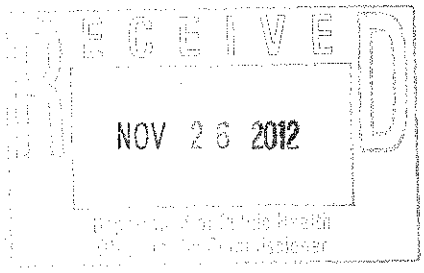
Yale SCHOOL OF MEDICINE

Department of Neurosurgery

KETAN R. BULSARA, MD
Associate Professor
Neurovascular, Endovascular and Skull Base Surgery

PO Box 208082
New Haven CT 06520-8082
T 203 737-2096
F 203 785-2044
ketan.bulsara@yale.edu
medicine.yale.edu/neurosurgery

courier
Tompkins Memorial Pavilion (TMP)
Room 404
789 Howard Avenue
New Haven CT 06519



11/19/2012

Lisa Davis, MBA, BSN, RN
Deputy Commissioner
Office of Health Care Access
Department of Public Health
410 Capitol Avenue, MS#13HCA
PO Box 340308
Hartford, CT 06134

Dear Deputy Commissioner Davis:

I am writing in support of Yale-New Haven Hospital's (YNHH) Certificate of Need (CON) application to acquire a NeuroLogica Ceretom Mobile CT scanner for neurological imaging of critically ill patients at the hospital. I am a cerebrovascular/skull base neurosurgeon who directs the Neuroendovascular and Skull Base Surgery Programs at YNHH.

The Neuroscience Center, one of YNHH's specialty centers, offers state-of-the-art resources and physicians with specialized training and expertise in treating the most complex brain and spine disorders. *US News & World Report* ranked YNHH as among the best hospitals for neurological and neurosurgical care in the nation. Patients from throughout Connecticut and beyond seek these specialized services.

YNHH created an intensivist model in its Neurosurgical Intensive Care Unit (NICU), making it the first fully intensivist staffed unit in Connecticut. The NICU offers 14 beds and is almost always fully occupied. This unit offers critical care medicine to a wide range of patients suffering from such conditions as brain tumors, intracerebral hemorrhages, severe strokes, subdural and epidural hematomas, and neurological infections.

Computed Tomography (CT) imaging has increasingly become a valuable and necessary diagnostic modality for critically ill neurological and neurosurgical patients. The current practice at YNHH requires these critically ill patients to be transported from the intensive care unit to the Radiology Department to receive a CT scan. Most patients are being mechanically ventilated, have invasive monitoring, and are receiving multiple intravenous medications. They must be transported in their hospital bed, a process which requires multiple staff, including the patient's nurse and a respiratory therapist, and often must occur during night time hours when the CT scanners have availability, but staffing levels are lower. This process creates risks to patient safety and many logistical difficulties for clinical staff. The availability of a portable CT scanner will serve to facilitate improved patient care and expedite patient care in a safe and efficient fashion.

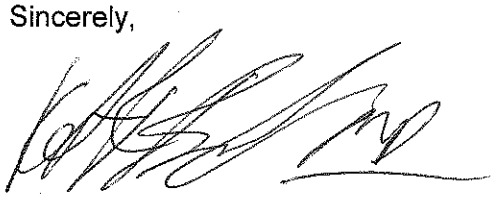
As CT technology has continued to advance and improve, there is now an opportunity to provide mobile CT scanning at the patient's bedside in the intensive care unit. Patients no longer have to be transported, clinicians do not have to leave the unit, and scans can be safely and effectively obtained. This technology is more frequently being offered by leading

neuroscience centers around the United States and represents a significant improvement to patient care.

I strongly support YNHH's CON application to acquire a NeuroLogica CereTom portable CT scanner for its critically ill neurologic and neurosurgical patients. The addition of this technology will significantly improve patient care, reduce the risk of morbidity due to complicated patient transport, and will improve the working environment for clinical staff. YNHH is a state-wide resource for the most complex neuroscience care and such technology is essential.

Thank you for your time and attention and I urge you to approve YNHH's CON application.

Sincerely,



Ketan R. Bulsara, M.D.
Yale University School of Medicine
Department of Neurosurgery
333 Cedar Street, Box 208082
New Haven, CT 06520

Yale Neurosurgery
A PRACTICE OF THE YALE MEDICAL GROUP

Yale School of Medicine
333 Cedar Street
P.O. Box 208082
New Haven, Connecticut
06520-8082

November 20, 2012

Epilepsy
Dennis Spencer MD
Kenneth Vives MD
(203) 785-4891

Neurovascular
Ketan Bulsara MD
Murat Gunel MD
Charles Matouk MD
(203) 737-2096

Oncology
Joseph Piepmeier MD
(203) 785-2791

Pediatric
Charles Duncan MD
Michael L. DiLuna MD
Katie Hagenow APRN
(203) 785-2809

Spine
Khalid Abbed MD
Kenneth Vives MD
Maxwell Laurans MD
(203) 785-2807

Stereotactic Radiosurgery
Veronica Chiang MD
(203) 785-2808

Functional
Kenneth Vives MD
(203) 785-5765

Lisa Davis, MBA, BSN, RN
Deputy Commissioner
Office of Health Care Access
Department of Public Health
410 Capitol Avenue, MS#13HCA
PO Box 340308
Hartford, CT 06134

Dear Deputy Commissioner Davis:

I am writing in support of Yale-New Haven Hospital's (YNHH) Certificate of Need (CON) application to acquire a NeuroLogica Ceretom Mobile CT scanner for neurological imaging of critically ill patients at the hospital. I am an Assistant Professor of Neurosurgery & Diagnostic Radiology, Neurovascular and Stroke Programs, at YNHH. I am also the Director of Medical Student Education for the Department of Neurosurgery. My clinical area of expertise is the open surgical and endovascular treatment of cerebrovascular diseases including aneurysms, arteriovenous malformations, and stroke. I routinely admit patients to the Neuro-ICU.

The Neuroscience Center, one of YNHH's specialty centers, offers state-of-the-art resources and physicians with specialized training and expertise in treating the most complex brain and spine disorders. *US News & World Report* ranked YNHH as among the best hospitals for neurological and neurosurgical care in the nation. Patients from throughout Connecticut and beyond seek these specialized services.

YNHH created an intensivist model in its Neurosurgical Intensive Care Unit (NICU), making it the first fully intensivist staffed unit in Connecticut. The NICU offers 14 beds and is almost always fully occupied. This unit offers critical care medicine to a wide range of patients suffering from such conditions as brain tumors, intracerebral hemorrhages, severe strokes, subdural and epidural hematomas, and neurological infections.

Computed Tomography (CT) imaging has increasingly become a valuable and necessary diagnostic modality for critically ill neurological and neurosurgical patients. The current practice at YNHH requires these critically ill patients to be transported from the intensive care unit to the Radiology Department to receive a CT scan. Most patients are being mechanically ventilated, have invasive monitoring, and are receiving multiple intravenous medications. They must be transported in their hospital bed, a process which requires multiple staff,

including the patient's nurse and a respiratory therapist, and often must occur during night time hours when the CT scanners have availability, but staffing levels are lower. This process creates risks to patient safety and many logistical difficulties for clinical staff. For example, my subarachnoid hemorrhage (SAH) patients are critically ill with invasive brain monitoring and intensive hemodynamic support. The results of CT imaging are required to inform therapeutic decision-making that often involves an emergent trip back to the neurovascular suite for a life-saving intervention.

As CT technology has continued to advance and improve, there is now an opportunity to provide mobile CT scanning at the patient's bedside in the intensive care unit. Patients no longer have to be transported, clinicians do not have to leave the unit, and scans can be safely and effectively obtained. This technology is more frequently being offered by leading neuroscience centers around the United States and represents a significant improvement to patient care.

I strongly support YNHH's CON application to acquire a NeuroLogica CereTom portable CT scanner for its critically ill neurologic and neurosurgical patients. The addition of this technology will significantly improve patient care, reduce the risk of morbidity due to complicated patient transport, and will improve the working environment for clinical staff. YNHH is a state-wide resource for the most complex neuroscience care and such technology is essential.

Thank you for your time and attention and I urge you to approve YNHH's CON application.

Sincerely,

Charles C. Matouk, M.D.

Charles C. Matouk, M.D.
Assistant Professor of Neurosurgery
And of Diagnostic Radiology

YALE NEW HAVEN HEALTH

January 4, 2013

Ms. Kimberly Martone
Director of Operations
Office of Healthcare Access
410 Capitol Avenue
MS #13HCA
P.O. Box 340308
Hartford, CT 06106

Re: Yale-New Haven Hospital (YNHH)
Acquisition of a portable multi-slice CT scanner for neurological and neurosurgical intensive care patients

Dear Ms. Martone:

Enclosed please find the original, four (4) hard copies and an electronic copy on CD of the Certificate of Need (CON) application for YNHH's proposal to acquire a portable multi-slice CT scanner for neurological and neurosurgical intensive care patients. This patient population requires frequent CT imaging to monitor responses to treatment and clinical status, and to assess radiographic correlates to clinical changes and currently must be transported to Radiology. The proposed mobile CT allows critically ill patients to remain in their own bed in the intensive care unit and represents a significant improvement to patient safety, quality of care and staff productivity.

Please do not hesitate to contact me with any questions or concerns. I can be reached at (203) 863-3908.

Thank you for your time and support of this project.

Sincerely,

Nancy Rosenthal

Nancy Rosenthal
Senior Vice President – Health Systems Development

Enclosures

YALE-NEW HAVEN HOSPITAL

Acquisition of a Portable Multi-Slice CT Scanner for Neurological and Neurosurgical Intensive Care Patients

January 4, 2013

Application 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 the CON application filing fee in the form of a certified, cashier or business check made out to the "Treasurer State of Connecticut" in the amount of $500.**

For OHCA Use Only:

Docket No.: 13-31815-CON **Check No.:** 162680D
OHCA Verified by: SWL **Date:** 1-7-13

☒ **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 paginated hard copy of the CON application including a completed affidavit, signed and notarized by the appropriate individuals.**

☒ **Attached are completed Financial Attachments I and II.**

☒ **Submission includes one (1) original and four (4) hard copies with each set placed in 3-ring binders.**

Note: A CON application may be filed with OHCA electronically through email, if the total number of pages submitted is 50 pages or less. In this case, the CON Application must be emailed to ohca@ct.gov.

Important: For CON applications(less than 50 pages) filed electronically through email, the singed affidavit and the check in the amount of $500 must be delivered to OHCA in hardcopy.

☒ **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 documents in MS Word and MS Excel as appropriate.**

YALE-NEW HAVEN HOSPITAL

Acquisition of a Portable Multi-Slice CT Scanner for Neurological and Neurosurgical Intensive Care Patients

Certificate of Need Application

TABLE OF CONTENTS

CON PUBLIC NOTICE

245 HOUSES FOR RENT

MADISON, 2 BR, 1 BA, unfurnished 1000sf, newly painted, new appls, close to town, 1 mile from 95. Year lease, oil heat. $1250. Call 203-645-9068.

MILFORD - 1+ bdrm, heat and all utilities included. Dead end street. Laundry. $1200/mo. 1st last and sec. non-smoking, pets on approval. Call 203-521-8513

255 GARAGES STORAGE SPACE

NEW HAVEN WHITNEY AVE
Garage
Immediate Occupancy
$85.00 month
CALL 203-777-4599

325 HOUSES FOR SALE

HAMDEN REDUCED
Remodeled 3BR, 1 1/2 bath Colonial. Completely updated kit & bath. Formal DR, new windows & roof. Walkup attic for expansion & full bsmnt. $149,900.
Christine Rubano
William Raveis Real Estate
203-650-1874

400 COMMERCIAL & INDUSTRIAL

410 COMMERCIAL INDUSTRIAL RENT

LEGALS

NOTICE OF 30-DAY COMMENT PERIOD FOR PUBLIC COMMENT

The Department of the Army proposes to transfer approximately 2.6 acres from the Area Maintenance Support Activity 69, located in Milford, Connecticut, to the City of Milford for use of vehicle storage and local governmental offices. In compliance with Section 120(h) of the Comprehensive Environmental Response, Compensation and Liability Act, the Army has prepared a draft Finding of Suitability for Transfer (FOST) in support of this project. It is the intent of the Army to sign the FOST in order to facilitate the property transfer.

The draft FOST (and support materials) will be available for public review at the Milford Public Library, 57 New Haven Ave, Milford, CT, 06460, (203) 783-3290. The FOST can also be viewed electronically at http://www.hqda.army.mil/acsimweb/brac/env_fost.htm.

Written comments on the FOST shall be received and considered up to 30 days from the publication of this notice, and should be directed to: Ms. Laura Dell'Olio via e-mail, laura.dellolio@usar.army.mil

LEGALS

NOTICE

A public sale of the contents of the storage units listed below will take place on December 6, 2012 at 10:00AM. This sale will take place at CubeSmart, 171 Cedar Street, Branford CT 06405 (203) 483-9442. Each space will be sold as one lot. All items in storage units contain household items unless otherwise mentioned.

D158-John Moschette
C64-Daniel Vargas
H296-James A Goodwin

LEGALS

PUBLIC NOTICE

Statute Reference: Section 19a-638 of the Connecticut General Statues

Applicant: Middlesex Hospital, 28 Crescent Street, Middletown, CT 06457

Project Title: Transfer of Ownership of Certain Assets of Madison Radiology P.C. to Middlesex Hospital

Project Summary: Middlesex Hospital is applying for a Certificate of Need requesting approval of a transfer of ownership of certain of the assets Madison Radiology, P.C. at the following location:

- 2A Samson Rock Drive, Madison, CT

Estimated Total Capital Expenditure: $ 1, 400, 000

BETHANY

LEGALS

PUBLIC NOTICE

Pursuant to section 19a-638 of Connecticut General Statutes, Yale-New Haven Hospital will submit the following Certificate of Need application:

Applicant(s): Yale-New Haven Hospital

Address: 20 York Street

Town: New Haven

Proposal: Acquisition of portable multi-slice CT scanner for neurological and neurosurgical intensive care patients

Estimated Total Project Cost/Expenditure: $436,860

NHR 11-22-12

230 APARTMENTS UNFURNISHED

WESTVILLE spacious 2 bedroom, hardwood floors, central air, dishwasher. Off street parking. Quiet conservative building. Call 203-777-4599

WESTVILLE
Spacious 2BR Twnhse,w/office,hdwd firs, w&d hkup, off st pkg. Very priv 203-799-2409 203-795-3748

235 APARTMENTS FURNISHED

HAMDEN The Carriage House 2257 Whitney Av. Nr. Yale Quinni, 1 Mo/more. Furnish all utili, . Start $950. 203-996-8067

240 CONDOMINIUMS FOR RENT

HAMDEN
Mt. Carmel, spac 2Br Twn, 1 1/2 bths, off st pkg, very priv. On walking trail. util not incl. 203-798-2409 795-3748

245 HOUSES FOR RENT

MADISON, 2 BR, 1 BA, unfurnished 1000sf, newly painted, new appls, close to town, 1 mile from 95. Year lease, oil heat. $1250. Call 203-645-9066.

255 GARAGES STORAGE SPACE

NEW HAVEN WHITNEY AVE Garage
Immediate Occupancy
$85.00 month
CALL 203-777-4599

325 HOUSES FOR SALE

Milford/Branford
800 sq ft & up. Office & Warehouse. D'Amato Bros
203-877-3276

345 GENERAL HELP WANTED

DRIVERS - LUMBER TRUCKS
EXPERIENCED ONLY
Apply in person to:
National Lumber
381 State Street, North Haven
CALL 203-777-3278 or
(TOLL FREE) 1-877-872-3278
TO PLACE
YOUR
CLASSIFIED AD

CALL EARLY,
CALL LATE!

LEGALS

LEGAL NOTICE NEW HAVEN SELF STORAGE

140 Ferry St.
New Haven, CT 06513
(203) 772-4050

Self Storage Facility Operator's Sale for non-payment of Storage Charges. To resolve this claim, property manager is conducting an auction. The following units will be sold by PUBLIC AUCTION
Wednesday@ 12:30pm
December 5, 2012
Contents of the following units to be sold in their entirety.

2135, 2261 Zaid Landscaping
3128 Douston II, Ralph
4129 Palmer, Tomasene
3039, 3127, 3330, 4296, 4300, 4303 4400 Guillen Acuna, Nelly Esp.
3060 Grice, Shirley
1200 Santos, Nathaniel
2141 Gaetano, Maryjane
3284 Castro, Renejeo
3337 Navarro, Luz
1139 Barger, Melinda
3278, 4221 Piontek, Marguerite
4192 Bearman, Norma
2116 Vauls, Melvin
3160 O'Grady, William
2111 Watts, Yvonne
2151 Hoover,Samuel
2150 Greene, Timothy
1140 Jimenez, Maura
4222 Rivera, Nitza

LIQUOR PERMIT

Notice of Application
This is to give notice that I, XIAO LING FANG
66 WASHINGTON RD
HAMDEN, CT 06518-3030
Have filed an application placarded 11/16/2012 with the Department of Consumer Protection for a RESTAURANT WINE & BEER PERMIT
for the sale of alcoholic liquor on the premises at
2779 DIXWELL AVE.

LEGALS

NOTICE OF 30-DAY COMMENT PERIOD FOR PUBLIC COMMENT

The Department of the Army proposes to transfer approximately 2.6 acres from the Area Maintenance Support Activity 69, located in Milford, Connecticut, to the City of Milford for use of vehicle storage and local governmental offices. In compliance with Section 120(h) of the Comprehensive Environmental Response, Compensation and Liability Act, the Army has prepared a draft Finding of Suitability for Transfer (FOST) in support of this project. It is the intent of the Army to sign the FOST in order to facilitate the property transfer.

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Written comments on the present any such claim may result in the loss of rights to recover on such claim.

Barbara Kieslich, Asst Clerk

The fiduciary is:

Linda A. Costelli, c/o Michael D. Saffer, Esq., The Pellegrino Law Firm, 475 Whitney Avenue, New Haven, CT 06510
2522283

NOTICE TO CREDITORS

LEGALS

NOTICE TO CREDITORS

ESTATE OF:
Etta Montano,
AKA Concetta Montano

The Hon. Clifford D. Hoyle, Judge of the Court of Probate, Derby Probate District, by decree dated october 22, 2012, 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.

Patricia Chase, Clerk

The fiduciary is:

Judith Esposito, c/o Donald S. Hendel, Esq., Donald S. Hendel, LLC, 118 Washington Avenue, 2nd Floor, North Haven, CT 06473
2522249

NOTICE TO CREDITORS

ESTATE OF
Wayne E. Martin,
AKA Wayne Enos Martin

The Hon. Beverly Streit-Kefalas, Judge of the Court of Probate, Milford - Orange Probate District, by decree dated October 16, 2012, ordered that all claims must be presented to the fidu-
2522975

LEGALS

Request for Qualifications

Architectural Services, Capital Needs Assessment Services and Cost Estimating Services

The Connecticut Housing Finance Authority ("CHFA") invites interested firms to submit their qualifications for evaluation and potential inclusion on CHFA's list of approved consultants with whom CHFA may contract for professional consulting services to (i) review construction documents, (ii) provide construction administration oversight, (iii) author Capital Needs Assessment ("CNA") reports, (iv) review CNA reports, or (v) provide construction cost estimates.

Respondents may submit their qualifications for one or more of these individual services by December 7, 2012, no later than 4:00 p.m., to CHFA.

To obtain a copy of the Request for Qualifications (RFQ), please reference the Authority's website at www.chfa.org (under "About Us – Request for Proposals" or "Press Releases").
2523815

MILFORD
@NHREGISTER.COM

LEGALS

PUBLIC NOTICE

Pursuant to section 19a-639 of Connecticut General Statutes, Yale-New Haven Hospital will submit the following Certificate of Need application:

Applicant(s): Yale-New Haven Hospital

Address: 20 York Street

Town: New Haven

Proposal: Acquisition of portable multi-slice CT scanner for neurological and neurosurgical intensive care patients

Estimated Total Project Cost/Expenditure: $436,860

NHR 11-24-12

LEGALS

Request for Qualifications

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LEGAL NOTICE

RETURN DATE: DECEMBER 11, 2012 : SUPERIOR COURT
ONEWEST BANK, FSB : J.D. OF NEW HAVEN
VS : AT NEW HAVEN
THE WIDOWER, HEIRS, AND/OR CREDITORS OF DORIS STANLEY, ET AL : OCTOBER 29, 2012

NOTICE TO THE WIDOWER, HEIRS, AND/OR CREDITORS OF DORIS STANLEY AND ALL UNKNOWN PERSONS, CLAIMING OR WHO MAY CLAIM, ANY RIGHTS, TITLE, INTEREST OR ESTATE IN OR LIEN OR ENCUMBRANCE

BETHANY, 16 Keegan Dr. Rt 67 to Bear Hill Rd to Keegan Sat. Nov. 24, 9-1. Recliner, desk, card tbl, foosball tbl, Xmas decor & Western misc.

HAMDEN, Giant craft and book sale. 70 Jaenicke Lane, Fri. & Sat. 9-3. Hundreds of children's books & teacher supplies, ceramics, candles, bakeware, fabric, yarn, rubber stamps, quilting, scrapbooking, patterns,needlepoint,latch hook

NEW HAVEN - Sat. 11/24 & Sun. 11/25, 8-4. 463 Smith Ave. Antiques,Christmas Decs, Tools, Cast Iron LR Stove, Motor Bike, Clothes,Collectibles and **More!**

WEST HAVEN - 26 Susquehanna Ave., Sat. 11/24, 11am-4pm. Wicker furn, antique drop leaf table, $150. Xmas DVDs

AFFIDAVIT

AFFIDAVIT

Applicant: Yale-New Haven Hospital

Project Title: Acquisition of a portable multi-slice CT scanner for neurological and neurosurgical intensive care patients

I, James Staten, (Individual's Name) Chief Financial Officer (Position Title – CEO or CFO)

of Yale-New Haven Hospital (Hospital or Facility Name) being duly sworn, depose and state that

Yale-New Haven Hospital's (Hospital or Facility Name) information submitted in this Certificate of Need Application is accurate and correct to the best of my knowledge.

Signature James Staten Date 1/4/13

Subscribed and sworn to before me on 1/4/13

Rose Arminio

Notary Public/Commissioner of Superior Court

My commission expires: _____

ROSE ARMINIO
NOTARY PUBLIC
State of Connecticut
My Commission Expires
February 28, 2013

CON FILING FEE

07-14-3774B 06-2005

Bank of America

Cashier's Check

No. **1626800**

Notice to Purchaser - In the event this check is lost, misplaced or stolen, a sworn statement and 90-day waiting period will be required prior to replacement. This check should be negotiated within 90 days.

Date DECEMBER 13, 2012

30-1/1140
NTX

Banking Center YALE NEW HAVEN HOSPITAL

0021178 00005 0001626800

MOBILE CT SCANNER
Remitter (Purchased By)

$ **500.00**

Pay **FIVE HUNDRED DOLLARS AND 00 CENTS**

To The Order Of **TREASURER, STATE OF CONNECTICUT** ****

Authorized Signature

Bank of America, N.A.
San Antonio, Texas

VOID AFTER 90 DAYS

07-14-3774B 06-2005

⑈1626800⑈ ⑆114000019⑆ 00164100554 5⑈

THE ORIGINAL DOCUMENT HAS REFLECTIVE WATERMARK ON THE BACK THE ORIGINAL DOCUMENT HAS REFLECTIVE WATERMARK ON THE BACK

CON APPLICATION

State of Connecticut
Office of Health Care Access
Certificate of Need Application

Instructions: Please complete all sections of the Certificate of Need ("CON") application. If any section or question is not relevant to your project, a response of "Not Applicable" may be deemed an acceptable answer. If there is more than one applicant, identify the name and all contact information for each applicant. OHCA will assign a Docket Number to the CON application once the application is received by OHCA.

Docket Number: TBD

Applicant: Yale-New Haven Hospital

Contact Person: Nancy Rosenthal

Contact Person's Title: Senior Vice President – Health Systems Development

Contact Person's Address: Department of Planning & Business Development
2 Howe Street, New Haven, CT 06510

Contact Person's Phone Number: (203) 863-3908

Contact Person's Fax Number: (203) 863-4736

Contact Person's Email Address: Nancy.Rosenthal@greenwichhospital.org

Project Town: New Haven

Project Name: Acquisition of a portable multi-slice CT scanner for neurological and neurosurgical intensive care patients

Statute Reference: Section 19a-638, C.G.S.

Estimated Total Capital Expenditure: $436,860

Project Description: Acquisition of Equipment

a. Please provide a narrative detailing the proposal.

Yale-New Haven Hospital (YNHH) offers state-of-the-art resources, programs and specially trained physicians in the area of neurosciences. *US News & World Report* ranks YNHH as among the best hospitals for neurological and neurosurgical care in the nation. Patients from throughout Connecticut and beyond seek these specialized services. YNHH has a 14-bed neuroscience intensive care unit (NICU) that is almost always fully occupied. This unit offers critical care medicine to a wide range of patients suffering from such conditions as brain tumors, intracerebral hemorrhages, severe strokes, intractable seizures, subdural and epidural hematomas, and neurological infections. YNHH created a neurointensivist model in its NICU, making it the first fully neurointensivist-staffed unit in Connecticut. The intensivists are specially trained physicians in neurointensive care, and are uniquely qualified to manage this patient population and oversee the operation of the intensive care unit.

Computed Tomography (CT) imaging has increasingly become a valuable and necessary diagnostic modality for critically ill neurological and neurosurgical patients. The current practice at YNHH requires these critically ill patients to be transported from the intensive care unit to the Radiology Department to receive a CT scan. Most patients are being mechanically ventilated, have invasive monitoring, and are receiving multiple intravenous vasoactive medications. They must be transported in their hospital bed, a process which requires multiple staff, including the patient's nurse and a respiratory therapist, and often must occur during night time hours when the CT scanners have availability, but staffing levels are lower. This process creates risks to patient safety and many logistical difficulties for clinical staff.

As CT technology has continued to advance and improve, there is now an opportunity to provide mobile CT scanning at the patient's bedside in the intensive care unit. Patients no longer have to be transported, clinicians do not have to leave the unit, and scans can be safely and effectively obtained. This technology is more frequently being offered by leading neuroscience centers around the United States and represents a significant improvement to patient care.

b. Provide letters that have been received in support of the proposal.

Several letters from physicians involved in the care of critically ill neuroscience patients have provided letters of support for this proposal. Copies are included in Appendix I.

c. Provide the Manufacturer, Model, Number of slices/tesla strength of the proposed scanner (as appropriate to each piece of equipment).

The manufacturer is NeuroLogica and the model is the Ceretom. This portable CT scanner has 8 slices and is capable of head CT imaging only.

d. List each of the Applicant's sites and the imaging modalities and other services currently offered by location.

Table A: YNHH CT Locations and Equipment

YNHH CT Service Locations	CT Scanners
Yale-New Haven Hospital 20 York Street New Haven, CT 06510	Emergency Dept.: GE Lightspeed 64 slice and GE 750 HD 64 slice Smilow Cancer Hospital: GE 64 slice (2) South Pavilion: GE 16 slice, GE 64 slice, GE 16 slice widebore
Yale-New Haven Hospital – Saint Raphael Campus 1450 Chapel Street New Haven, CT 06510	Siemens Somatom Sensation 64 slice Toshiba Aquillion 32 slice
Temple Radiology 2560 Dixwell Avenue Hamden, CT 06518	GE 64 slice
Temple Radiology 60 Temple Street New Haven, CT 06510	GE 16 slice
Shoreline Medical Center 111 Goose Lane Guilford, CT 06437	GE 16 slice GE 16 slice simulator

2. Clear Public Need

a. Explain why there is a clear public need for the proposed equipment. Provide evidence that demonstrates this need.

Public need for the proposed equipment is based on an imperative to improve the quality of care delivery and CT imaging to critically ill neuroscience patients. As briefly described, YNHH operates a large and busy neuroscience critical care unit (NICU). This 14-bed unit treats patients with a wide variety of neurological and neurosurgical conditions such as brain tumors, intracerebral hemorrhages, severe strokes, refractory seizures, subdural and epidural hematomas, and neurological infections. This patient population requires frequent CT imaging to monitor responses to treatment and clinical status, and to assess radiographic correlates to clinical changes.

On average each patient encounter in the NICU requires between 2.0 and 2.3 CT scans during their stay in the intensive care unit.

Quality of Care

Transporting critically ill patients, especially those with neurological injuries or conditions, is inherently risky. Multiple studies have identified complications that may occur during intra-hospital transport. For intensive care unit patients, transport off the unit increases the risk of injury or complication since patients are likely to be in a more remote area in the hospital with fewer resources, equipment and staff in the event of an emergency. Peace et al. (2010) note that intra-hospital transfers can adversely affect brain oxygenation and transport to radiology is associated with logistical and safety issues, often requiring significant provider time. In a second article by Peace et al (2010), the authors note that patient transport to and from the ICU can negatively impact intracranial physiology due to the stress and difficulty associated with such transport. Historically such transport had been necessary since the marketplace did not offer portable CT scanning. But over the past several years, this technology has been developed and perfected and is now available.

References:

Peace, K., Wilensky, E., Frangos, S., MacMurtrie, E., Shields, E., Hujcs, M...LeRoux, P. (2010). The use of a portable head CT scanner in the intensive care unit. *Journal of Neuroscience Nursing*, *42*, 109-116.

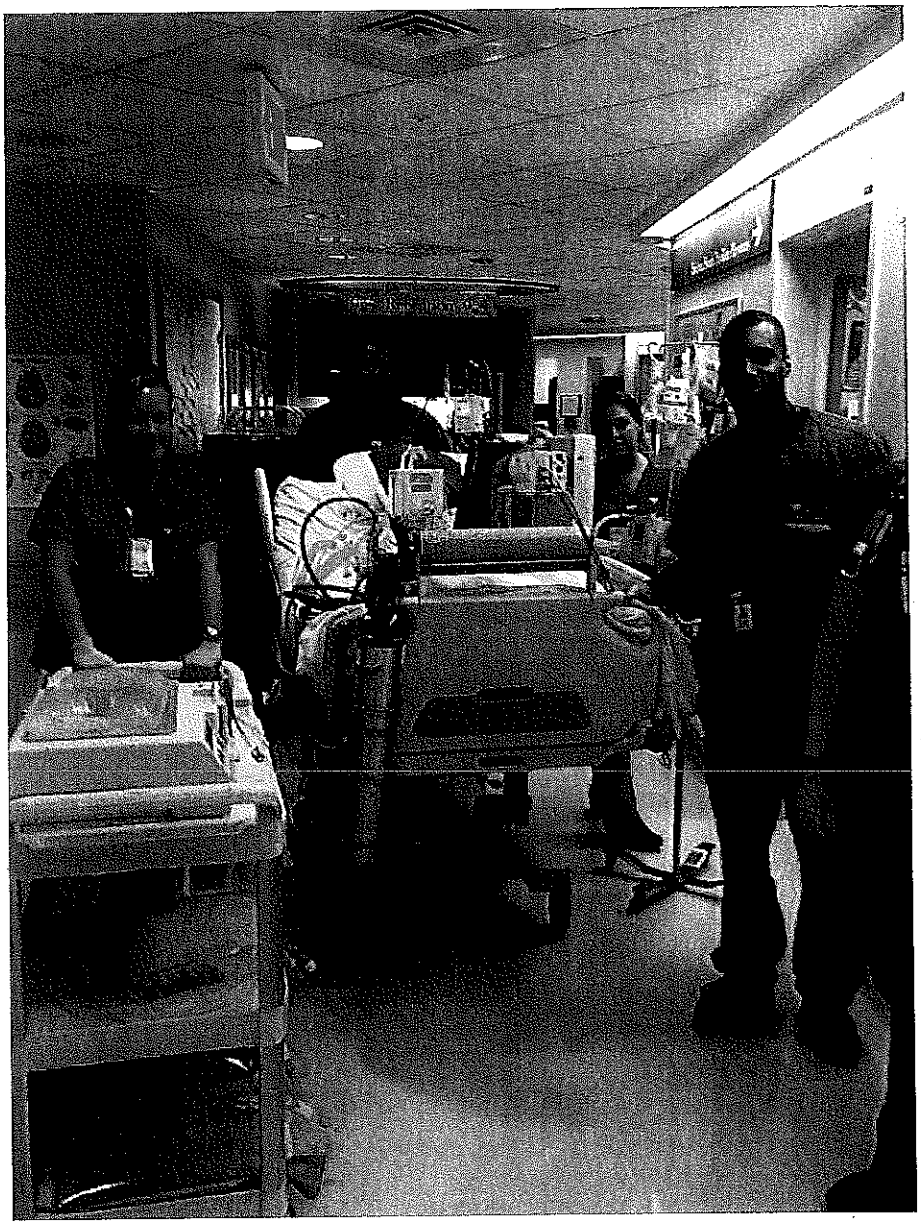
Peace, K., Wilensky, E., Frangos, S., MacMurtrie, E., Shields, E., Hujcs, M...LeRoux, P. (2010). Portable head CT scan and its effect on intracranial pressure, cerebral perfusion pressure, and brain oxygen. *Journal of Neurosurgery*, 1-6.

Patient Transport – Distances and Staff Time

The NICU is located on the 6th floor of the South Pavilion. When NICU patients require a CT scan, they must be transferred to the Radiology Department on the second floor of the South Pavilion. Since these are critically ill patients, they must be transported in their hospital bed, are receiving multiple intravenous vasoactive fluids and are frequently connected to mechanical ventilators and monitors. Transportation of such patients requires at least three staff members and sometimes more.

Patients must first be disconnected from all fixed monitors and equipment in their room and attached to portable machines. Multiple staff then must wheel the patient and their bed along with other necessary equipment to the elevator and then to the Radiology department. After the scan is completed, the staff transport the patient back to the intensive care unit, reconnect all unit-based equipment and return portable equipment. The picture below

shows a NICU patient and staff beginning a transport from the NICU to Radiology.



This process is time consuming and labor intensive, and staff are off the unit for extended periods of time which strains the NICU staffing for the care of other patients in the ICU.

Appendix II contains a floor plan which illustrates the journey these patients and the staff must travel to obtain CT scans. The travel route includes travel between the NICU and the 6th floor South Pavilion elevator and the 2nd floor of the South Pavilion elevators and the CT scanners in Radiology.

The proposed mobile CT allows critically ill patients to remain in their own bed in the intensive care unit. The scanner is brought to the head of the bed and only the patient's head enters the machine. They remain in their bed the entire time the scan is obtained. Minimal patient movement is required to obtain the CT scan with the proposed equipment which significantly improves patient safety.

b. Provide the utilization of existing health care facilities and health care services in the Applicant's service area.

YNHH is the only provider in the service area that offers neuroscience intensive care services. In addition, no other Connecticut provider offers portable CT services to this population.

c. Complete **Table 1** for each piece of equipment of the type proposed currently operated by the Applicant at each of the Applicant's sites.

Table 1: Existing Equipment Operated by the Applicant

Provider Name Street Address Town, Zip Code	**Description of Service ***	**Hours/Days of Operation ****	**Utilization ***** **(FY 12)**
Yale-New Haven Hospital 20 York Street New Haven, CT 06510	CT Services	ER: 24/7 Smilow: Mon-Fri, 8 am-7:30 pm and Sat, 7:50 am-2:30 pm South Pavilion: Mon-Fri, 7:30 am-11 pm; Sat, 3:30 am-8 pm; and Sun, 11:30 am-8 pm	66,302
Yale-New Haven Hospital – Saint Raphael Campus 1450 Chapel Street New Haven, CT 06510	CT Services	Sun-Sat, 7 am-8 pm	28,165
Temple Radiology 2560 Dixwell Avenue Hamden, CT 06518	CT Services	Mon-Fri, 8 am-5 pm Sat, 8 am-12 noon	2,027
Temple Radiology 60 Temple Street New Haven, CT 06510	CT Services	Mon-Fri, 8 am-5 pm	2,313
Shoreline Medical Center 111 Goose Lane Guilford, CT 06437	CT Services	Mon-Fri, 8 am-5 pm	9,096

* 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; and

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

d. Provide the following regarding the proposal's location:

i. The rationale for locating the proposed equipment at the proposed site;

As previously described, the proposed equipment is a portable CT scanner which will be housed in the NICU and transported to other critical care units as needed.

ii. The population to be served, including specific evidence such as incidence, prevalence, or other demographic data that demonstrates need;

The population to be served is neuroscience intensive care unit patients. Approximately 2,000 CT scans are performed annually on NICU patients. There are also other NICU patients who would have benefited from a CT scan, but were too unstable to be transported to Radiology. Therefore, the volume of neuro CT scans for this patient population is expected to increase with a CT scanner in the NICU.

As previously stated, the NICU is almost always fully occupied. This specialized unit is unique in the State of Connecticut and serves as a major referral source for critically ill neurological and neurosurgical patients.

If a head CT scan were needed for a critically ill patient in one of the other intensive care units, the unit could be moved to another location, however projected volumes for the proposed scanner were assumed to be NICU patients.

iii. How and where the proposed patient population is currently being served;

The proposed patient population is currently being served at YNHH and receiving CT scans in the Radiology Department.

iv. All existing providers (name, address) of the proposed service in the towns listed above and in nearby towns;

Not applicable. There are no other neuroscience ICU providers or providers offering mobile CT services to critically ill patient populations.

v. The effect of the proposal on existing providers; and

The proposal will have no effect on existing providers since the proposed patient population already resides at YNHH.

vi. If the proposal involves a new site of service, identify the service area towns and the basis for their selection.

Not applicable. The proposal does not involve a new site of service.

e. Explain why the proposal will not result in an unnecessary duplication of existing or approved health care services.

As previously stated, there are no other neuroscience ICU providers or providers offering mobile CT services to critically ill patient populations.

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 2a, report the units of service by piece of equipment, and in Table 2b, 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 2a: Historical, Current, and Projected Volume, by Equipment Unit

	Actual Volume (Last 3 Completed FYs)			**CFY Volume***	**Projected Volume (First 3 Full Operational FYs)****		
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
Scanner***							
CT Scans for Neuro ICU patients	**2,087**	**2,371**	**1,883**	**462**	**2,479**	**2,479**	**2,479**
Total							

* 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. **FY 2013 represents volume from October 1, 2012 – December 14, 2012.**

** 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 2b: Historical, Current, and Projected Volume, by Type of Scan/Exam

	Actual Volume (Last 3 Completed FYs)			CFY Volume*	Projected Volume (First 3 Full Operational FYs)**		
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
Service type***							
Head CT	**2,087**	**2,371**	**1,883**	**462**	**2,479**	**2,479**	**2,479**
Total							

* 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. **FY 2013 represents volume from October 1, 2012 – December 14, 2012.**
** 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 breakdown, by town, of the volumes provided in Table 2a for the most recently completed full FY.

Appendix III contains a listing of NICU patients who received a CT scan by patient town of origin for FY 12.

c. Describe existing referral patterns in the area to be served by the proposal.

CT scans are ordered by the neurointensivists who oversee the care of all patients in the NICU.

d. Explain how the existing referral patterns will be affected by the proposal.

There will be no change in referral patterns. Neurointensivists will continue to order CT scans when needed.

e. Explain any increases and/or decreases in volume seen in the tables above.

Volumes will fluctuate to some degree as the patient mix in the NICU varies from year to year and the frequency and quantity of CT scans varies by diagnosis and patient condition.

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

Historical scan volume between 2010 and 2012 was averaged to estimate 2013 volume (2,114 scans). In addition, 122 scans were added to account for one additional scan per day for 4 months of FY 13. The additional scan per day for the last four months of FY 13 (estimate June 1, 2013 for start of service) was included since on average there is 1 patient per day who needs to be scanned but cannot tolerate being transported to Radiology. These patients will be able to receive CT scans on the NICU with the proposed scanner.

Scan volume projections for FY 2014 – FY 2016 were based on the following calculations:

FY 2014: Average of 2010, 2011 and 2012 volume (2,114) plus an additional 365 scans which accounts for one additional scan/day for the entire year (2,114+365) = 2,479

FY 2015 & FY 2016: Volume held flat since NICU is fully occupied and CT volume not expected to change materially.

g. Provide a copy of any articles, studies, or reports that support the need to acquire the proposed scanner, along with a brief explanation regarding the relevance of the selected articles.

Appendix IV contains a number of articles which discuss the benefits of a portable CT scanner for intensive care patients and some of the risks and negative outcomes of transporting these critically ill patients.

4. **Quality Measures**

a. Submit a list of all key professional, administrative, clinical, and direct service personnel related to the proposal. Attach a copy of their Curriculum Vitae.

- **Marna P. Borgstrom, CEO**
- **Richard D'Aquila, President and COO**
- **James Staten, Senior Vice President, Finance and CFO**
- **Peter N. Herbert, MD, Chief of Staff**
- **James A. Brink, MD, FACR, Professor and Chairman, Yale University School of Medicine, Department of Diagnostic Radiology**
- **David Greer, MD, MA, FCCM, FAHA, Professor and Vice Chair, Director NICU, Yale University School of Medicine, Department of Neurology**

b. Explain how the proposal contributes to the quality of health care delivery in the region.

Please refer to the response to question 2a. Eliminating transport of NICU patients for CT scans will improve patient safety, reduce any negative effects on neurological physiology and aid in the patient's recovery. The improved quality of care that will be delivered to NICU patients will contribute to an overall improvement in the quality of health care delivery in the region.

5. Organizational and Financial Information

a. Identify the Applicant's ownership type(s) (e.g. Corporation, PC, LLC, etc.).

b. Does the Applicant have non-profit status?
☒ Yes (Provide documentation) ☐ No

c. Provide a copy of the State of Connecticut, Department of Public Health license(s) currently held by the Applicant and indicate any additional licensure categories being sought in relation to the proposal.

A copy of YNHH's DPH license is included in Appendix V.

d. Financial Statements

i. If the Applicant is a Connecticut hospital: Pursuant to Section 19a-644, C.G.S., each hospital licensed by the Department of Public Health is required to file with OHCA copies of the hospital's audited financial statements. If the hospital has filed its most recently completed fiscal year audited financial statements, the hospital may reference that filing for this proposal.

YNHH has filed FY 2011 audited financial statements with OHCA. FY 2012 audited statements are not yet completed but will be filed with OHCA once complete and approved.

ii. If the Applicant is not a Connecticut hospital (other health care facilities): Audited financial statements for the most recently completed fiscal year. If audited financial statements do not exist, in lieu of audited financial statements, provide other financial documentation (e.g. unaudited balance sheet, statement of operations, tax return, or other set of books.)

e. Submit a final version of all capital expenditures/costs as follows:

Table 3: Proposed Capital Expenditures/Costs

Medical Equipment Purchase	$
Imaging Equipment Purchase	$436,860
Non-Medical Equipment Purchase	
Land/Building Purchase *	

Construction/Renovation **	
Other Non-Construction (Specify)	
Total Capital Expenditure (TCE)	$
Medical Equipment Lease (Fair Market Value) ***	$
Imaging Equipment Lease (Fair Market Value) ***	
Non-Medical Equipment Lease (Fair Market Value) ***	
Fair Market Value of Space ***	
Total Capital Cost (TCC)	$436,860
Total Project Cost (TCE + TCC)	$
Capitalized Financing Costs (Informational Purpose Only)	
Total Capital Expenditure with Cap. Fin. Costs	$

* 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.

A copy of the vendor quote is included in Appendix VI.

f. 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 funded with an equity contribution.

g. Demonstrate how this proposal will affect the financial strength of the state's health care system.

By improving the quality of care and minimizing patient safety risks, potential health care costs and resources can be avoided that might otherwise be necessary. Any reduced or avoided health care costs that are preventable help to improve the financial strength of the state's health care system.

6. Patient Population Mix: Current and Projected

a. Provide the current and projected patient population mix (based on the number of patients, not based on revenue) with the CON proposal for the proposed program.

Table 4: Patient Population Mix – NICU Patients

	Current** FY 2013	Year 1 FY 2014	Year 2 FY 2015	Year 3 FY 2016
Medicare*	36%	36%	36%	36%

	Current** FY 2013	Year 1 FY 2014	Year 2 FY 2015	Year 3 FY 2016
Medicaid*	18%	18%	18%	18%
CHAMPUS & TriCare	1%	1%	1%	1%
Total Government	**55%**	**55%**	**55%**	**55%**
Commercial Insurers*	43%	43%	43%	43%
Uninsured	2%	2%	2%	2%
Workers Compensation	0%	0%	0%	0%
Total Non-Government	**45%**	**45%**	**45%**	**45%**
Total Payer Mix	**100%**	**100%**	**100%**	**100%**

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

b. Provide the basis for/assumptions used to project the patient population mix.

Payor mix is assumed to remain constant from FY 2013 since the current patient population will continue to be served with the proposed mobile CT scanner.

7. Financial Attachments I & II

a. Provide a summary of revenue, expense, and volume statistics, without the CON project, incremental to the CON project, and with the CON project. **Complete Financial Attachment I.** (Note that the actual results for the fiscal year reported in the first column must agree with the Applicant's audited financial statements.) The projections must include the first three full fiscal years of the project.

Appendix VII contains a completed Financial Attachment I.

b. Provide a three year projection of incremental revenue, expense, and volume statistics attributable to the proposal by payer. **Complete Financial Attachment II.** The projections must include the first three full fiscal years of the project.

Appendix VIII contains a completed Financial Attachment II.

c. Provide the assumptions utilized in developing **both Financial Attachments I and II** (e.g., full-time equivalents, volume statistics, other expenses, revenue and expense % increases, project commencement of operation date, etc.).

Appendix IX contains the assumptions utilized in developing Financial Attachments I and II.

d. Provide documentation or the basis to support the proposed rates for each of the FYs as reported in Financial Attachment II. Provide a copy of the rate schedule for the proposed service(s).

YNHH files its Chargemaster with OHCA on an annual basis. All rates for CT scans are included in the Chargemaster on file.

e. Provide the minimum number of units required to show an incremental gain from operations for each fiscal year.

The minimum number of units required to show an incremental gain is not applicable for this proposal. The proposed scanner will be utilized only for inpatients. There is no incremental revenue associated with use of the proposed scanner, only incremental expense. This project is being pursued as a patient safety and quality of care initiative.

f. Explain any projected incremental losses from operations contained in the financial projections that result from the implementation and operation of the CON proposal.

Incremental losses from operations in the financial projections are due to the incremental expenses associated with the purchase and operation of the proposed scanner. Overall, they are modest and necessary to provide the safest, highest quality of care to NICU patients.

g. Describe how this proposal is cost effective.

This proposal is cost effective for several reasons. The absence of the proposed scanner requires time consuming, personnel-intensive patient transport to Radiology from the NICU to obtain CT images. Staff must leave the NICU for long periods of time and in some cases incremental staff must be provided to cover the unit. Eliminating the need for this patient transport will improve staff productivity and patient safety on the NICU.

Additionally, obtaining timely CT scans are essential to making patient care decisions for this patient population. Being able to obtain these scans directly in the NICU will provide more timely clinical information on patient progress and may help to advance their treatment. More timely clinical information and treatment may lead to lower costs of care.

APPENDIX I

PHYSICIAN LETTERS OF SUPPORT

Yale SCHOOL OF MEDICINE

Department of Neurology

DAVID M. GREER, MD, MA, FCCM, FAHA
Professor and Vice Chairman
Dr. Harry M. Zimmerman and Dr. Nicholas and Viola Spinelli Endowed Chair
Program Director
Neurology Residency Program
Director, Neurosciences Intensive Care Unit and Medical Studies

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November 13, 2012

Lisa Davis, MBA, BSN, RN
Deputy Commissioner
Office of Health Care Access
Department of Public Health
410 Capitol Avenue, MS#13HCA
PO Box 340308
Hartford, CT 06134

Dear Deputy Commissioner Davis:

I am writing in support of Yale-New Haven Hospital's (YNHH) Certificate of Need (CON) application to acquire a NeuroLogica Ceretom Mobile CT scanner for neurological imaging of critically ill patients at the hospital. I am currently the Clinical Vice Chairman and Professor of Neurology at Yale University School of Medicine, and the Director of the Neurointensive Care Unit (NICU) at YNHH.

The NICU, one of YNHH's specialty centers, offers state-of-the-art resources and physicians with specialized training and expertise in treating the most complex brain and spine disorders, specifically in patients with severe nervous system or systemic diseases that require intensive care. *US News & World Report* ranked YNHH as among the best hospitals for neurological and neurosurgical care in the nation. Patients from throughout Connecticut and beyond seek these specialized services.

YNHH created an intensivist model in its NICU, making it the first fully neurointensivist-staffed unit in Connecticut. The NICU offers 14 beds and is almost always fully occupied. This unit offers critical care medicine to a wide range of patients suffering from such conditions as brain tumors, intracerebral hemorrhages, severe strokes, subdural and epidural hematomas, seizures and neurological infections.

Computed Tomography (CT) imaging has increasingly become a valuable and necessary diagnostic modality for critically ill neurological and neurosurgical patients. The current practice at YNHH requires these critically ill patients to be transported from the intensive care unit to the Radiology Department to receive a CT scan. Most patients are being mechanically ventilated, have invasive monitoring, and are

receiving multiple intravenous medications. They must be transported in their hospital bed, a process which requires multiple staff, including the patient's nurse and a respiratory therapist, and often must occur during nighttime hours when the CT scanners have availability, but staffing levels are lower. This process creates risks to patient safety and many logistical difficulties for clinical staff.

As CT technology has continued to advance and improve, there is now an opportunity to provide portable CT scanning at the patient's bedside in the intensive care unit. Patients no longer have to be transported, clinicians do not have to leave the unit, and scans can be safely and effectively obtained. This technology is more frequently being offered by leading Neuroscience ICUs around the United States, and represents a significant improvement to patient care.

I strongly support YNHH's CON application to acquire a NeuroLogica CereTom portable CT scanner for its critically ill neurologic and neurosurgical patients. The addition of this technology will significantly improve patient care, reduce the risk of morbidity due to complicated patient transport, and will improve the working environment for clinical staff. YNHH is a state-wide resource for the most complex neuroscience care and such technology is essential.

Thank you for your time and attention and I urge you to approve YNHH's CON application.

Sincerely yours,

David M. Greer

David M. Greer MD, MA, FCCM, FAHA

Yale SCHOOL OF MEDICINE

Department of Neurosurgery

KETAN R. BULSARA, MD
Associate Professor
Neurovascular, Endovascular and Skull Base Surgery

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11/19/2012

Lisa Davis, MBA, BSN, RN
Deputy Commissioner
Office of Health Care Access
Department of Public Health
410 Capitol Avenue, MS#13HCA
PO Box 340308
Hartford, CT 06134

Dear Deputy Commissioner Davis:

I am writing in support of Yale-New Haven Hospital's (YNHH) Certificate of Need (CON) application to acquire a NeuroLogica Ceretom Mobile CT scanner for neurological imaging of critically ill patients at the hospital. I am a cerebrovascular/skull base neurosurgeon who directs the Neuroendovascular and Skull Base Surgery Programs at YNHH.

The Neuroscience Center, one of YNHH's specialty centers, offers state-of-the-art resources and physicians with specialized training and expertise in treating the most complex brain and spine disorders. *US News & World Report* ranked YNHH as among the best hospitals for neurological and neurosurgical care in the nation. Patients from throughout Connecticut and beyond seek these specialized services.

YNHH created an intensivist model in its Neurosurgical Intensive Care Unit (NICU), making it the first fully intensivist staffed unit in Connecticut. The NICU offers 14 beds and is almost always fully occupied. This unit offers critical care medicine to a wide range of patients suffering from such conditions as brain tumors, intracerebral hemorrhages, severe strokes, subdural and epidural hematomas, and neurological infections.

Computed Tomography (CT) imaging has increasingly become a valuable and necessary diagnostic modality for critically ill neurological and neurosurgical patients. The current practice at YNHH requires these critically ill patients to be transported from the intensive care unit to the Radiology Department to receive a CT scan. Most patients are being mechanically ventilated, have invasive monitoring, and are receiving multiple intravenous medications. They must be transported in their hospital bed, a process which requires multiple staff, including the patient's nurse and a respiratory therapist, and often must occur during night time hours when the CT scanners have availability, but staffing levels are lower. This process creates risks to patient safety and many logistical difficulties for clinical staff. The availability of a portable CT scanner will serve to facilitate improved patient care and expedite patient care in a safe and efficient fashion.

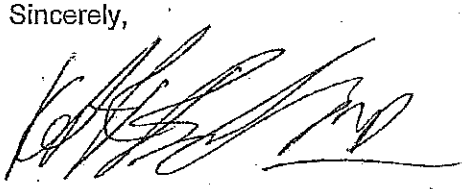
As CT technology has continued to advance and improve, there is now an opportunity to provide mobile CT scanning at the patient's bedside in the intensive care unit. Patients no longer have to be transported, clinicians do not have to leave the unit, and scans can be safely and effectively obtained. This technology is more frequently being offered by leading

neuroscience centers around the United States and represents a significant improvement to patient care.

I strongly support YNHH's CON application to acquire a NeuroLogica CereTom portable CT scanner for its critically ill neurologic and neurosurgical patients. The addition of this technology will significantly improve patient care, reduce the risk of morbidity due to complicated patient transport, and will improve the working environment for clinical staff. YNHH is a state-wide resource for the most complex neuroscience care and such technology is essential.

Thank you for your time and attention and I urge you to approve YNHH's CON application.

Sincerely,



Ketan R. Bulsara, M.D.
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Department of Neurosurgery

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November 14, 2012

Lisa Davis, MBA, BSN, RN
Deputy Commissioner
Office of Health Care Access
Department of Public Health
410 Capitol Avenue, MS#13HCA
PO Box 340308
Hartford, CT 06134

Dear Deputy Commissioner Davis:

I am writing in support of Yale-New Haven Hospital's (YNHH) Certificate of Need (CON) application to acquire a NeuroLogica Ceretom Mobile CT scanner for neurological imaging of critically ill patients at the hospital. I chair the Department of Neurosurgery at the Yale University School of Medicine and I am Chief of Neurosurgery at Yale-New Haven Hospital.

The Neuroscience Center, one of YNHH's specialty centers, offers state-of-the-art resources and physicians with specialized training and expertise in treating the most complex brain and spine disorders. *US News & World Report* ranked YNHH as among the best hospitals for neurological and neurosurgical care in the nation. Patients from throughout Connecticut and beyond seek these specialized services.

YNHH created an intensivist model in its Neurosurgical Intensive Care Unit (NICU), making it the first fully intensivist staffed unit in Connecticut. The NICU offers 14 beds and is almost always fully occupied. This unit offers critical care medicine to a wide range of patients suffering from such conditions as brain tumors, intracerebral hemorrhages, severe strokes, subdural and epidural hematomas, and neurological infections.

Computed Tomography (CT) imaging has increasingly become a valuable and necessary diagnostic modality for critically ill neurological and neurosurgical patients. The current practice at YNHH requires these critically ill patients to be transported from the intensive care unit to the Radiology Department to receive a CT scan. Most patients are being mechanically ventilated, have invasive monitoring, and are receiving multiple intravenous medications. They must be transported in their hospital bed, a process which requires multiple staff, including the patient's nurse and a respiratory therapist, and often must occur during night time hours when the CT scanners have availability, but staffing levels are lower. This process creates risks to patient safety and many logistical difficulties for clinical staff. The neurosurgery patients are often the most ill, represented by those with ruptured aneurysms or arteriovenous malformations where transportation puts them at risk for bleeding or temporary loss of control of intracranial pressure. The second neurosurgical population are those with traumatic brain injury, and again, they

frequently suffer from multiple organ injury and skeletal fractures, making long distance transport hazardous or impossible.

As CT technology has continued to advance and improve, there is now an opportunity to provide mobile CT scanning at the patient's bedside in the intensive care unit. Patients no longer have to be transported, clinicians do not have to leave the unit, and scans can be safely and effectively obtained. This technology is more frequently being offered by leading neuroscience centers around the United States and represents a significant improvement to patient care.

I strongly support YNHH's CON application to acquire a NeuroLogica CereTom portable CT scanner for its critically ill neurologic and neurosurgical patients. The addition of this technology will significantly improve patient care, reduce the risk of morbidity due to complicated patient transport, and will improve the working environment for clinical staff. YNHH is a state-wide resource for the most complex neuroscience care and such technology is essential.

Thank you for your time and attention and I urge you to approve YNHH's CON application.

Sincerely,

Dennis D. Spencer, MD
Harvey & Kate Cushing Professor and Chairman
Department of Neurosurgery

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Spine
Khalid Abbed MD
Kenneth Vives MD
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Kenneth Vives MD
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Lisa Davis, MBA, BSN, RN
Deputy Commissioner
Office of Health Care Access
Department of Public Health
410 Capitol Avenue, MS#13HCA
PO Box 340308
Hartford, CT 06134

Dear Deputy Commissioner Davis:

I am writing in support of Yale-New Haven Hospital's (YNHH) Certificate of Need (CON) application to acquire a NeuroLogica Ceretom Mobile CT scanner for neurological imaging of critically ill patients at the hospital. I am an Assistant Professor of Neurosurgery & Diagnostic Radiology, Neurovascular and Stroke Programs, at YNHH. I am also the Director of Medical Student Education for the Department of Neurosurgery. My clinical area of expertise is the open surgical and endovascular treatment of cerebrovascular diseases including aneurysms, arteriovenous malformations, and stroke. I routinely admit patients to the Neuro-ICU.

The Neuroscience Center, one of YNHH's specialty centers, offers state-of-the-art resources and physicians with specialized training and expertise in treating the most complex brain and spine disorders. *US News & World Report* ranked YNHH as among the best hospitals for neurological and neurosurgical care in the nation. Patients from throughout Connecticut and beyond seek these specialized services.

YNHH created an intensivist model in its Neurosurgical Intensive Care Unit (NICU), making it the first fully intensivist staffed unit in Connecticut. The NICU offers 14 beds and is almost always fully occupied. This unit offers critical care medicine to a wide range of patients suffering from such conditions as brain tumors, intracerebral hemorrhages, severe strokes, subdural and epidural hematomas, and neurological infections.

Computed Tomography (CT) imaging has increasingly become a valuable and necessary diagnostic modality for critically ill neurological and neurosurgical patients. The current practice at YNHH requires these critically ill patients to be transported from the intensive care unit to the Radiology Department to receive a CT scan. Most patients are being mechanically ventilated, have invasive monitoring, and are receiving multiple intravenous medications. They must be transported in their hospital bed, a process which requires multiple staff,

including the patient's nurse and a respiratory therapist, and often must occur during night time hours when the CT scanners have availability, but staffing levels are lower. This process creates risks to patient safety and many logistical difficulties for clinical staff. For example, my subarachnoid hemorrhage (SAH) patients are critically ill with invasive brain monitoring and intensive hemodynamic support. The results of CT imaging are required to inform therapeutic decision-making that often involves an emergent trip back to the neurovascular suite for a life-saving intervention.

As CT technology has continued to advance and improve, there is now an opportunity to provide mobile CT scanning at the patient's bedside in the intensive care unit. Patients no longer have to be transported, clinicians do not have to leave the unit, and scans can be safely and effectively obtained. This technology is more frequently being offered by leading neuroscience centers around the United States and represents a significant improvement to patient care.

I strongly support YNHH's CON application to acquire a NeuroLogica CereTom portable CT scanner for its critically ill neurologic and neurosurgical patients. The addition of this technology will significantly improve patient care, reduce the risk of morbidity due to complicated patient transport, and will improve the working environment for clinical staff. YNHH is a state-wide resource for the most complex neuroscience care and such technology is essential.

Thank you for your time and attention and I urge you to approve YNHH's CON application.

Sincerely,

Charles C. Matouk, M.D.

Charles C. Matouk, M.D.
Assistant Professor of Neurosurgery
And of Diagnostic Radiology

Yale University
School of Medicine
Department of Neurosurgery
P.O. Box 208082
New Haven, CT 06520-8082

Tuesday, November 27, 2012

Lisa Davis, MBA, BSN, RN
Deputy Commissioner
Office of Health Care Access
Department of Public Health
410 Capitol Avenue, MS#13HCA
PO Box 340308
Hartford, CT 06134

Dear Deputy Commissioner Davis:

I am writing in support of Yale-New Haven Hospital's (YNHH) Certificate of Need (CON) application to acquire a NeuroLogica Ceretom Mobile CT scanner for neurological imaging of critically ill patients at the hospital. I work as a neurosurgeon at Yale – New Haven Hospital and an Assistant Professor of Neurosurgery at the Yale School of Medicine, specializing in the treatment of brain and spinal cord injury, and brain and spinal cord tumors.

The Neuroscience Center, one of YNHH's specialty centers, offers state-of-the-art resources and physicians with specialized training and expertise in treating the most complex brain and spine disorders. *US News & World Report* ranked YNHH as among the best hospitals for neurological and neurosurgical care in the nation. Patients from throughout Connecticut and beyond seek these specialized services.

YNHH created an intensivist model in its Neurosurgical Intensive Care Unit (NICU), making it the first fully intensivist staffed unit in Connecticut. The NICU offers 14 beds and is almost always fully occupied. This unit offers critical care medicine to a wide range of patients suffering from such conditions as brain tumors, intracerebral hemorrhages, severe strokes, subdural and epidural hematomas, and neurological infections.

Computed Tomography (CT) imaging has increasingly become a valuable and necessary diagnostic modality for critically ill neurological and neurosurgical patients. The current practice at YNHH requires these critically ill patients to be transported from the intensive care unit to the Radiology Department to receive a CT scan. Most patients are being mechanically ventilated, have invasive monitoring, and are receiving multiple intravenous medications. They must be transported in their hospital bed, a process which requires multiple staff, including the patient's nurse and a respiratory therapist, and often must occur during night time hours when the CT scanners have availability, but staffing levels are lower. This process creates risks to patient safety and many logistical difficulties for clinical staff. Often, we are even unable to obtain this important imaging, as patients are too unstable for transport.

As CT technology has continued to advance and improve, there is now an opportunity to provide mobile CT scanning at the patient's bedside in the intensive care unit. Patients no longer have to be transported, clinicians do not have to leave the unit, and scans can be safely and effectively obtained. This technology is more frequently being offered by leading neuroscience centers around the United States and represents a significant improvement to patient care.

I strongly support YNHH's CON application to acquire a NeuroLogica CereTom portable CT scanner for its critically ill neurologic and neurosurgical patients. The addition of this technology will significantly improve patient care, reduce the risk of morbidity due to complicated patient transport, and will improve the working environment for clinical staff. YNHH is a state-wide resource for the most complex neuroscience care and such technology is essential.

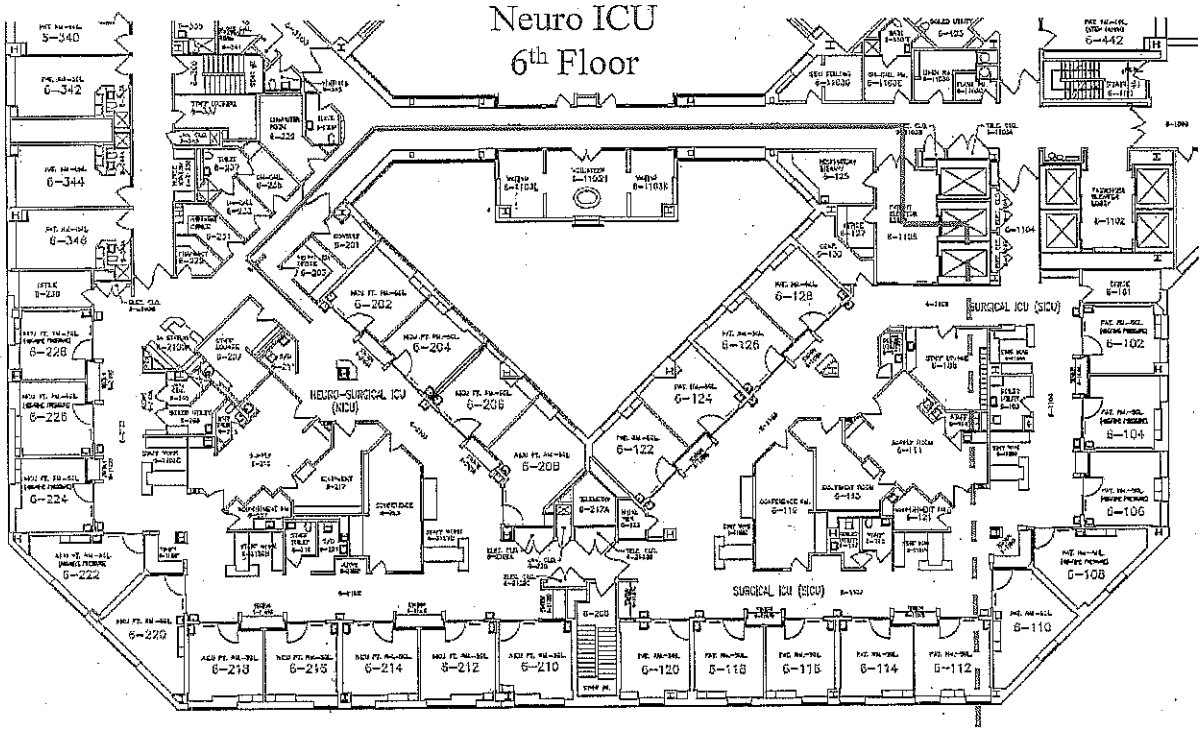
Thank you for your time and attention and I urge you to approve YNHH's CON application.

Sincerely,

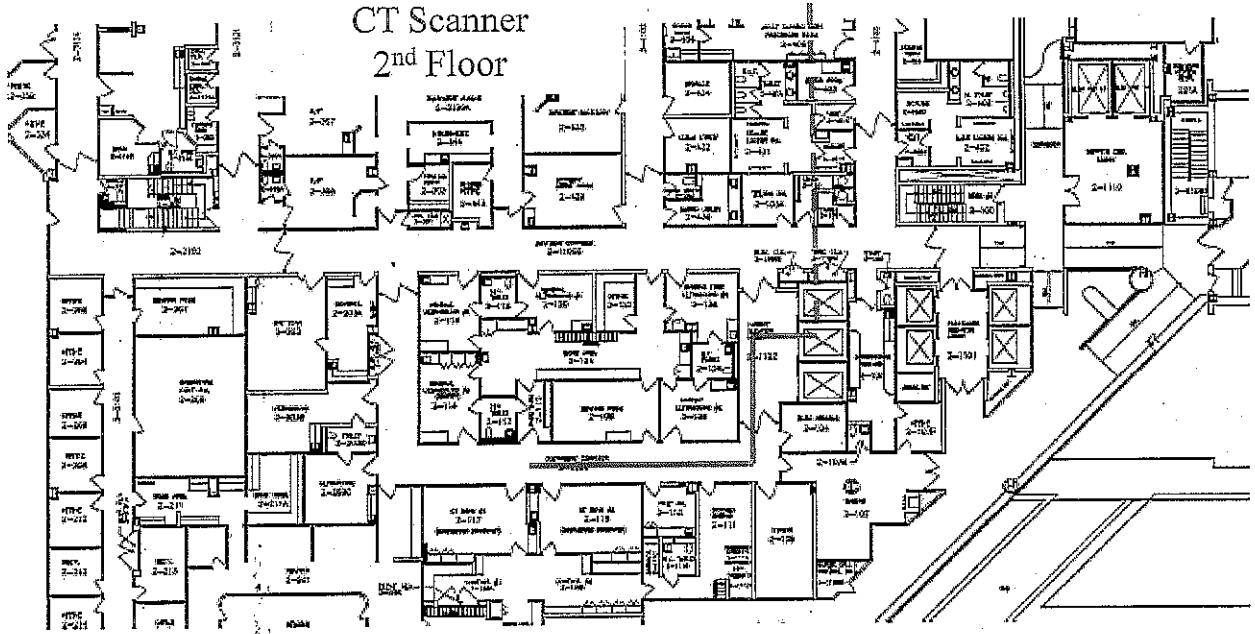
Maxwell S. Laurans, M.D., M.B.A.
Assistant Professor, Department of Neurosurgery
Yale University School of Medicine

APPENDIX II

FLOOR PLAN OF TRAVEL ROUTE



The total horizontal distance is approximately 242 feet (155 feet on SP-6 and 87 feet on SP-2). The vertical distance down from SP-6 to SP-2 is approximately 53 feet.



APPENDIX III

NICU PATIENTS BY TOWN OF ORIGIN

YNHH - Neuro ICU Patients with CT Scan
FY 2012

ZIP	TOWN	PATIENTS
06511	New Haven	29
06516	West Haven	22
06405	Branford	21
06460	Milford	20
06512	East Haven	19
06513	New Haven	18
06514	Hamden	14
06443	Madison	13
06473	North Haven	11
06519	New Haven	11
06492	Wallingford	10
06360	Norwich	9
06457	Middletown	9
06518	Hamden	9
06437	Guilford	8
06614	Stratford	8
06382	Montville	7
06477	Orange	7
06770	Naugatuck	7
06902	Stamford	7
06475	Old Saybrook	6
06478	Oxford	6
06484	Shelton	6
06515	New Haven	6
06517	Hamden	6
06790	Torrington	6
06854	Norwalk	6
06320	New London	5
06371	Old Lyme	5
06385	Waterford	5
06410	Cheshire	5
06418	Derby	5
06611	Trumbull	5
06615	Stratford	5
06705	Waterbury	5
02891	Westerly	4
06033	Glastonbury	4
06051	New Britain	4
06339	Ledyard	4
06340	Groton	4
06357	Waterford	4
06401	Ansonia	4
06461	Milford	4
06483	Seymour	4
06608	Bridgeport	4
06610	Bridgeport	4
06704	Waterbury	4
06706	Waterbury	4
06109	Wethersfield	3
06111	Newington	3

YNHH - Neuro ICU Patients with CT Scan
FY 2012

ZIP	TOWN	PATIENTS
06351	Lisbon	3
06468	Monroe	3
06488	Southbury	3
06489	Southington	3
06498	Westbrook	3
06604	Bridgeport	3
06605	Bridgeport	3
06606	Bridgeport	3
06708	Waterbury	3
06710	Waterbury	3
06716	Wolcott	3
06804	Brookfield	3
06810	Danbury	3
06811	Danbury	3
06053	New Britain	2
06066	Vernon	2
06067	Rocky Hill	2
06118	East Hartford	2
06333	East Lyme	2
06355	Stonington	2
06379	Stonington	2
06387	Plainfield	2
06412	Chester	2
06415	Colchester	2
06422	Durham	2
06450	Meriden	2
06472	North Branford	2
06525	Woodbridge	2
06607	Bridgeport	2
06712	Prospect	2
06751	Bethlehem	2
06812	New Fairfield	2
06824	Fairfield	2
06850	Norwalk	2
12522	Dover Plains	2
12581	Stanfordville	2
01259	#N/A	1
01420	#N/A	1
01610	#N/A	1
02171	#N/A	1
02359	#N/A	1
02467	#N/A	1
02481	#N/A	1
02492	#N/A	1
02864	#N/A	1
02879	South Kingstown	1
04087	#N/A	1
06001	Avon	1
06010	Bristol	1
06011	Bristol	1

YNHH - Neuro ICU Patients with CT Scan
FY 2012

ZIP	TOWN	PATIENTS
06013	Burlington	1
06018	North Canaan	1
06019	Canton	1
06021	Colebrook	1
06023	Berlin	1
06029	Ellington	1
06031	Canaan	1
06037	Berlin	1
06040	Manchester	1
06062	Plainville	1
06074	South Windsor	1
06095	Windsor	1
06098	Winchester	1
06105	Hartford	1
06107	West Hartford	1
06108	East Hartford	1
06238	Coventry	1
06242	Eastford	1
06248	Hebron	1
06250	Mansfield	1
06254	Franklin	1
06256	Windham	1
06259	Pomfret	1
06264	Scotland	1
06281	Woodstock	1
06354	Plainfield	1
06359	North Stonington	1
06365	Preston	1
06374	Plainfield	1
06378	Stonington	1
06403	Beacon Falls	1
06409	Essex	1
06413	Clinton	1
06416	Cromwell	1
06419	Killingworth	1
06424	East Hampton	1
06426	Essex	1
06438	Haddam	1
06439	Lyme	1
06455	Middlefield	1
06470	Newtown	1
06471	North Branford	1
06479	Southington	1
06480	Portland	1
06482	Newtown	1
06504	New Haven	1
06510	New Haven	1
06524	Bethany	1
06540	New Haven	1
06702	Waterbury	1

YNHH - Neuro ICU Patients with CT Scan
FY 2012

ZIP	TOWN	PATIENTS
06750	Litchfield	1
06759	Litchfield	1
06762	Middlebury	1
06786	Plymouth	1
06793	Washington	1
06795	Watertown	1
06798	Woodbury	1
06801	Bethel	1
06825	Fairfield	1
06855	Norwalk	1
06877	Ridgefield	1
06880	Westport	1
06883	Weston	1
06901	Stamford	1
06906	Stamford	1
07666	#N/A	1
10019	#N/A	1
10509	North Salem	1
10512	Carmel	1
10598	Yorktown	1
10805	New Rochelle C.	1
11205	#N/A	1
11238	#N/A	1
12501	Amenia	1
28277	#N/A	1
32137	#N/A	1
76310	#N/A	1
94002	#N/A	1
FOREIGN	FOREIGN	1
TOTAL		578

APPENDIX IV

ARTICLES

The Use of a Portable Head CT Scanner in the Intensive Care Unit

Kaitlin Peace, Eileen Maloney Wilensky, Suzanne Frangos, Eileen MacMurtrie, Elizabeth Shields, Marianne Hujcs, Joshua Levine, Andrew Kofke, Wei Yang, Peter D. Le Roux

ABSTRACT

Transport of critically ill intensive care unit (ICU) patients may be hazardous. In this study, we examined the use of a portable head CT scanner (CereTom®) in the ICU to assess its feasibility, safety, and radiological quality. Two hundred and twenty-five portable head CT scans were obtained from 114 patients (mean age = 57 ± 18 years) treated in a neurosurgical intensive care unit at a university-based Level I trauma center. Patient radiological and ICU records were retrospectively reviewed. The vast majority of portable CT scans were performed after an intracranial procedure (24%) due to neurological deterioration (16%) or in routine follow-up (16%). Diagnostic quality was judged to be adequate, and no scans needed to be repeated because of poor quality. No scans were complicated by accidental disconnection of an intravenous line. In ventilated patients, there were no interruptions in mechanical ventilation and no inadvertent extubations. In addition, continuous intracranial monitoring, when in use, remained connected. The average total time to perform a portable head CT scan was 19.5 ± 3.5 min. The actual scan time was 2.5 ± 0.7 min. These results suggest that the portable CT scanner (CereTom®) is feasible, easy to use, and safe and provides adequate radiological quality for diagnostic decisions.

The management and prevention of secondary neuronal injury is important in modern neurocritical care. Follow-up head CT (HCT) scans are frequently used to identify patients at risk for secondary neuronal injury and have become a necessary part of the care of severely brain-injured patients and patients in intensive care unit (ICUs; Chang, Meeker, & Holland, 2006; Dharap, Khandkar, Pandey, & Sharma, 1990). Follow-up HCTs may be obtained emergently when there is a decline in neurological function or as a part of routine care and generally involve transport of severely ill patients from the ICU to the CT suite in the radiology department.

Transport of a patient to and from the ICU is associated with risks, including unexpected events that may compromise patient safety or outcome (Andrews, Piper, Dearden, & Miller, 1990; Bercault, Wolf, Runge, Fleury, & Boulain, 2005; Papson, Russel, & Taylor, 2007). Complications associated with intrahospital transport (IHT) may occur in as many as two thirds of patients. Approximately half of the incidents appear to be patient related and half are equipment related (Doring, Kerr, Lovasik, & Thayer, 1999; Lovell, Mudaliar, & Klineberg, 2001; Smith, Fleming, & Cernaianu, 2000; Waydhas, 2001). Furthermore, transporting patients out of the ICU may leave critically ill patients at risk in remote hospital locations where there are fewer resources or in circumstances where support needs to be delivered emergently. We have observed that IHT can adversely affect brain oxygen

Kaitlin Peace is a research assistant in the Neurosurgery Clinical Research Division, Department of Neurosurgery, The Hospital of the University of Pennsylvania, Philadelphia, PA.

Eileen Maloney Wilensky, MSN ACNP-BC, is a director in the Neurosurgery Clinical Research Division and in the Mid-Level Provider Program, Department of Neurosurgery, The Hospital of the University of Pennsylvania, Philadelphia, PA.

Suzanne Frangos, RN, is a research nurse in the Neurosurgery Clinical Research Division, Department of Neurosurgery, The Hospital of the University of Pennsylvania, Philadelphia, PA.

Questions or comments about this article may be directed to Eileen MacMurtrie, MSN ANP-BC, at macmurte@uphs.upenn.edu. She is a nurse practitioner in the Department of Neurosurgery, The Hospital of the University of Pennsylvania, Philadelphia, PA.

Elizabeth Shields, BSRT(R)(CT), is lead CT scan technologist in the Department of Radiology, The Hospital of the University of Pennsylvania, Philadelphia, PA.

Marianne Hujcs, MSN, is a clinical nurse specialist in the Neuro-Trauma ICU, The Hospital of the University of Pennsylvania, Philadelphia, PA.

Joshua Levine, MD, is an assistant professor of neurology at the Department of Stroke and Neurocritical Care Division, The Hospital of the University of Pennsylvania, University of Pennsylvania School of Medicine, Philadelphia, PA.

Andrew Kofke, MD, is a professor in the Departments of Neurosurgery, Neurology, and Anesthesiology and Critical Care, The Hospital of the University of Pennsylvania, University of Pennsylvania School of Medicine, Philadelphia, PA.

Wei Yang, PhD, is an instructor of biostatistics in the Department of Biostatistics and Center for Clinical Epidemiology and Biostatistics, University of Pennsylvania School of Medicine, Philadelphia, PA.

Peter D. Le Roux, MD, is an associate professor in the Department of Neurosurgery, The Hospital of the University of Pennsylvania, Philadelphia, PA.

Portable CT scanners that produce high-resolution, high-quality images comparable to those generated by nonportable machines are now available for routine use in intensive-care settings.

(Swanson et al., in press). Transport of patients within the hospital to the radiology suite also is associated with logistical and safety issues and may require a significant amount of care provider time. Together, these various factors can increase the risk of secondary neuronal injury.

Although patient risk can be reduced with increased staffing, careful planning, and use of appropriate equipment, unexpected complications remain common during IHT; when they do occur, they may be difficult to treat (Lahner et al., 2005; Warren, Fromm, Orr, Rotello, & Horst, 2004). Consequently, point-of-care testing may be appropriate for some patients because it may decrease the time needed for critical decision making, reduce adverse clinical events, and contribute to economic savings (Kendall, Reeves, & Clancy, 1998; Halpern et al., 1998). Portable HCT scanners allow an HCT to be performed at the patient's bedside and are an excellent example of point-of-care testing that potentially reduces time delay in critical decision making and intervention and reduces the risks of IHT (Gunnarsson et al., 1999). Newer portable scanners that have become available in North America in recent years can now produce high-resolution, high-quality images that are comparable with standard scanners. In addition, portable scanners can now support non-enhanced and enhanced imaging, CT angiography (CTA), and bolus contrast perfusion as well as Xenon CT blood flow studies, increasing their versatility and use in the neuro ICU (NICU). A portable CT scanner recently was introduced to our ICUs. A descriptive review was performed to examine its use. The goals of this study were to examine feasibility, indications, radiological quality, staff involvement, time to perform a scan, and radiation safety.

Methods

Patient Population

Patients admitted to the Hospital of the University of Pennsylvania, a Level I trauma center and a certified Joint Commission Primary Stroke Center, who received portable CT scans within the NICU, trauma surgical ICU (TSICU), or cardiothoracic surgical ICU (CTSICU) were included in this analysis. Approval for the study was obtained from the institutional review board; consent was waived. The patients were studied retrospectively between February 26, 2007, and June 21, 2007, a period that corresponded to the introduction of portable CT scanning to the ICUs and as required by the institution's New Technology Committee to examine the feasibility of portable CT scanning. Patients underwent a portable HCT scan at the discretion of their treating physician on the basis of clinical presentation and necessity. The treatment protocol for portable HCT scans at our center includes the following: (a) a neurological decline after a craniotomy, (b) a suspected postoperative hemorrhage, (c) follow-up imaging after acute traumatic brain injury, and (d) an ICU patient who experiences acute neurological decline and is a high transport risk, for example, mechanical ventilation, administration of vasopressors, or cerebral and/or hemodynamic monitoring.

Portable HCT Scan

Patients were examined using the CereTom® portable eight-slice CT scanner (NeuroLogica Corporation, Danvers, MA), a high-speed, lightweight device that runs on batteries and is charged from a standard three-prong (100y) outlet. The following parameters were used for this study: 120 kV, 7 mA, standard sharpness, and standard resolution (4-s scan), CTDIw = 80 mGy. Three 5-mm axial sections were acquired per 4-s scan to a maximum of 46 images total, and an additional reconstruction at 2.5-mm intervals was typically performed after initial data acquisition. Since this study was completed, we now use low-dose resolution (2-s scan) to decrease radiation exposure. Although this increases image noise, it is still sufficient for image interpretation in the ICU. The scanner also is capable of performing CTA and bolus contrast CT perfusion studies as well as Xenon CT perfusion. The scanner was available for use Sunday through Saturday between the hours of 7:00 a.m. and 3:30 p.m., when CT technical support was available in the ICU.

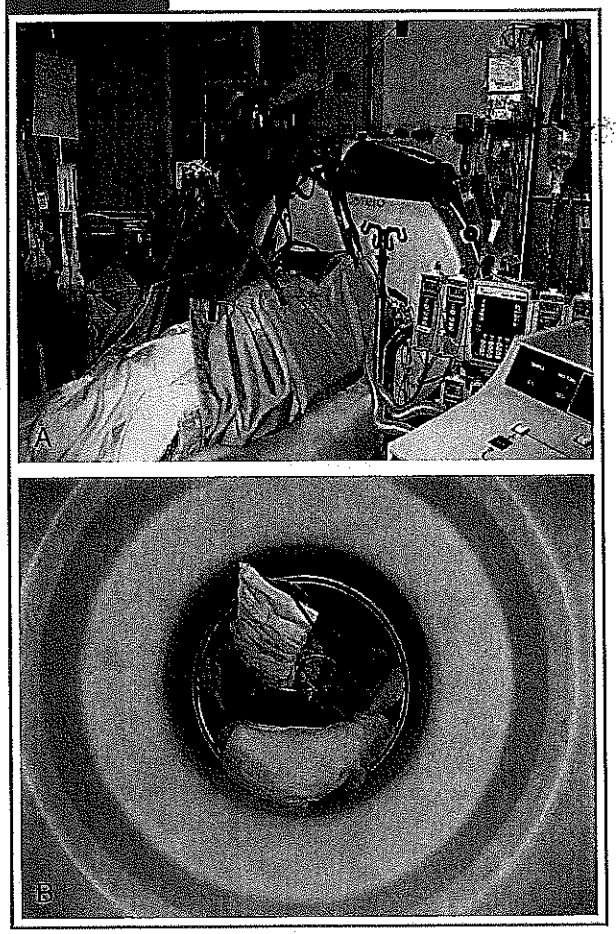
Bedside Scan Preparation

The charge nurse and the CT technologists developed a patient order list for portable CT scans after morning rounds. Two technologists then retrieved the portable CT scanner from the ICU storeroom. The patient's data were loaded onto the acquisition screen of a laptop connected remotely to the portable scanner, and the scanner was brought to the patient's room. The ICU nurse assisted with patient set up, which required the portable scanner to be placed according to the furniture arrangement in each individual room to be minimally intrusive. The patient's head of bed was

oriented toward the ventilator to reduce the risk of extubation. Similarly, intravenous pumps and tubing, multimodality brain monitors, ventilator tubing, Foley catheters, and lower leg compression devices were carefully aligned to prevent inadvertent disconnection.

The patient was placed in supine position, and a bed extension with a cradle for the head was attached to the bed. A lift system (GH2; Guldmann Inc., Tampa, FL) was used to lift the patient and lower them onto the bed extension (Figure 1A). The scanner gantry was lined up with the cradle and slid into place up to the cervical spine. The scanner position was checked with a laser, and a lead shield was placed over the open end of the device. Scans were initiated from the laptop outside the patient's room. The radiologic technicians (RTs) informed all ICU staff in the immediate area that a CT scan was about to begin, and all staff exited the patient's room. The scanner performed two slices per rotation then automatically slid into place for the next series of slices. Neurointensivists were able to view images in real time from the laptop and make immediate management decisions. The images were then uploaded directly to the hospital's picture archiving and communication system after study completion. The scanner was moved out of the room, and the patient's bed was returned to its normal position. Intravenous lines connected to the patient were checked for entanglement or disconnection. The scanner was readied for the next patient or returned to the storeroom for recharging.

FIGURE 1 Portable CT Scanners in Use



Note. (a) ICU patient being lifted into the portable CT scanner while he remains connected to his monitors, ventriculostomy, and multiple infusion pumps. (b) A patient with multiple intracranial monitors that fit easily into the portable HCT scanner.

Data Collection

Data for each scan were retrieved from the portable CT scan log. Clinical information including gender, age, admission Glasgow Coma Scale (GCS), admission diagnosis, GCS at the time of scan, rationale for the scan, and scan outcome was collected retrospectively from ICU flow sheets completed by nursing staff. For this study, individual patient scans were reviewed in the picture archiving and communication system by the treating physicians, judged for diagnostic quality, and compared with the original report generated by the radiologists at the time of the scan.

ICU Staff Survey

ICU nursing staffs, physicians, and RTs from the NICU, CTSICU, and TSICU were surveyed about portable CT scanner use. Each member of the ICU staff and the CT portable technician team were asked to complete a seven-question survey. Healthcare providers were made aware of the survey through a mass e-mail. The survey was conducted over 10 days.

Results

Patient Population

Between February 26, 2007, and June 21, 2007, 225 portable HCT scans were obtained from 114 patients. This represented 27% of all HCT scans performed on NICU, CTSICU, or TSICU patients during the same period. There were 65 men and 49 women with a mean age of 57 ± 18 years. Table 1 lists patients' admission GCS and diagnosis. One hundred and six patients (93%) had undergone a surgical procedure.

Patients and CT Scans

Seventy-three patients (64%) received one portable HCT scan, 18 patients (16%) received two scans, 9 patients (8%) received three scans, and 14 patients (12%) received more than three scans during their ICU stay. Four Xenon CT perfusion scans were performed using the portable scanner during the study period. The clinical indications for the portable HCT scans are listed in Table 2. Intracranial monitors used to measure intracranial pressure including ventriculostomies or Camino intracranial pressure monitors (Integra Neuroscience, Plainsboro NJ), brain oxygen (LICOX, Integra Neuroscience), microdialysis catheters (CMA-70 microdialysis probes and CMA 106

TABLE 1. Admission Clinical and Diagnostic Characteristics of the Patients Included in This Analysis (N = 114)

Admission Diagnosis		Patients	GCS 3–8	GCS 9–12	GCS 13–15
Neurologic	Subarachnoid hemorrhage	17	5	4	8
	Tumor	15	1	–	14
	Traumatic brain injury	13	10	1	2
	Subdural hematoma	10	–	2	8
	Stroke	8	3	3	2
	Intracerebral hemorrhage	7	3	3	1
	Intraparenchymal hemorrhage	3	1	2	–
	Encephalitis	2	–	–	2
	Amyloid bleed	1	1	–	–
	Arterial venous malformation	1	–	–	1
	Cerebral aneurysm	1	–	–	1
	Hydrocephalus	1	–	–	1
	Left hemifacial spasm	1	–	–	1
	Status epilepticus	1	–	1	–
	Vertebral artery dissection	1	1	–	–
Cardiac	Congestive heart failure	6	2	–	4
	Aortic dissection	5	2	2	1
	Myocardial infarction	3	–	1	2
	Coronary artery disease	2	–	–	2
	Thoracic aortic aneurysm	2	–	–	2
	Other (cardiac)	7	1	1	5
Other		7	1	2	4
Total		114	31	22	61

Note. GCS = Glasgow Comal Scale.

perfusion pump; CMA, Stockholm, Sweden), and scalp electrodes for continuous electroencephalogram easily fit into the portable CT scan opening (Figure 1B). During portable HCT scanning, continuous intracranial and systemic monitoring was continued without interruption in each patient. No scans were complicated by accidental disconnection of an intravenous line or disconnection from mechanical ventilation.

CT Scans

The average total time to perform a portable HCT scan (from CT scan setup by the technician, patient preparation, to completion of the scan and equipment removal) was 19.5 min and ranged from 17 to 22 min. The median actual scan time was 2.5 min (range = 2–3 min). The remaining time was required for room and patient setup, and this usually required two RTs and one ICU nurse. Five patients can be scanned consecutively before the portable scanner loses power. However, if the device is plugged into a standard electrical outlet between scans, more patients can be scanned in a given period.

Radiation

Radiation was emitted from the portable scanner at an angle of 45° and spread outward 10 ft. During a scan, the radiation dose to the patient's head was 0.025 μSv. Measurements taken at 6 and 10 ft away in front of the scanner demonstrated radiation exposure free-in-air of 50 and 139 μR, respectively (129 kVp at 7 mA for 3 min). Radiation badges worn the first year demonstrated that staff were not exposed to radiation; thus, staff are no longer required to wear the badges.

Radiological Findings

The radiological findings described at the time of the scan are listed in Table 3. Management changes were made after 108 (48%) of the portable HCT scans that were obtained. Post hoc blinded review of all CT scans by an independent neurosurgeon or agreed with the original diagnosis described by the radiologist in 197 scans (88%). The differences were largely semantic, for example, "subacute versus evolving infarct." None were clinically significant or altered management. Two hundred and sixteen scans (96%) were

TABLE 2. Rationale Behind Each of the Portable HCT Scans Performed in This Analysis (*N* = 225)

Reason for Scan	No. Patients (%)
After central nervous system surgery	54 (24)
Mental status change	37 (16)
Follow-up	36 (16)
Cerebral edema	24 (11)
Suspected hydrocephalus	18 (8)
Suspected bleed	17 (8)
Cerebral infarct localization	16 (7)
Ventriculostomy placement/ replacement	7 (3)
Head trauma	6 (3)
Licox placement/replacement	4 (2)
Suspected subdural hematoma	4 (2)
Aneurysm/after angiogram	1 (0.4)
Seizures	1 (0.4)

judged to be of adequate quality for diagnostic use. No patient required transport to the radiology suite because an image was unclear on portable CT.

Survey on Use of Portable HCT Scan in the ICU

Seventy-three surveys were completed. Respondents included 13 RTs (18%) who support the portable CT program, 4 physician providers (5.5%), 4 nurse practitioners (5.5%), 2 respiratory therapists (2.7%), 48 ICU nurses (66%), 1 nurse manager (1.4%), and 1 certified nurse's aid (1.4%). Twenty-one surveys (29%) were returned from the NICU, 19 (26%) were returned from the CTSICU, and 18 (25%) were returned from the TSICU. Two hundred and twenty-nine nurses work in these three ICUs; that is, 21% of possible nurse respondents replied. Two physicians and 13 RTs circled all three ICUs because they care for patients across the hospital's ICUs. The results of the survey are listed in Table 4.

Case Studies

Case 1

A 22-year-old man was admitted to the emergency department after a motorcycle accident. His admission GCS was 3 and the initial emergency department HCT scan revealed right frontal and temporal contusions, bilateral subdural hemorrhages, and a subarachnoid hemorrhage (Figure 2A). The patient was admitted to the NICU for observation and follow-up. A portable HCT scan was obtained after an intracranial monitor was placed. The evolution of traumatic intracranial hemorrhage was easily assessed (Figure 2B).

Case 2

A 62-year-old woman was admitted to the hospital with an acute loss of consciousness and a left hemiparesis. Admission HCT revealed a large right centrum semiovale intracerebral hematoma and intraventricular hemorrhage (Figure 3A). A craniotomy was performed, the hematoma was partially evacuated, and a right frontal ventriculostomy was placed. A portable HCT scan was performed postoperatively (Figure 3B), documenting the partial evacuation of the hematoma, the location of the ventriculostomy, and the evolution of intraventricular hemorrhage and hydrocephalus.

Discussion

In this descriptive review, we examined the initial use of a portable HCT scanner in the ICU. We reviewed the first 225 portable HCT scans and found that the scans could be performed on a routine basis, and in a short time, radiological quality was adequate and complications were rare. Physicians caring for the patients believed that the radiological quality was adequate for bedside clinical decision making. Furthermore, use of the portable CT scanner meant that no patient required disconnection from a ventilator or intracranial monitors to undergo an imaging study. Our experience has encouraged us to increase the time that the portable CT scanner is available for use and to implement its use in other ICUs.

TABLE 3. Radiological Findings for Each of the Portable HCT Scans Performed (*N* = 225)

Radiological Findings	No. Scans (%)
Postoperative changes	53 (24)
No interval change	40 (18)
Hemorrhage/hematoma	39 (17)
No new pathology found	26 (12)
Worsening/resolving hydrocephalus	19 (8.4)
Infarct	15 (6.7)
Edema	13 (5.8)
Ventriculostomy placement	5 (2.2)
Licox placement	4 (1.8)
Ischemia	3 (1.3)
Ventriculostomy removal	2 (0.9)
Mass	2 (0.9)
Follow-up pathology	2 (0.9)
Hygroma	1 (0.4)
Device placement check	1 (0.4)

Study Limitations

This is a purely descriptive study of our initial experience with a portable CT scanner. Consequently, there was a learning curve associated with its use as we developed protocols. The data do not allow us to conclude that portable CT scanner use is associated with fewer secondary cerebral insults or better patient outcome. However, because we did not need to disconnect patients from their ventilators or intracranial monitors and did not observe any inadvertent disconnection of intravenous lines, we expect that the risk of secondary cerebral insults will be reduced. At the time of the study, we lacked the radiological support required to perform CTA; therefore, we were not able to evaluate the feasibility of this type of scan. This study was conducted over a short period, and scans were

TABLE 4. Responses to Survey on Portable HCT Scan Use

Question	No. response (%)
Do you think portable head CT scanning improves patient care?	
Yes	69 (95)
No	1 (1.4)
Sometimes	2 (2.7)
Don't know	1 (1.4)
Do you prefer portable head CT scans or transporting a patient to the CT suite?	
Portable	54 (74)
Transport	10 (14)
Depends on patient	4 (5.5)
Both	2 (3)
Unsure	2 (3)
No response	1 (1)
What do you like about portable head CT scanning? (n = 125 responses)	
Safety	24 (19)
Convenience	18 (14)
Promptness of scanning	17 (14)
Less patient movement	17 (13.6)
"Safer" for the hemodynamically unstable patient	14 (11.2)
Do not take staff away from the ICU	13 (10.4)
Able to maintain the resources of the critical care environment	12 (9.6)
What do you dislike about portable head CT scanning? (n = 93 responses)	
No limiting factor	9 (10)
Lack of 24/7 portable HCT availability	18 (19)
Image quality	8 (9)
Arranging the room	17 (18)
Time needed for set up	3 (3)
Concern for radiation exposure	6 (7)
Multimodality monitoring access concerns	1 (1)
Communication between the unit and the RT staff	9 (10)
Maneuvering bulky equipment around an ICU	9 (10)
Risk of injury to staff member	4 (4)
Potential for equipment abuse in locations outside the CT suite	3 (3)
Are you aware of literature about portable head CT scans and/or intrahospital transport?	
Yes	17 (23)
No	53 (73)
No response	3 (4)

Note. Percentages represent number of surveys completed (N = 73) unless otherwise noted.

FIGURE 2 Portable CT Scans in Case 1

Note. (a) Unenhanced HCT scan performed in the emergency room (Siemens Sensation 16) showing the right frontal and temporal contusions, the bilateral subdural hemorrhages, and a subarachnoid hemorrhage (Case 1). (b) Unenhanced portable HCT scan showing evolution of right frontal pathology (Case 1).

obtained during regular working hours. Whether the same results would be obtained over a longer period of evaluation or during "off" hours is not known. Finally, this study was conducted at a single center and so lacks external validity.

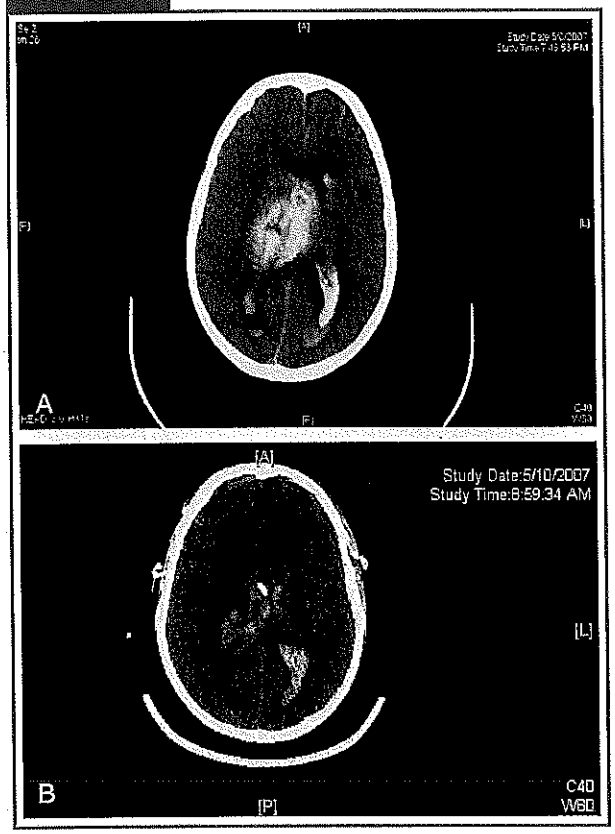
Intrahospital Transport

Technical mishaps, including inadvertent ventilator disconnection and problems with monitoring equipment, have been associated with IHT, and greater than 50% of IHTs involve some difficulty during transport that is either patient or equipment related (Doring et al., 1999; Lovell et al., 2001). Even the shortest transports can have an adverse effect on patient outcome or lead to unexpected events that may compromise patient care (Andrews et al., 1990; Bercault et al., 2005; Papson et al., 2007). In our own center, 157 transports of critically ill patients requiring HCT scans were recorded, and the average time of transport was 47 min with transport times ranging from 20 to 240 min. IHT is a well-known risk factor that can exacerbate the pulmonary function of intubated patients because of disconnection from a ventilator (Marx et al., 1998; Szem et al., 1995; Waydhas, Schneck, & Duswald, 1995). Our own audit process demonstrated an increased risk for hyperventilation associated with excessive manual bagging resulting in a decrease in arterial PCO_2, which can then adversely affect brain oxygenation ($PbtO_2$); this deleterious effect is greater when $PbtO_2$ is already compromised (Swanson et al., in press). A recent study compared the incidence of ventilator-associated pneumonia in patients transported outside the ICU with patients that did not undergo IHT. Although both populations had similar mortality rates, the transported group had a higher incidence of ventilator-associated pneumonia (Bercault et al., 2005). Together, these events during IHT may contribute to secondary neuronal injury.

The Potential Benefits of Portable HCT Scans

There are several inherent advantages to portable CT scanners that may benefit the patient, the staff, and the hospital. First, point-of-care technology, unlike IHT, means that the patient remains in their bed and care is not interrupted. This includes continuous intracranial

FIGURE 3 Portable CT Scans in Case 2



Note. (a) Unenhanced scan obtained in the emergency room (Siemens Sensation 16) showing a large right centrum semiovale intracerebral hematoma and an intraventricular hemorrhage (Case 2). (b) Unenhanced portable CT scan showing evolution of intracerebral hematoma, vasogenic edema, and placement of ventricular catheter (Case 2).

monitoring and no change in ventilator support. This may be an important factor in reducing secondary cerebral insults because IHT may be associated with a compromise in lung function or oxygenation. Furthermore, the technological advancements in portable HCT scanners mean that high-quality Xenon CT perfusion, contrast enhanced, and CT angiograms can also be obtained at the bedside. This increased diagnostic capability can help guide patient care. Second, new treatments may be initiated sooner because the treating physicians can rapidly diagnose new radiological findings and review these at the bedside. Third, staff satisfaction can be increased because ICU nurses remain in a safe and controlled environment with their patients (Gunnarsson et al., 1999). In addition, there may be fewer staff injuries associated with moving patients and, particularly with critically ill patients, the equipment needed during transport. Fourth, there may be an economic benefit independent of any effect on patient outcome. For example, fewer staff is needed to perform the portable CT scan, ICU nurses do not leave other patients, and there may be fewer staff injuries.

Conclusions

Review of our initial experience using a portable CT scanner suggests that it is easy to implement, feasible, and safe. In addition, we found that healthcare providers quickly embraced the technology, and most preferred using a portable HCT scan because they believed that it improved patient safety. There was an initial learning curve of approximately 1 month, and this was facilitated by close communication and teamwork between the radiology staff and technicians, the ICU nurses, and the treating physicians. In addition, the design of standard protocols has facilitated easy implementation of portable HCT scan use. Further study will be necessary to determine if portable CT scans make a difference in patient outcome and in ICU nurse safety. However, it is our belief that portable CT scanning should improve patient care because enhanced patient safety is likely to result from use of this point-of-care technology.

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LETTER TO THE EDITORS

Cerebral computed tomography perfusion at the bedside using a portable CT scanner: report of two cases

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Dear Sirs,

Patients with symptoms of acute cerebral infarction require prompt diagnostic evaluation in order to determine appropriate treatment. In cases of ongoing ischemia, computed tomography perfusion (CTP) can be a useful adjunct to non-contrast CT and computed tomography angiography (CTA) for evaluation of tissue at risk [1, 2]. Traditionally, obtaining a CTP study has required transporting the patient from the ER or inpatient setting to the radiology department for a scan on a conventional fixed CT scanner. Often, patients with acute strokes are unstable, and transporting them away from the ICU can pose unnecessary health risks. With the development of a portable head and neck CT scanner, bedside head CT has become a common practice in critically ill patients and has been shown to be a feasible, safe and reliable technique, providing adequate radiological quality for diagnostic decisions [3–5]. Computed tomography angiography and perfusion can also be obtained efficiently at bedside.

The portable CTP is obtained with repetitive scanning at one selected slice position during injection of nonionic contrast through a portable injector. After a delay of 5 s during which contrast is injected, a continuous acquisition is obtained using 100 kV, 7.5 mA at 10 mm thick slices, over a period of 45 s. Images are then transferred from the scanner to a laptop for display. The CTP maps, including relative mean transit time (rMTT), relative cerebral blood volume (rCBV) and relative cerebral blood flow (rCBF), are post-processed on the laptop using the advanced visualization custom solution software Voxar 3D. The approximate radiation dose for the entire perfusion scan is about 380 mGy, which is less than the dose from a typical CTP study performed on a conventional scanner (approximately 500 mGy). Due to recent concerns about radiation dosages in CTP studies on conventional scanners [6], the portable CT scanner has a scan time limit of 60 s for the CTP and the maximum scan voltage cannot exceed 100 kV. Personnel are advised to stand at least 3 feet away from the scanner and the radiation dose is negligible at this distance.

We report two cases of a portable CTP (CereTom) used for the assessment of patients with acute cerebral ischemia in the ICU setting.

The first patient was a 56 year old woman with a 1-day history of acute onset of left hemiparesis. MRI of the head showed an acute right basal ganglia infarct and chronic infarcts involving the right parietal lobe and caudate nucleus. Conventional CTA of the head and neck showed a right MCA occlusion. CTP demonstrated a prolonged rMTT, decreased rCBF involving most of the right MCA territory with a smaller area of involvement on rCBV. Due to the large area of potential ischemia, the patient was transferred to the ICU for further monitoring and treatment. A follow-up CT, CTA and CTP performed 3 days after admission using the portable CT scanner did not show any progression of the infarct and continued to show occlusion of the proximal right MCA and a perfusion mismatch (Fig. 1). The patient continued to be intermittently symptomatic, requiring a superficial temporal artery to middle cerebral artery bypass with resolution of ischemic symptoms.

The second patient was a 50 year old man admitted to the hospital for a right superficial temporal artery-middle cerebral artery bypass for treatment of a symptomatic right internal carotid artery occlusion. Patient also had severe stenosis of the left supraclinoid internal carotid artery.

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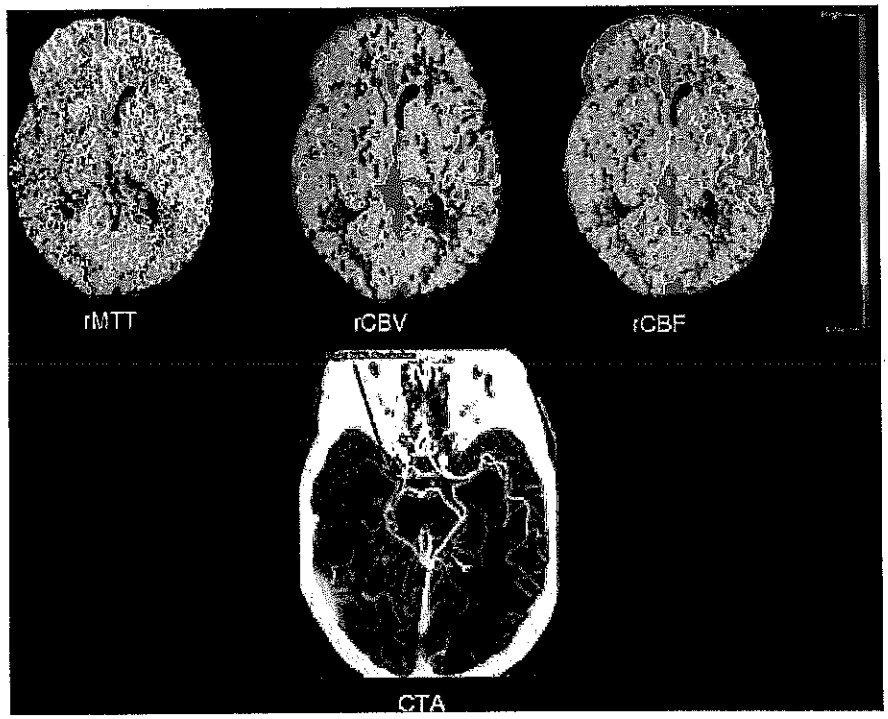

Fig. 1 Portable CTP (*top*) showing a prolonged rMTT, decreased rCBV and decreased rCBF involving most of the right MCA territory. CTA (*bottom*) showing right MCA occlusion just distal to its origin

On the second postoperative day, the patient developed two transient episodes of aphasia and right arm weakness. MRI of the brain did not show any acute infarcts. CTP performed at the bedside showed a prolonged rMTT, normal rCBV and rCBF in the left temporal lobe. The patient was treated with bedrest, pressors and antiplatelet agents with resolution of the symptoms.

In recent years, CTP and CTA have proven to be useful in the evaluation of acute strokes, and can be performed in less time than a standard MRI or MRA [7, 8]. The advent of portable CT scanners with CTP and CTA capabilities has made it more convenient to assess patients with acute strokes in the emergency room or inpatient setting.

The CTP studies obtained with the portable CT scanner in our two ICU patients demonstrated areas of cerebral hypoperfusion. The CTP maps were of sufficient quality to diagnose the areas of ischemia in both patients. In patient 1, the portable CTP confirmed the areas of cerebral hypoperfusion seen on the initial study that had been done a few days earlier on a conventional CT scanner; while in patient 2, the portable CTP showed a new area of potential ischemia which corresponded to the patient's acute symptoms.

In conclusion, our findings suggest that CTP studies can be efficiently and effectively performed at the bedside using the portable CT scanner.

Acknowledgments NeuroLogica Corporation, 14 Electronics Ave., Danvers, MA is the manufacturer of the CereTom™ CT scanner. We thank the following individuals from NeuroLogica: Dr. Eric M. Bailey, Dr. Ibrahim Bechwati, and Mr. Phil Sullivan for providing the technical support for the scans.

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Experience With Use of a Second Generation Portable Head CT Scanner in the Neuroscience Intensive Care Unit

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Background

- Transportation of patients to radiology poses risks such as line displacement and ventilator circuit disconnection (1-3)
- Transportation also diverts nursing staff attention away from other patients (4)
- Most OR suites are not equipped with imaging capabilities
- Portable CT allows immediate bedside decision-making and can be used in locations where imaging is limited.
- Portable CT has historically been limited by large size and unreliability.
- We report our experience with a second-generation portable head CT machine (CereTom: NeuroLogica: Danvers, MA).

Methods

- Radiology records were reviewed to determine the number of portable head CT scans done and the location of scanning at the University of New Mexico from June, 2006- December, 2008.
- The CT technician notes were reviewed for any mention of adverse event.

Results

- 2103 portable CTs were performed
- 2045 (97%) were performed in the neuroscience intensive care unit (ICU) for an average of 2.3 neuroscience ICU CT scans per day.
- Other locations where CTs were performed included other ICUs (n=30), the operating room (n=36), the emergency department (n=1), and the angiography suite (n=1).
- Most studies (2075) were noncontrasted or Xenon enhanced head CT, though other modalities including contrasted CT (n=8) and CT angiography (n=2) were performed.
- No adverse event due directly to a scan was noted in the record.

Conclusions

- Portable head CT can be reliably and consistently be performed at the patient's bedside in the ICU as well as other locations.
- This should lead to decreased transportation related morbidity and improved rapid decision making in the ICU, OR, and other locations.
- Further studies to address this are needed.

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Portable head CT scan and its effect on intracranial pressure, cerebral perfusion pressure, and brain oxygen

Clinical article

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Object. Follow-up head CT scans are important in neurocritical care but involve intrahospital transport that may be associated with potential hazards including a deleterious effect on brain tissue oxygen pressure ($PbtO_2$). Portable head CT (pHCT) scans offer an alternative imaging technique without a need for patient transport. In this study, the investigators examined the effects of pHCT scans on intracranial pressure (ICP), cerebral perfusion pressure (CPP), and $PbtO_2$ in patients with severe brain injury.

Methods. Fifty-seven pHCT scans were obtained in 34 patients (mean age of 42 ± 15 years) who underwent continuous ICP, CPP, and $PbtO_2$ monitoring in the neuro intensive care unit at a university-based Level I trauma center. Patient ICU records were retrospectively reviewed and physiological data obtained during the 3 hours before and after pHCT scans were examined.

Results. Before pHCT, the mean ICP and CPP were 14.3 ± 7.4 and 78.9 ± 20.2 mm Hg, respectively. Portable HCT had little effect on ICP (mean ICP 14.1 ± 6.6 mm Hg, $p = 0.84$) and CPP (mean CPP 81.0 ± 19.8 mm Hg, $p = 0.59$). The mean $PbtO_2$ was similar before and after pHCT (33.2 ± 17.0 mm Hg and 31.6 ± 15.9 mm Hg, respectively; $p = 0.6$). Ten episodes of brain hypoxia ($PbtO_2 < 15$ mm Hg) were observed before pHCT; these episodes prompted scans. Brain hypoxia persisted in 5 patients after pHCT despite treatment. No new episodes of brain hypoxia were observed during or after pHCT.

Conclusions. These data suggest that pHCT scans do not have a detectable effect on a critically ill patient's ICP, CPP, or $PbtO_2$. *(DOI: 10.3171/2010.11.JNS091148)*

KEY WORDS • **brain oxygen** • **computed tomography** • **intracranial pressure**

FOLLOW-UP head CT studies are critical in the management of patients with severe brain injuries. Usually when a follow-up HCT is obtained, transport of the patient to and from the CT suite in the radiology department is necessary. However, transport of patients within the hospital is associated with logistical and safety issues including line and tube disconnections and potential aggravation of secondary injuries.[1–3,13,19] Furthermore, several lines of evidence suggest that intrahospital transport can aggravate pulmonary function or have a deleterious effect on patient outcome.[10,17,22,25]

Patient outcome after severe TBI or SAH is frequently influenced by delayed cerebral injury that develops while a patient is in the ICU. This concept of secondary neuronal injury and its prevention is central to modern TBI and SAH management.[8,18] We recently observed that patient transport to and from the ICU to obtain a follow-up head CT may reduce $PbtO_2$ in some patients and this deleterious effect is greater when $PbtO_2$ is already compromised.[21] Others have observed that glutamate and the lactate pyruvate ratio, a marker of anaerobic metabolism measured using cerebral microdialysis, can increase during hospital transport in ventilated neurotrauma patients.[15] This adverse effect of transport on intracranial physiology may be important since observational clinical studies demonstrate that compromised $PbtO_2$ is common in severe brain injury and is associated with poor outcome.[9] Furthermore, the cumulative duration of reduced $PbtO_2$ is associated with poor outcome.

It is feasible now to perform a head CT scan at a patient's bedside using a portable head CT (pHCT) scanner in the ICU[14]—patient transport is not necessary. The pHCT units that have become available in the US in recent years produce high-resolution, high-quality images comparable to those produced by standard scanners. A head CT performed at the bedside is an excellent example of point-of-care testing that can reduce the risks of intrahospital transport.[6] In this study, we examined how pHCT affects $PbtO_2$, ICP, and CPP in critically ill patients with severe brain injuries. In particular, we were interested

Abbreviations used in this paper: CPP = cerebral perfusion pressure; GCS = Glasgow Coma Scale; ICP = intracranial pressure; NICU = neuro intensive care unit; $PbtO_2$ = brain tissue oxygen pressure; pHCT = portable head CT; SAH = subarachnoid hemorrhage; TBI = traumatic brain injury.

in the effects of pHCT on $PbtO_2$, because intrahospital transport appears to have an adverse effect on $PbtO_2$ but not on ICP or CPP.[21] We hypothesized that pHCT would have little if any effect on intracranial physiology.

Methods

Patient Population

Patients admitted to the Hospital of the University of Pennsylvania, a Level I trauma center and Joint Commission–certified primary stroke center, who underwent portable head CT scans and continuous ICP, CPP, and $PbtO_2$ monitoring in the NICU were considered for this study. Patients were retrospectively identified from a prospective observational database (the Brain Oxygen Monitoring Outcome study) with institutional review board approval. Those patients who 1) had a GCS score ≤ 8; 2) had a pHCT; and 3) had at least 3 hours of $PbtO_2$ monitoring in the ICU before and after pHCT were included in this study. Patients underwent a pHCT scan at the discretion of their treating physician based on clinical presentation and necessity.

Portable Head CT Scan

Patients were examined using the CereTom portable 8-slice CT scanner (NeuroLogica Corporation). The scanner was available for use Monday through Sunday between the hours of 7:00 AM and 3:30 PM, when CT technical support was available in the ICU. Of all NICU patients who had a head CT scan during the period of this study, one-third underwent pHCT and two-thirds were transported for CT. During the pHCT, patients remained in their ICU bed and remained connected to all monitors, lines, and their ventilator. Sedation and analgesia were maintained; additional medication was not administered for the scan. For the pHCT the patient was placed in the supine position on their ICU bed, and a bed extension with a cradle for the head was attached. A lift system (GH2, Guldmann, Inc.) was used to lift the patient and lower them onto the bed extension for a pHCT.[14] The following imaging parameters were used for this study: 120 kV, 7 mA, standard sharpness, and standard resolution (4-second scan), CTDIw 80 mGy. Three 5-mm axial sections were acquired per 4-second scan to a maximum of 46 images total. The average total time to perform a pHCT scan in our ICU (from CT scan set-up by the technician and patient preparation to completion of the scan and equipment removal) is about 20 minutes.[14] The patient is in the pHCT scanner for 2–3 minutes of this time.

Intracranial Monitoring

Intracranial pressure (Camino, Integra Neurosciences), brain temperature (BT), and $PbtO_2$ (LICOX, Integra Neuroscience) were monitored continuously. Intraparenchymal probes (for ICP, BT, and $PbtO_2$) were inserted at the bedside in the NICU through a bur hole into the frontal lobe and secured with a triple-lumen bolt. The monitors were placed into white matter that appeared normal on admission head CT and on the side of maximum pathology. The function was checked according to published techniques (FiO_2 challenge and follow-up CT scan).

Physiological Measurements

The following parameters were continuously monitored before and after pHCT in each patient: 1) heart rate using 5- or 12-lead electrocardiogram, 2) mean arterial blood pressure (MABP) by radial artery catheter, 3) SaO_2 by pulse oximetry, 4) ICP, 5) brain temperature, and 6) local $PbtO_2$. Cerebral perfusion pressure was calculated from the measured parameters (CPP = MABP − ICP). Physiological parameters were recorded continuously using a bedside monitor (Component Monitoring System M1046–9090C, Hewlett Packard) linked to a computerized, multimodality data acquisition system (MP100, Biopac). In addition these physiological variables and FiO_2 and central venous pressure were recorded every 15 minutes on the ICU flow sheet. The PaO_2 and hemoglobin level were measured between 1 and 3 hours before and after pHCT scan.

Statistical Analysis

All analyses were performed using a commercially available software package, SAS version 9.1 (SAS Institute, Inc.). Data are expressed as means ± SDs unless otherwise stated. A p value < 0.05 was considered statistically significant. Physiological data from each patient obtained during the 3 hours before and after a pHCT were used. Each pHCT was considered a separate event, and each patient served as his or her own internal control at each pHCT scan. Physiological measurements and outcome $PbtO_2$ were characterized using the mean, minimum, and maximum values measured during the 3 hours before and after pHCT scan. For ICP, CPP, and $PbtO_2$, values recorded each minute were averaged every 15 minutes, and the means from each 15-minute period were calculated. The means and SDs were given for each of the defined variables. Differences between mean values 3 hours before and after a pHCT scan were evaluated using the Student t-test.

Results

Patient Population

Thirty-four patients cared for in our NICU between February 26, 2007, and December 31, 2007, are included in this study. There were 16 male and 18 female patients with a mean age of 42 ± 15 years. Twenty patients had TBI; the remaining diagnoses are listed in Table 1. Two-thirds of the patients had an admission GCS score ≤ 8; the condition of the remaining patients deteriorated while in hospital, and all patients had a GCS score ≤ 8 at the time of pHCT. Patient clinical and radiological characteristics are summarized in Table 1.

Portable Head CT Scan

A total of 57 pHCT scans were obtained in the 34 patients included in this study. This represents 10.1% of all pHCT scans obtained in NICU patients during the same time period. Eighteen patients (53%) received 1 pHCT scan, 10 patients (29%) received 2 scans, 5 (15%) patients had 3 scans, and 1 (3%) patient received more than 3 scans during the ICU stay. Fourteen pHCTs (25%)

TABLE 1: Baseline patient characteristics*

Variable	Value
no. of patients	34
mean age in yrs	42 ± 15
sex (F/M)	18:16
admission GCS score	
3–8	20 (59)
9–12	2 (9)
13–15	12 (32)
admission diagnosis	
closed head injury	15 (44)
acute subdural hematoma	4 (12)
SAH	12 (35)
intracerebral hematoma	1 (3)
gunshot wound	1 (3)
myocardial infarct	1 (3)

* Values represent numbers of patients (%) unless otherwise indicated. The mean value is given ± SD.

were obtained in routine follow-up. The indications for the remaining scans are listed in Table 2.

Intracranial Pressure and CPP

All patients were monitored continuously during their pHCTs. Intracranial pressure and CPP data were collected during the 3 hours before and after the pHCT scans and the differences were calculated (Table 3). The mean ICP (averaged during 3 hours) before and after the 57 pHCT scans was 14.3 ± 7.4 mm Hg and 14.1 ± 6.6 mm Hg, respectively ($p = 0.84$). The mean CPP before and after 57 pHCT scans was 78.9 ± 20.2 mm Hg and 81.0 ± 19.8 mm Hg, respectively. The mean, minimum, and maximum ICP and CPP values are listed in Table 3. Overall, the ICP and CPP values were similar before and after pHCT (Fig. 1).

Brain Oxygen

Mean $PbtO_2$ values for all patients 3 hours before and after pHCT are listed in Table 4. Portable head CT had little if any affect on $PbtO_2$ (Fig. 1). The average mean $PbtO_2$ values before and after pHCT, for all 57 scans, were 33.2 ± 17.0 mm Hg and 31.6 ± 15.9 mm Hg, respectively ($p = 0.6$). While there were small decreases in mean, minimum, and maximum $PbtO_2$ after some pHCT scans, none were significant, and overall there was a small increase in $PbtO_2$ when all pHCTs were considered (Table 4). The $PbtO_2$ values were similar whether the pHCT was obtained routinely or was clinically indicated.

Brain Hypoxia

Ten episodes of brain hypoxia ($PbtO_2 < 15$ mm Hg) were observed in the hour before a pHCT (17.5% of scans). These episodes of brain hypoxia, in part, prompted the head CT. During pHCT patients received treatment for the reduced $PbtO_2$; in 5 instances the hypoxia persisted after the scan was completed. No new events of brain hypoxia were seen as a result of the portable CT studies.

TABLE 2: Reason for pHCT scan in the 57 scans performed during the study

Reason	No. of Scans
routine follow-up	14
postcraniotomy	12
suspected cerebral edema	10
mental status change	7
post Licox placement/replacement	4
suspected stroke	4
suspected intracranial hemorrhage	2
postventriculostomy placement/replacement	2
seizures	1
suspected carotid artery dissection	1

$PbtO_2$ After pHCT or Transport Head CT

Brain oxygen values collected during the 3 hours before and after intrahospital transport to CT in 45 patients who underwent 100 head CT scans[21] were averaged and compared with the values before and after pHCT. The demographics of the 2 groups were similar. There was a trend for pHCT to have less effect (reduction) on $PbtO_2$ than transport head CT (Table 5). Unlike pHCT, where no new episodes of brain hypoxia ($PbtO_2 < 15$ mm Hg) were observed after the study, a new episode of brain hypoxia was observed after 19% of transport head CTs.

Discussion

Follow-up CT scans are an important component in the care of patients with severe brain injuries. In this study we examined 34 patients with continuous ICP and $PbtO_2$ monitoring during the 3 hours before and after 57 follow-up pHCTs. Our findings show that ICP, CPP, and $PbtO_2$ remain stable and brain hypoxia ($PbtO_2 < 15$ mm Hg) does not occur as a result of pHCT. In addition, there is a tendency for pHCT to have a less deleterious effect on $PbtO_2$ than transport head CT. These results, while preliminary, suggest that pHCTs have little if any effect

TABLE 3: Intracranial pressure and CPP during the 3 hours before and after pHCT in 57 patients*

Variable	Before (mm Hg)	After (mm Hg)	p Value
mean ICP	14.3 ± 7.4	14.1 ± 6.6	0.84
min ICP	10.3 ± 6.9	10.6 ± 5.9	0.84
max ICP	21.4 ± 19.3	18.1 ± 9.0	0.25
mean CPP	78.9 ± 20.2	81.0 ± 19.8	0.59
min CPP	67.1 ± 25.2	69.9 ± 26.1	0.58
max CPP	88.0 ± 22.01	90.8 ± 21.8	0.51

* Data are recorded as the mean ± SD and are from the 3 hours before and after a pHCT.

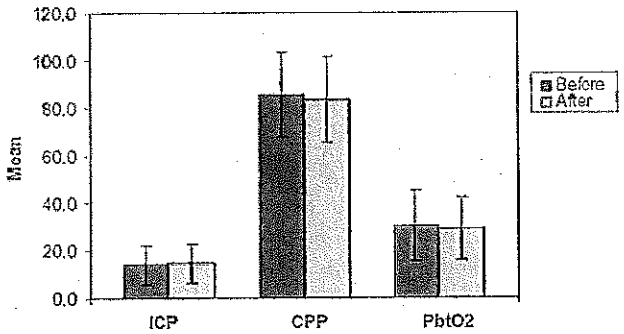

FIG. 1. Mean ICP, CPP, and $PbtO_2$ in mm Hg during the 3 hours before and after 57 pHCT scans. The *error bars* represent ± 1 SD.

on intracranial hemodynamics and that pHCTs are safe to use during the care of critically ill patients with brain injury.

Methodological Limitations

Our study has several limitations. First, the data were examined retrospectively, which may bias our results. However, the patients were all treated according to standard ICU protocols, the data were entered prospectively, and each patient met clear inclusion criteria. Second, the study was performed in patients treated at a single institution and may lack external validity. Third, we examined 34 patients with a total of 57 pHCTs, so the results should be considered preliminary. A robust variance estimator was used to account for the clustering effect due to multiple CT scans in the same patient. Fourth, the patients were examined at different time points after their injury. This can influence cerebral blood flow and thus $PbtO_2$. Each patient, however, was his or her own internal control, and time was factored into our statistical model. Fifth, the reason why patients underwent a pHCT varied; this may influence the results. Sixth, the pHCTs examined in this series represent a select subgroup of patients, and therefore the conclusions apply only to ventilated and comatose patients and not to all patients who undergo imaging. Finally, this was not a pure observational study in that interventions were directed at low $PbtO_2$, low CPP, and high ICP; this may bias the results. In addition, since we averaged values obtained during the 3 hours before and after an imaging study, a brief episode of reduced $PbtO_2$ may be missed in this analysis because of an escalation in intensity of therapy. However we did not observe any new episodes of brain hypoxia after pHCT whereas this occurred in 19% of transport head CTs.

TABLE 4: Brain oxygen ($PbtO_2$ in mm Hg) during the 3 hours before and after pHCT in 57 patients*

Variable	Before pHCT	After pHCT	p Value
mean $PbtO_2$	33.2 ± 17.0	31.6 ± 15.9	0.6
mean difference (95% CI)	—	−1.5 (−3.3 to 0.2)	
min $PbtO_2$	27.6 ± 15.8	26.6 ± 14.2	0.73
mean difference (95% CI)	—	−1.0 (−3.3 to 1.3)	
max $PbtO_2$	38.8 ± 21.1	36.9 ± 18.1	0.6
mean difference (95% CI)	—	1.8 (−4.9 to 1.2)	

* Data are recorded as the mean ± SD and are from the 3 hours before and after a pHCT.

TABLE 5: Comparisons of $PbtO_2$ changes during the 3 hours before and after pHCT (57 scans in 34 patients) or transport to HCT scan (100 scans in 45 patients)*

Variable	HCT (mean change [95% CI])	pHCT (mean change [95% CI])	p Value
mean $PbtO_2$	−4.0 (−5.9 to −2.1)	−1.5 (−3.3 to 0.2)	0.07
min $PbtO_2$	−2.5 (−4.3 to −0.7)	−1.0 (−3.3 to 1.3)	0.28
max $PbtO_2$	−6.4 (−11.1 to −1.7)	−1.8 (−4.9 to 1.2)	0.12

* The data on changes before and after HCT are based on results reported by Swanson et al. Values are in mm Hg.

Follow-Up Head CT Scans

There is general consensus that follow-up head CT scans are useful in severe TBI and SAH. However, the timing of, and number of follow-up head CT scans to be performed remains poorly defined, and there is a paucity of direct information that links follow-up CT scans to better patient outcome. Usually follow-up imaging requires transport of the patient to and from the radiology suite. This transport carries with it an inherent risk of complications or mishaps. In addition intrahospital transport, including even the shortest transports, can affect patient outcome adversely or lead to unexpected events that may compromise patient care.[1,2,13,19] For example we have observed that intrahospital transport can compromise $PbtO_2$.[21] Furthermore, when we compared $PbtO_2$ averaged during the 3 hours before and after pHCT or before and after transport to HCT, there was a tendency for pHCT to have less deleterious effects than transport. Peerdeman et al.[15] also have observed, using cerebral microdialysis, that the cerebral lactate/pyruvate ratio, a marker of anaerobic metabolism, increases during transport to and from the radiology department. This suggests an increase in metabolic demand or impaired oxygen delivery. These various risks associated with intrahospital transport can be reduced with correct staffing, careful planning, and appropriate equipment,[24] but when complications do occur, they may be difficult to treat.[7,24]

Alternatively, point-of-care testing—that is, a portable CT scan—may be appropriate for critically ill patients in an ICU. Portable CT scanners for ICU use have become readily available in recent years, and these units are simple to use. In a previous feasibility study we observed that pHCTs are easy, safe, and quick to obtain and provide images of more than adequate diagnostic quality.[14] The current findings extend these observations and, importantly, demonstrate that obtaining a pHCT in ventilated patients in an ICU does not have any effect on ICP, CPP, and $PbtO_2$. Our data do not allow us to comment on the clinical value of a pHCT and, specifically, do not relate outcome to the ability to maintain stable intracranial physiology.

Brain Oxygen

It has long been established that the early detection, prevention, and management of secondary cerebral insults is a fundamental tenet of ICU care of the patient with severe brain injury.[8,18] This includes prevention of compromised brain oxygenation. Our data indicate that a pHCT may help to reduce the risk of altered intracranial physiology and in particular prevent a reduction in $PbtO_2$. Whether this means better patient outcome is not apparent from these data. However, several lines of experimental and clinical evidence demonstrate that there is a significant association between poor patient outcome and the number, duration, and intensity of episodes of low $PbtO_2$ after severe brain injury, including adult and pediatric TBI, and after severe SAH.[4,9,12,16,23] Compromised $PbtO_2$ and brain hypoxia are surprisingly common during ICU care of critically ill patients with brain injuries and are not necessarily predicted by changes in ICP or CPP.[5,11,20] We suggest that portable CT scanners are safe to use in an ICU and may help reduce the incidence of some secondary cerebral insults in select patients.

Conclusions

Follow-up head CT scans are useful in the care of patients with severe brain injuries. Similarly, prevention and management of secondary cerebral insults is fundamental to TBI and SAH management. Repeat imaging usually requires transport of patients from the ICU to the radiology department. This transport, however, carries an inherent risk and may exacerbate pulmonary function, compromise intracranial physiology, or aggravate outcome, intrahospital transport having the potential to increase the likelihood of secondary cerebral insults.[1,2,15,21] In this study we demonstrate that a pHCT scan has little if any affect on ICP, CPP, or $PbtO_2$. These data suggest that pHCT may be helpful in reducing the risk of secondary cerebral insults after severe TBI or SAH.

Disclosure

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Author contributions to the study and manuscript preparation include the following. Conception and design: Le Roux. Acquisition of data: Peace. Analysis and interpretation of data: Le Roux, Peace, Maloney-Wilensky. Drafting the article: Peace. Critically revising the article: Le Roux, Peace, Maloney-Wilensky, Frangos, Levine, Kofke. Reviewed final version of the manuscript and approved it for submission: all authors. Statistical analysis: Yang. Administrative/technical/material support: Maloney-Wilensky, Hujcs. Study supervision: Le Roux, Maloney-Wilensky.

Acknowledgments

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APPENDIX V

YNHH DPH LICENSE

STATE OF CONNECTICUT

Department of Public Health

LICENSE

License No. 0044

General Hospital

In accordance with the provisions of the General Statutes of Connecticut Section 19a-493: Yale-New Haven Hospital, Inc. of New Haven, CT d/b/a Yale-New Haven Hospital, Inc. is hereby licensed to maintain and operate a General Hospital.

Yale-New Haven Hospital, Inc. is located at 20 York Street, New Haven, CT 06504.

The maximum number of beds shall not exceed at any time:
134 Bassinets
1407 General Hospital Beds

This license expires **September 30, 2013** and may be revoked for cause at any time.
Dated at Hartford, Connecticut, October 1, 2011.

SATELLITES

Hill Regional Career High School, 140 Legion Avenue, New Haven, CT
Branford High School Based Health Center, 185 East Main Street, Branford, CT
Walsh Middle School, 185 Damascus Road, Branford, CT
James Hillhouse High School Based Health Center, 480 Sherman Parkway, New Haven, CT
Weller Building, 425 George Street, New Haven, CT
Yale-New Haven Psychiatric Hospital, 184 Liberty Street, New Haven, CT
Yale-New Haven Shoreline Medical Center, 111 Goose Lane, Guilford, CT
Pediatric Dentistry Center, 860 Howard Avenue, New Haven, CT
YNHASC Temple Surgical Center, 60 Temple Street, New Haven, CT
YNHASC Women's Surgical Center, 40 Temple Street, New Haven, CT
Mauro-Sheridan School Based Health Center, 191 Fountain Street, New Haven, CT
Yale-New Haven Hospital Dental Center, 2560 Dixwell Avenue, Hamden, CT
Murphy School Based Health Center, 14 Brushy Plain Road, Branford, CT
P.T. Barnum Pediatric Center, 226 Mill Hill Avenue, Bridgeport, CT
Yale-New Haven Hospital-Saint Raphael Campus, 1450 Chapel Street, New Haven, CT
Adolescent Day Hospital, 646 George Street, New Haven, CT
Psychiatric Day Hospital, 1294 Chapel Street, New Haven, CT
Children's Psychiatric Day Hospital, 1450 Chapel Street, New Haven, CT
Elder Care Clinic, Atwater Clinic, 26 Atwater Street, New Haven, CT
Elder Care Clinic/Tower One, 18 Tower Lane, New Haven, CT
Elder Care Clinic/Casa Otonal, 135 Sylvan Avenue, New Haven, CT
Elder Care Clinic/Edith Johnson Tower, 114 Bristol Street, New Haven, CT
Evening Chemical Dependency Program, 1294 Chapel Street, New Haven, CT
Elder Care Clinic/Surfside, 200 Oak Street, West Haven, CT
Troup Magnet Academy School-Based Health Center, New Haven, CT
Adult PHP, 110 Sherman Avenue, Hamden, CT
Wheat, 674 Washington Avenue, West Haven, CT
Barnard Environmental Studies Magnet School, 170 Derby Avenue, New Haven, CT
Center for Women's Health/Midwifery & Chapel Pediatrics, 2 Ivy Brook Road, Suite 111, Shelton, CT
"Smiles 2 Go" Dental Mobile Van, 60 Commerce Street, East Haven, CT
Project Eldercare, 2080 Whitney Avenue, Suite 150, Hamden, CT
Chapel Pediatrics, 2080 Whitney Avenue, Suite 150, Hamden, CT
Shoreline Child and Adolescent Mental Health Services, 21 Business Park Drive, Branford, CT

License Revised to Reflect:
* Hospital of Saint Raphael merged with Yale-New Haven Hospital, Inc. effective 9/12/12

Jewel Mullen, MD, MPH, MPA
Commissioner

APPENDIX VI

VENDOR QUOTE

NeuroLogica
Bringing the Power of Imaging to the Patient

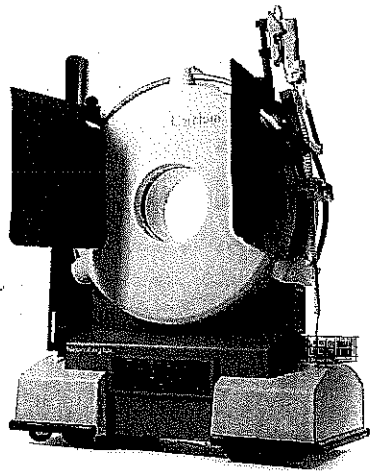
CereTom® Quotation

Neurologica Corp
14 Electronics Ave
Danvers, MA 01923
Fax: 1.978.560.0602

Sales Representative Information

Name: Dan Alosco
Region: North East
Email: dalosco@neurologica.com
Phone: 978.853.5370

Quote # 5713a
Quote Date: 11/19/2012
Valid Until: 1/31/2013
Prepared by: Hchang



*Picture includes optional accessories

US Director of Sales	Email	Phone	F.O.B. Point	Payment Terms
Greg Johnson	gjohnson@neurologica.com	941.809.5500	Danvers, MA	Net 30 Days

Customer Information

Yale New Haven Medical Center
Neurology
15 York Street
New Haven, CT 06520

	Name	Phone	Email
Project Manager:	David Greer MD, MA	203-785-6351	david.greer@yale.edu
Other			

CereTom® Quotation

Neurologica Corp
14 Electronics Ave
Danvers, MA 01923
Fax: 1.978.560.0602

Comments:

Yale New Haven Medical Center
Neurology
15 York Street
New Haven, CT 06520

QUANTITY	DESCRIPTION	ITEM	UNIT PRICE	AMOUNT
1	CereTom® Core System	0-NL3000-001	329,900.00	$ 329,900.00
	CereTom® Multislice Scanner		Included	
	NeCT		Included	
	Imaging Station and Case		Included	
	2D Software		Included	
	Multi Planar Reconstruction (MPR)		Included	
	3D Volumetric Reconstruction		Included	
	2GB USB Flash Drive		Included	
	Silhouette Scan Board (ICU / ER / OR)		Included	
	Bed Adapter (Insert Make/ Model)		Included	
	Standard Warranty Service Agreement Gold		Included	
			Subtotal	$ 329,900.00
	Critical Care Accessories			
1	Lead Curtain Upgrade	0-00031-001	3,000.00	$ 3,000.00
1	Scanner Drive System (SDS)	0-00116-001	35,000.00	$ 35,000.00
1	Universal Body Transfer Board	0-00036-001	5,000.00	$ 5,000.00
			Subtotal	$ 43,000.00
	Software Accessories			
1	CT Angiography with Bolus Tracking	0-00059-001	15,000.00	$ 15,000.00
1	Scout Scan	0-00060-001	10,000.00	$ 10,000.00
1	Contrast Perfusion with Test Bolus	0-00003-001	15,000.00	$ 15,000.00
1	RadRedux	0-00056-001	10,000.00	$ 10,000.00
1	Medrad Injector		45,000.00	$ 45,000.00
			Subtotal	$ 95,000.00
	Adapters			
1	Custom Adapter (Specify Make & Model)	0-00008-001	5,000.00	$ 5,000.00
			Subtotal	$ 5,000.00
	Training			
1	New System Training	0-00094-001	10,000.00	$ 10,000.00
	4 Days Initial Training		Included	
			Subtotal	$ 10,000.00
			SALES TAX RATE	0.00%
			SALES TAX	$ -
			SUBTOTAL	$ 482,900.00
			DISCOUNT	$ 48,290.00
			DISCOUNTED SUBTOTAL	$ 434,610.00
			SHIPPING AND HANDLING	$ 2,250.00
			TOTAL	$ 436,860.00

PURCHASER IS RESPONSIBLE FOR ALL SALES AND/OR USE TAX

NeurOLogica
Bringing the Power of Imaging to the Patient

CereTom® Quotation

Neurologica Corp
14 Electronics Ave
Danvers, MA 01923
Fax: 1.978.560.0602

Comments:

Yale New Haven Medical Center
Neurology
15 York Street
New Haven, CT 06520

QUANTITY	DESCRIPTION	ITEM	UNIT PRICE	AMOUNT
	Service Agreements			
3	Annual Service Agreement Scanner Drive System		3,500.00	$ 10,500.00
3	Annual Service Agreement Gold	0-00010-001	39,000.00	$ 117,000.00
	Gold Service Contract Coverage includes: • **Labor and travel coverage at no charge from 8:00 a.m. to 5:00 p.m., Monday—Friday, excluding holidays** • Telephone Support (within 1 hour) 24 hours per day, 7 days per week • Onsite personnel (within 24 hours) • Onsite Spare part (within 24 hours) • 100% Warranty on all parts • Preferred rates for labor and travel outside coverage hours. ($250/hr). Normal rate is $325/hr • The completion of all the required routine maintenance. This will include replacing all consumable parts such as brushes, batteries and belts as required. Cleaning slip ring, cleaning centipede belt, vacuuming and cleaning interior assemblies. • Uptime guarantee of 95% • Any required software updates (Safety or specification) • Routine maintenance is required to satisfy the conditions of warranty.			

SALES TAX RATE	0.00%
SALES TAX	$ -
SUBTOTAL	$ 127,500.00
DISCOUNT	$ 6,375.00
DISCOUNTED SUBTOTAL	$ 121,125.00
SHIPPING AND HANDLING	$ -
TOTAL	$ 121,125.00

PURCHASER IS RESPONSIBLE FOR ALL SALES AND/OR USE TAX

TERMS AND CONDITIONS OF SALE

All purchases of equipment ("Equipment") from NeuroLogica Corporation (the "Seller") by the purchaser ("Purchaser") shall be governed by these terms and conditions of sale (these "Terms"). These Terms and any exhibits shall control over any conflicting, inconsistent or additional terms or conditions or any purchase order of Purchaser (including any terms and conditions of Purchaser) and all such conflicting, inconsistent or additional terms are rejected by Seller and shall have no effect.

1. ORDERS. All orders to purchase Equipment shall be made in writing and shall be subject to the written acceptance of the Seller.

2. QUOTATIONS AND PRICES. Seller's prices and quotations are subject to the following:

(a) Quotations are only solicitations for offers and not offers which may be accepted by the Purchaser.

(b) Published prices are subject to change without notice.

(c) All prices quoted shall be exclusive of the costs of transportation or insurance, taxes, including without limitation, any sales, use or similar tax, license fees, customs fees, duties and other charges related thereto, which shall be the responsibility of Purchaser. Any such costs shall be separately itemized on Seller's invoices and paid by Purchaser, or, in lieu thereof, Purchaser shall furnish Seller a properly executed tax exemption certificate prior to shipment.

(d) All prices and quotations and any discussion regarding the same are confidential and proprietary information of the Seller and may not be disclosed to any third party.

3. TERMS OF PAYMENT. Payment shall be made in U.S. Dollars. Full payment is due thirty (30) days from the date of invoice or acceptance, whichever is later. All sales are subject to prior credit approval by Seller. If the above terms of payment are not met, Seller may, in its sole discretion, in addition to other remedies, withhold all warranty service, training and technical service and support.

4. TRANSPORTATION AND RISK OF LOSS. All shipments shall be F.O.B. Danvers Massachusetts and title and risk of loss of damage shall pass to Purchaser upon delivery to carrier by Seller. Seller does not accept any liability for losses or added costs due to delivery delays.

5. SECURITY INTEREST. Seller shall retain a security interest in the Equipment until the entire balance of the Equipment price and all other monies payable hereunder are paid in full. Purchaser shall execute, upon request by Seller, financing statements deemed necessary or desirable by Seller to perfect its security interest in the Equipment. Purchaser authorizes Seller to file a copy of this security agreement or a financing statement with the appropriate state authorities at any time thereafter as a financing statement in order to perfect Seller's security interest. A financing statement may be filed without Purchaser's signature on the basis of this security agreement where allowed by law. Purchaser shall keep the Equipment in good order and repair until the purchase price has been paid in full and shall promptly pay all taxes and assessments upon purchase of the Equipment or use of the Equipment.

6. INSURANCE. Purchaser shall maintain adequate and appropriate insurance policies in relation to its obligations under these Terms, which shall include property damage insurance to the Equipment for the full replacement value thereof. Until full payment for the Equipment has been made, Seller shall be added as an additional loss payee on such insurance policies. As evidence of such coverage, prior to shipment of the Equipment, Purchaser shall provide to Seller a certificate of insurance.

7. INSTALLATION AND ACCEPTANCE. Purchaser shall provide a suitable installation environment and the Site shall be ready to receive the Equipment at the time scheduled for the delivery date. Purchaser shall provide adequate working space within reasonable distance of the Equipment for use by Seller's personnel. Seller or its representatives shall install the Equipment during Purchaser's normal working hours. Equipment shall be deemed accepted by Purchaser unless written notice of nonconformity is received within fourteen (14) days of installation. Use of Equipment by Purchaser or any of its agents, employees, or licensees, for any purpose (other than to determine that it meets specifications) after delivery thereof shall constitute acceptance.

8. WARRANTY. SELLER WARRANTS TO PURCHASER THAT THE EQUIPMENT SHALL BE IN GOOD WORKING ORDER ON THE DATE OF DELIVERY AND THAT THE EQUIPMENT SHALL BE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP AT THE TIME OF DELIVERY AND FOR A PERIOD OF TWELVE MONTHS (12) THEREAFTER. SELLER'S OBLIGATIONS UNDER THE FOREGOING WARRANTY SHALL BE LIMITED SOLELY TO SELLER MAKING, AT ITS COST AND EXPENSE, SUCH REPAIRS AND REPLACEMENTS AS ARE NECESSARY TO PLACE THE EQUIPMENT IN GOOD WORKING ORDER AND TO CONFORM THE EQUIPMENT TO SELLER'S PUBLISHED SPECIFICATIONS. NOTWITHSTANDING THE FOREGOING, THE WARRANTY PROVIDED HEREIN SHALL BE VOID IN THE EVENT (1) THE EQUIPMENT FAILS, MALFUNCTIONS OR IS DAMAGED AS A RESULT OF IMPROPER HANDLING, MAINTENANCE, REMOVAL, MODIFICATION OR REPAIR BY PURCHASER OR A THIRD PARTY (NOT AUTHORIZED BY SELLER); OR (2) THE EQUIPMENT IS ACCIDENTALLY DAMAGED, SUBJECT TO ABUSE OR IMPROPER USE; OR (3) THE EQUIPMENT IS ALTERED OR DAMAGED SUCH THAT SELLER IS UNABLE TO VERIFY THE DEFECT WITH ITS NORMAL TEST EQUIPMENT. AS A FURTHER CONDITION OF THIS WARRANTY, PURCHASER IS REQUIRED TO REQUEST AND ALLOW THE SELLER'S SERVICE REPRESENTATIVE TO COMPLETE ALL ROUTINE MAINTENANCE ACCORDING TO THE ROUTINE MAINTENANCE SERVICE SCHEDULE. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

9. LIMITATION OF LIABILITY. NEITHER PARTY SHALL BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN ANY WAY CONNECTED WITH THESE TERMS OR THE SALE AND PURCHASE OF THE EQUIPMENT, THE EQUIPMENT ITSELF OR ANY OTHER MATTER RELATED HERETO, INCLUDING WITHOUT LIMITATION, LOST BUSINESS OR LOST PROFITS, EVEN IF SUCH PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. SELLER'S AGGREGATE LIABILITY TO PURCHASER ARISING OUT OF THESE TERMS OR THE SALE AND PURCHASE OF THE EQUIPMENT SHALL NOT EXCEED THE SUM PAID TO SELLER BY PURCHASER FOR THE EQUIPMENT SOLD HEREUNDER. IT IS FURTHER AGREED THAT SELLER SHALL HAVE NO LIABILITY TO PURCHASER, PURCHASER'S PATIENTS, OR ANY THIRD PARTIES FOR ANY DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES CONCERNING THE EQUIPMENT, UNLESS SUCH DAMAGES ARE A DIRECT RESULT OF SELLER'S GROSS NEGLIGENCE OR WILLFUL MISCONDUCT; PROVIDED, HOWEVER, THAT NOTHING IN THIS AGREEMENT SHALL DEPRIVE PURCHASER OF ANY RIGHTS IT MAY HAVE AGAINST ANY PERSON OTHER THAN SELLER.

10. INTELLECTUAL PROPERTY. No rights to any intellectual property residing in the Equipment, software, documentation, or any data furnished hereunder are granted except the right to use such intellectual property. Purchaser recognizes that, among other items, computer software necessary to the operation of the Equipment is confidential information belonging to Seller. Purchaser shall have no right to copy, reproduce or disclose to others in whole or in part any of the above without the prior written permission of Seller.

11. INDEMNITY. As an express condition of sale, Purchaser agrees to hold Seller and its parent, owners, subsidiaries and affiliates and their directors, officers, shareholders, employees and agents harmless from and against any claims, suits, losses, liabilities, injuries or damages (including, without limitation, reasonable attorneys' fees and litigation expenses) arising out of or in connection with: (i) use of the Equipment not in accordance with the Documentation; and (ii) all actions or omissions by Purchaser personnel (including employees and independent contractors) who use the Equipment. Seller agrees to hold Purchaser, its parent, owners, subsidiaries and affiliates and their directors, officers, shareholders, employees and agents harmless from and against any claims, suits, losses, liabilities, injuries or damages (including, without limitation, reasonable attorneys' fees and litigation expenses) arising out of or in connection with (i) any third party claims that the Equipment caused injury solely as a result of Seller's gross negligence or due to defects in material or workmanship of the Equipment for which Seller is legally liable.

12. GOVERNING LAW. These Terms shall be governed by the laws of the Commonwealth of Massachusetts, without giving effect to its provisions on conflicts of laws. Seller and Purchaser hereby submit to the jurisdiction of the state and federal courts located in the Commonwealth of Massachusetts and agree not to contest the jurisdiction of such courts. No action, regardless of form, arising out of, or in any way connected with, the Equipment or any service furnished, or to be furnished, may be brought by Purchaser more than (1) one year after the cause of action has accrued to Purchaser.

13. FORCE MAJURE. Neither party shall be liable for any delay in performance, not to exceed six months, caused by any occurrence beyond its reasonable control, including but not limited to acts of God, power outages, wars, commencement or escalation of hostilities, terrorist acts, industrial disputes and governmental restrictions, strikes, labor disputes, floods, fires, accidents, and any such delay, not to exceed six months, shall not be considered a breach of this Agreement and such performance shall be excused for the number of days such occurrence reasonably prevents performance.

14. SEVERABILITY. Each provision of these Terms shall be severable. If, for any reason, any provision herein is finally determined to be invalid and contrary to, or in conflict with, any existing or future law or regulation by a court or agency having valid jurisdiction, such determination shall not impair the operation or affect the remaining provisions of these Terms, and such remaining provisions will continue to be given full force and effect and bind the parties hereto. Each invalid provision shall be revised only to the extent necessary to bring it within the requirements of such law or regulation.

15. ENTIRE AGREEMENT; NO WAIVER. These Terms, along with any purchase order and any and all exhibits hereto represents the entire understanding of the parties hereto and supersedes any prior understandings or agreements (whether oral or in writing) relating to the subject matter hereof. None of the terms of this Agreement can be waived, amended or modified except by an express agreement in writing signed by the parties. There are no representations, promises, warranties, covenants or undertakings other than those contained in this Agreement. No custom or practice of the parties hereto at variance with the terms hereof shall constitute a waiver of either party's right to demand exact compliance with any of the terms herein at any time. The failure of either party hereto to enforce, or the delay by either party hereto in enforcing, any or all of its rights under these Terms shall not be deemed as constituting a waiver or a modification thereof, and either party hereto may, within the time provided by applicable law, commence appropriate proceedings to enforce any or all of such rights.

APPENDIX VII

FINANCIAL ATTACHMENT I

Yale-New Haven Hospital
(All dollars are in thousands)

Total Facility:	FY 2012 Actual	FY 2013 Projected	FY 2013 Projected	FY 2013 Projected	FY 2014 Projected	FY 2014 Projected	FY 2014 Projected	FY 2015 Projected	FY 2015 Projected	FY 2015 Projected	FY 2016 Projected	FY 2016 Projected	FY 2016 Projected
Description	Results	With CON	Incremental	W/out CON	With CON	Incremental	W/out CON	With CON	Incremental	W/out CON	With CON	Incremental	W/out CON
Net Patient Revenue													
Non- Government	$ 660,140	$ 1,164,381	$ -	$ 1,164,381	$ 1,229,971	$ -	$ 1,229,971	$ 1,304,374	$ -	$ 1,304,374	$ 1,379,340	$ -	$ 1,379,340
Medicare	590,993	800,034	-	800,034	822,116	-	822,116	847,043	-	847,043	880,833	-	880,833
Medicaid and Other Medical Assistance	251,911	341,015	-	341,015	354,193	-	354,193	371,275	-	371,275	392,921	-	392,921
Other Government	10,227	13,844	-	13,844	13,658	-	13,658	13,872	-	13,872	13,885	-	13,885
Total Net Patient Revenue	$ 1,713,271	$ 2,319,274	$ -	$ 2,319,274	$ 2,420,138	$ -	$ 2,420,138	$ 2,536,564	$ -	$ 2,536,564	$ 2,666,979	$ -	$ 2,666,979
Other Operating Revenue	$ 47,684	$ 60,727	$ -	$ 60,727	$ 60,727	$ -	$ 60,727	$ 60,727	$ -	$ 60,727	$ 60,727	$ -	$ 60,727
Revenue from Operations	$ 1,760,955	$ 2,380,001	$ -	$ 2,380,001	$ 2,480,865	$ -	$ 2,480,865	$ 2,597,291	$ -	$ 2,597,291	$ 2,726,806	$ -	$ 2,726,806
Salaries and Fringe Benefits	$ 757,263	$ 1,053,715	$ 24	$ 1,053,740	$ 1,159,251	$ 77	$ 1,159,174	$ 1,181,845	$ 81	$ 1,181,764	$ 1,222,724	$ 85	$ 1,222,640
Professional / Contracted Services	374,830	520,852	-	520,852	471,809	-	471,809	518,642	-	518,642	557,345	-	557,345
Supplies and Drugs	376,271	522,654	-	522,654	551,159	-	551,159	580,995	-	580,995	611,670	-	611,670
Bad Debts	32,622	35,046	-	35,046	36,097	-	36,097	37,180	-	37,180	38,295	-	38,295
Other Operating Expense	12,497	17,366	-	17,366	17,687	40	17,847	18,423	40	18,383	18,976	40	18,936
Subtotal	$ 1,553,484	$ 2,149,833	$ 24	$ 2,149,857	$ 2,236,203	$ 117	$ 2,236,086	$ 2,337,085	$ 121	$ 2,336,964	$ 2,449,010	$ 125	$ 2,448,885
Depreciation/Amortization	73,101	$ 102,560	$ -	$ 102,560	$ 108,838	$ 87	$ 108,751	$ 113,235	$ 87	$ 113,148	$ 118,460	$ 87	$ 118,373
Interest Expense	17,720	42,420	-	42,420	44,111	-	44,111	43,490	-	43,490	47,846	-	47,846
Lease Expense	10,139	14,089	-	14,089	14,512	-	14,512	14,947	-	14,947	15,396	-	15,396
Total Operating Expense	$ 1,654,444	$ 2,308,902	$ 24	$ 2,308,926	$ 2,403,664	$ 204	$ 2,403,460	$ 2,508,757	$ 208	$ 2,508,549	$ 2,630,714	$ 212	$ 2,630,502
Gain/(Loss) from Operations	$ 106,511	$ 71,099	$ (24)	$ 71,075	$ 77,201	$ (204)	$ 77,405	$ 88,534	$ (208)	$ 88,742	$ 96,092	$ (212)	$ 96,304
Plus: Non-Operating Revenue	$ 24,098	$ 39,099	$ -	$ 39,099	$ 40,840		$ 40,840	$ 42,708		$ 42,708	$ 44,804	$ -	$ 44,804
Revenue Over/(Under) Expense	$ 130,609	$ 110,198	$ (24)	$ 110,174	$ 118,041	$ (204)	$ 118,245	$ 131,242	$ (208)	$ 131,450	$ 140,896	$ (212)	$ 141,108
Number of FTE's	10,807	10,862	0.7	10,862	10,936	0.7	10,937	11,015	0.7	11,014	11,093	0.7	11,092
Inpatient Cases	59,427	80,208		80,208	81,950		81,950	83,580		83,580	85,456		85,456
Patient Days	309,396	417,201		417,201	423,031	-	423,031	428,493	-	428,493	433,777	-	433,777
Outpatient encounters	774,085	844,267		844,267	875,626	-	875,626	908,249	-	908,249	942,188	-	942,188
Neuro ICU CT Scans			122			365			365			365	

Notes:

APPENDIX VIII

FINANCIAL ATTACHMENT II

Office of Health Care Access
Financial Atttachment II

Yale-New Haven Hospital

Please provide three years of projections of incremental revenue, expense and volume statistics **attributable to the proposal** in the following reporting format:

Type of Service Description	CT									
Type of Unit Description:	Scans									
# of Months in Operation	12									
Year 1 - 2014 (full year)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FY Projected Incremental		Rate	Units	Gross Revenue Col. 2 * Col. 3	Allowances/ Deductions	Charity Care	Bad Debt	Net Revenue Col.4 - Col.5 -Col.6 - Col.7	Operating Expenses Col. 1 Total * Col. 4 / Col. 4 Total	Gain/(Loss) from Operations Col. 8 - Col. 9
Total Incremental Expenses:	**$204,308**									
Total Facility by Payer Category:										
Medicare		$0	-	$0	$0			$0	$74,253	($74,253)
Medicaid		$0	-	$0	$0			$0	$36,451	($36,451)
CHAMPUS/TriCare		$0	-	$0	$0			$0	$2,043	($2,043)
Total Governmental			0	$0	$0	$0	$0	$0	$112,747	($112,747)
Commercial Insurers		$0	0	$0	$0			$0	$87,978	($87,978)
Uninsured		$0	-	$0		$0	$0	$0	$4,086	($4,086)
Total NonGovernment		$0	0	$0	$0	$0	$0	$0	$92,064	($92,064)
Total IP All Payers		$0	-	$0	$0	$0	$0	$0	$204,812	($204,812)
		5% inflation								

Office of Health Care Access
Financial Attachment II

Yale-New Haven Hospital

Please provide three years of projections of incremental revenue, expense and volume statistics **attributable to the proposal** in the following reporting format:

Type of Service Description	CT
Type of Unit Description:	Scans
# of Months in Operation	12

Year 3 - 2015 FY Projected Incremental Total Incremental Expenses:	(1) $208,154	(2) Rate	(3) Units	(4) Gross Revenue Col. 2 * Col. 3	(5) Allowances/ Deductions	(6) Charity Care	(7) Bad Debt	(8) Net Revenue Col.4 - Col.5 -Col.6 - Col.7	(9) Operating Expenses Col. 1 Total * Col. 4 / Col. 4 Total	(10) Gain/(Loss) from Operations Col. 8 - Col. 9
Total Facility by Payer Category:										
Medicare		$0	-	$0	$0			$0	$75,651	($75,651)
Medicaid		$0	-	$0	$0			$0	$37,138	($37,138)
CHAMPUS/TriCare		$0	-	$0	$0			$0	$2,082	($2,082)
Total Governmental			0	$0	$0	$0	$0	$0	$114,870	($114,870)
Commercial Insurers		$0	0	$0	$0			$0	$89,635	($89,635)
Uninsured		$0	-	$0	$0	$0	$0	$0	$4,163	($4,163)
Total NonGovernment		$0	-	$0	$0	$0	$0	$0	$93,798	($93,798)
Total All Payers		$0	-	$0	$0	$0	$0	$0	$208,668	($208,668)
		5% inflation								

Office of Health Care Access
Financial Attachment II

Yale-New Haven Hospital

Please provide three years of projections of incremental revenue, expense and volume statistics **attributable to the proposal** in the following reporting format:

Type of Service Description	CT
Type of Unit Description:	Scans
# of Months in Operation	12

Year 3 - 2016 FY Projected Incremental Total Incremental Expenses:	(1) $212,193	(2) Rate	(3) Units	(4) Gross Revenue Col. 2 * Col. 3	(5) Allowances/ Deductions	(6) Charity Care	(7) Bad Debt	(8) Net Revenue Col.4 - Col.5 -Col.6 - Col.7	(9) Operating Expenses Col. 1 Total * Col. 4 / Col. 4 Total	(10) Gain/(Loss) from Operations Col. 8 - Col. 9
Total Facility by Payer Category:										
Medicare		$0	-	$0	$0			$0	$77,119	($77,119)
Medicaid		$0	-	$0	$0			$0	$37,858	($37,858)
CHAMPUS/TriCare		$0	-	$0	$0			$0	$2,122	($2,122)
Total Governmental			0	$0	$0	$0	$0	$0	$117,099	($117,099)
Commercial Insurers		$0	0	$0	$0			$0	$91,374	($91,374)
Uninsured		$0	-	$0	$0	$0	$0	$0	$4,244	($4,244)
Total NonGovernment		$0	-	$0	$0	$0	$0	$0	$95,618	($95,618)
Total All Payers		$0	-	$0	$0	$0	$0	$0	$212,717	($212,717)
		5% inflation								

APPENDIX IX

FINANCIAL ASSUMPTIONS

YALE-NEW HAVEN HOSPITAL
Proposal for the CT Neuro ICU Portable

Assumptions

Net Revenue Rate Increases	FY 2013	FY 2014	FY 2015	FY 2016
1) Government	0.0 - 2.8%	0.0 - 2.8%	0.0 - 2.8%	0.0 - 2.8%
2) Non-Government	5.0 - 8.0%	5.0 - 6.0%	4.5 - 6.0%	4.0 - 6.0%

	FY 2013	FY 2014	FY 2015	FY 2016
EXPENSES				
A. Salaries and Fringe Benefits	5.0%	5.0%	5.0%	5.0%
B. Non-Salary				
1) Medical and Surgical Supplies	3.5%	3.5%	3.5%	3.5%
2) Pharmacy and Solutions	6.0%	6.0%	6.0%	6.0%
3) Malpractice Insurance	3.0%	3.0%	3.0%	3.0%
4) Professional and Contracted Services	2.5%	2.5%	2.5%	2.5%
5) All Other Expenses	3 - 4%	3 - 4%	3 - 4%	3 - 4%

	FY 2013	FY 2014	FY 2015	FY 2016
FTEs				
1) Total estimated FTEs	10,861.5	10,937.5	11,014.5	11,092.6

Note - The above increase projections reflect all changes relating to Medicare and Medicaid reimbursement regulations.

NEURO ICU CT SCANS will increase by 1 patient per day for starting June FY 2013 due to the ability to scan extreme patients that could not be moved prior

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

Office of Health Care Access

February 6, 2013 VIA FAX

Nancy Rosenthal
Senior Vice President-Health Systems Development
Department of Planning & Business Development
Yale New Haven Hospital
20 Howe Street
New Haven, CT 06510

RE: Certificate of Need Application; Docket Number: 13-31815-CON
Yale-New Haven Hospital
Acquisition of a Portable Computer Tomography Scanner for Neurological and Neurological Intensive Care Patients

Dear Ms. Rosenthal:

On January 7, 2013, the Office of Health Care Access ("OHCA") received your initial Certificate of Need ("CON") application on behalf of Yale-New Haven Hospital ("Hospital") to acquire a portable Computer Tomography ("CT") scanner, at a total capital expenditure of $436,860.

OHCA has reviewed the CON application and requests the following additional information pursuant to General Statutes §19a-639a(c):

1. Did the Hospital consider any alternatives to the acquisition of the Portable CT scanner? If so, please detail.

2. On page 19 of the CON application, the Hospital states that it is the only provider of neuroscience in the service area and that no other Connecticut provider currently offers portable CT service to the neurological/neurological ICU patient population. In regard to that:

    a. Who are the other providers in Connecticut that provide medical care to this population?
    b. How are other providers currently providing CT scanning services to this particular population at their facilities?

3. On page 10 of the CON application, the Hospital provides the historical and projected CT utilization for the proposed Portable CT scanner. In regard to that:

    a. Explain the decline in utilization between FYs 2010-2012.
    b. Explain why the Hospital is only reporting 462 scans for FY2013.
    c. Since the Hospital has experienced a steady annual decline between FYs 2010-2012, how did the Hospital determine that there will be an increase to 2,479 annual CT scans for FYs 2014-2016?

4. On page 72 of the CON application, the Hospital is projecting incremental losses of approximately $204,000 annually for the first three years of the proposal due to purchase and operation of the Portable CT scanner. Please detail what the $204,000 annual incremental loss is attributed to and during which year does the Hospital expect to break even?

5. Explain how the Hospital would address concerns regarding radiation emanating from a portable CT in areas of the Hospital which are not equipped for protection against radiation.

In responding to the questions contained in this letter, please repeat each question before providing your response. **Paginate and date** your response (i.e., each page in its entirety). Information filed after the initial CON application submission (i.e. completeness response letter, prefile testimony, late file submissions and the like) must be numbered sequentially from the Applicant's document preceding it. Please reference "Docket Number: 13-31815-CON." Submit one (1) original and five (5) hard copies of your response. In addition, please submit a scanned copy of your response including all attachments on CD in an Adobe format (.pdf) and in an MS Word format.

If you have any questions concerning this letter, please feel free to contact me at (860) 418-7012.

Sincerely,

Steven W. Lazarus
Associate Health Care Analyst

****
*** TX REPORT ***
****

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STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
OFFICE OF HEALTH CARE ACCESS

FAX SHEET

TO: Nancy Rosenthal

FAX: (203) 863-4736

AGENCY:

FROM: Steven Lazarus

DATE: 2/6/13 TIME: 2:10 pm

NUMBER OF PAGES: 3
(including transmittal sheet

Comments: Completion Letter for DN: 13-31815-CON.

PLEASE PHONE IF THERE ARE ANY TRANSMISSION PROBLEMS.