. Exhibit A, p. 9.
17. No change in the patient population mix is projected by the Applicant.

TABLE 6
APPLICANT'S CURRENT & PROJECTED PAYER MIX

Payer	Most Recently Completed FY 2015		Projected							
			FY 2016		FY 2017		FY 2018		FY 2019	
	Volume	%	Volume	%	Volume	%	Volume	%	Volume	%
Medicare	418	46%	405	45%	405	45%	405	45%	405	45%
Medicaid	218	24%	207	23%	207	23%	207	23%	207	23%
CHAMPUS & TriCare	0	0%	0	0%	0	0%	0	0%	0	0%
Total Government	636	70%	612	68%	612	68%	612	68%	612	68%
Commercial Insurers	228	25%	243	27%	243	27%	243	27%	243	27%
Uninsured	41	4.5%	40	4.5%	40	4.5%	40	4.5%	40	4.5%
Workers Compensation	5	0.5%	5	0.5%	5	0.5%	5	0.5%	5	0.5%
Total Non- Government	274	30%	288	32%	288	32%	288	32%	288	32%
Total Payer Mix	910		900		900	100%	900	100%	900	100%

Exhibit. A, p. 20; Exhibit C, p. 195.

18. There will be no gap in service as the SPECT-CT will be housed in a new location within the Radiology Department, allowing the current SPECT camera to be utilized during construction. Exhibit A, pp. 6, 9, Exhibit C, p. 195.

19. OHCA is currently in the process of establishing its policies and standards as regulations. Therefore, OHCA has not made any findings as to this proposal's relationship to any regulations adopted by OHCA. (Conn. Gen. Stat. § 19a-639(a)(1))
20. This CON application is consistent with the Statewide Health Care Facilities and Services Plan. (Conn. Gen. Stat. § 19a-639(a)(2))
21. The Applicant has established that there is a clear public need for the proposal. (Conn. Gen. Stat. § 19a-639(a)(3))
22. The Applicant has satisfactorily demonstrated that the proposal is financially feasible. (Conn. Gen. Stat. § 19a-639(a)(4))
23. The Applicant has satisfactorily demonstrated that access to services will be maintained and quality of health care delivery in the region as well as cost effectiveness will be improved. (Conn. Gen. Stat. § 19a-639(a)(5))
24. The Applicant has shown that there will be no change in access to the provision of health care services to the relevant populations and payer mix, including access to services by Medicaid recipients and indigent persons. (Conn. Gen. Stat. § 19a-639(a)(6))
25. The Applicant has satisfactorily identified the population to be served and that this population has a need for the proposal. (Conn. Gen. Stat. § 19a-639(a)(7))
26. The Applicant's historical utilization in the service area supports this proposal. (Conn. Gen. Stat. § 19a-639(a)(8))
27. The Applicant has satisfactorily demonstrated that the proposal will not result in an unnecessary duplication of existing services in the area. (Conn. Gen. Stat. § 19a-639(a)(9))
28. The Applicant has satisfactorily demonstrated that the proposal will not result in a reduction or change in access to services for Medicaid recipients or indigent persons. (Conn. Gen. Stat. § 19a-639(a)(10))
29. The Applicant has satisfactorily demonstrated that the proposal will not negatively impact the diversity of health care providers in the area. (Conn. Gen. Stat. § 19a-639(a)(11))
30. The Applicant has satisfactorily demonstrated that the proposal will not result in any consolidation that would affect health care costs or access to care. (Conn. Gen. Stat. § 19a-639(a)(12))

Discussion

CON applications are decided on a case by case basis and do not lend themselves to general applicability due to the uniqueness of the facts in each case. In rendering its decision, OHCA considers the factors set forth in General Statutes § 19a-639(a). The Applicant bears the burden of proof in this matter by a preponderance of the evidence. *Jones v. Connecticut Medical Examining Board*, 309 Conn. 727 (2013).

St. Vincent's Medical Center ("Hospital" or "Applicant"), a 473-bed not-for-profit general hospital in Bridgeport, is seeking authorization for the acquisition of a 4-slice GE Optima NM/CT 640 SPECT-CT camera to replace its nuclear camera that is at the end of its useful life. *FF1,3*. The Hospital currently operates one nuclear camera at its main campus. *FF2*. There are no other cameras within the Applicant's service area that offer the capabilities of a SPECT-CT. *FF4*.

The SPECT-CT will enable direct correlation of anatomic and functional information, resulting in a reduction in indeterminate findings. *FF8*. It will also allow for more reliable and faster diagnosis, more accurate anatomical localization and provide attenuation correction, while decreasing radiation exposure. *FF5,6*. SPECT-CT increases image accuracy while decreasing the need for additional exams in different test locations, thus reducing patient wait times, travel and out of network costs. *FF7*. The superiority of SPECT-CT over SPECT has been demonstrated for the imaging of skeletal diseases, cancer, parathyroid adenoma and sentinel lymph nodes mapping. Additionally, it may further benefit patients by identifying candidates for more extensive prevention or risk factor modification strategies or those needing coronary angiography. *FF8*.

The proposed SPECT-CT will serve the oncology, cardiology and the gastroenterology departments. *FF9*. The Hospital's Community Health Needs Assessment identified cardiovascular disease and cancer to be among the leading causes of death in the Hospital's service area. *FF10*. The Applicant's primary service area includes Bridgeport, the state's most impoverished and diverse urban center. The Statewide Health Care Facilities and Services Plan notes that Black non-Hispanics and Hispanics are more likely than non-Hispanics to have a potentially preventable hospitalization or avoidable ED visit. As the leading causes of emergency department admissions are heart and digestive diseases, the proposed SPECT-CT will allow the area's underserved minority population access to clinical testing that may prevent hospitalizations or ED visits through providing more accurate diagnoses. *FF11*. Patient outcomes may be improved by enabling more accurate identification and treatment of diseases, thus preventing long term hospitalization as well as lowering the potential for ED visits. Together, these multiple advantages will improve the quality of care delivered to patients in the area.

The SPECT-CT will serve the same patient population and no change in the patient population mix, including Medicaid patients, is projected by the Applicant. *FF16,17*. Additionally, the cost for diagnostic imaging for patients will remain the same as on existing equipment. *FF13*. As a result, the proposal will have no negative impact on access to or the cost of care to patients.

While the Applicant anticipates incremental losses of \$123,000 in FY17, FY18 and in FY19, these losses are attributable to depreciation and costs associated with renovating the SPECT-CT space. *FF15*. The costs related to the proposed project have been approved by the Applicant's capital committee to fully fund the project with capital dollars. Additional funding through fundraising, the incurring of debt or through current operations will not be necessary. *FF14*. Therefore, OHCA finds the proposal financially feasible.

The Applicant has satisfactorily demonstrated clear public need for this proposal as access to care will be maintained and quality of care will be improved. These two benefits are consistent with the Statewide Health Care Facilities and Services Plan.

Order

Based upon the foregoing Findings of Fact and Discussion, the Certificate of Need application of St. Vincent's Medical Center for the acquisition of a SPECT-CT camera is hereby **APPROVED**.

All of the foregoing constitutes the final order of the Office of Health Care Access in this matter.

By Order of the
Department of Public Health
Office of Health Care Access

5/20/2016
Date

Janet M. Brancifort
Janet M. Brancifort, RRT, MPH
Deputy Commissioner