

The Complete

**ICACTL STANDARDS
FOR COMPUTED TOMOGRAPHY (CT)
LABORATORY OPERATIONS**

Part I and II

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PART I

ORGANIZATION

The Intersocietal Commission for the Accreditation of Computed Tomography Laboratories (ICACTL) Standards lists the requirements and recommendations for laboratories performing diagnostic computed tomography (CT) examinations. **All absolute requirements appear in bolded text.**

In addition to all standards listed below, the Laboratory, the Medical Director and the Technical Director must comply at all times with all federal, state and local laws and regulations, including but not limited to laws relating to licensed scope of practice, facility operations and billing requirements.

SECTION 1

Personnel and Supervision

STANDARD – Medical Director(s)

1.1 **The Medical Director must be a licensed physician certified by the American Board of Medical Specialists (ABMS) in a relevant specialty, or board certified in a relevant specialty recognized by the American Osteopathic Association, Royal College of Physicians and Surgeons of Canada or Le College des Medecins du Quebec.**

1.1.1 **Medical Director required training and experience:**

The Medical Director must meet at least one of the following criteria:

1.1.1.1 Cardiac CT

Completion of Level 2 or equivalent training meeting ACCF/AHA/ACP guidelines for cardiovascular CT with SCCT letter of verification or a letter of verification from the program director and independent interpretation of at least 50 CT examinations.

OR

Diplomat of the Certification Board of Cardiovascular Computed Tomography (CBCCT) or Certificate of Advanced Proficiency in Cardiac CT offered through the American College of Radiology (ACR).

OR

1.1.1.2 Non-cardiac CT

Interpretation of at least 150 studies (with at least 50 where the candidate is physically present and involved in the acquisition and interpretation of the case) and attendance in at least 20 hours of CT classes relevant to the specialty with a letter of verification from the program director and independent interpretation of at least 50 CT examinations.

OR

1.1.1.3 Established Practice

A physician who has been interpreting computed tomography studies for at least five years, has acquired 150 hours Category I CME and has interpreted a minimum of 500 computed tomography examinations relative to the organ system (s) with self attestation.

AND

40 hours of CT relevant CME. The majority of the 40 hours should be Category I. A minimum of three hours of documented continuing education must be in radiation safety. If 15 of the 40 hours have been obtained within the past 3 years, the CME requirement will be considered fulfilled.

1.1.2 **Medical Director responsibilities:**

1.1.2.1 **The Medical Director is responsible for all clinical services provided and for the determination of the quality and appropriateness of care provided.**

1.1.2.2 The Medical Director may supervise the entire operation of the laboratory or may delegate specific operations to associate Medical Directors, medical staff and the Technical Director.

1.1.2.3 **The Medical Director is responsible for arranging for qualified providers in the absence of medical staff for contrast administration, drug administration and patient and staff safety.**

1.1.2.4 **The Medical Director is responsible for assuring compliance of the medical and technical staff to the standards outlined in this document and the supervision of their work.**

1.1.2.5 **The Medical Director must be an active participant in the interpretation of examinations performed in the laboratory. If not generating final reports, the medical director must provide documentation of review and acceptance, or amendment of findings.**

1.1.2.6 The Medical Director, in consultation with the medical physicist and/or qualified expert, may delegate the operation of the CT scanner to a qualified physician as outlined in 1.2.1.3 based on potential dose to the patient and technical complexity of the CT system as long as the state permits physicians to operate x-ray producing equipment.

1.1.3 **Continuing Medical Education (CME) requirements:**

1.1.3.1 **The Medical Director must document at least 15 hours of Category I American Medical Association (AMA) Physician's Recognition Award (PRA) CME credits in CT over a period of three (3) years.**

1.1.3.2 **A minimum of three hours of the documented 15 hours of CME must be related to radiation safety.**

1.1.3.3 **Yearly accumulated continuing education must be kept on file and available to the ICACTL, when requested.**

Comment: If the Medical Director has completed training or certification, as specified under 1.1.1 in the past three years, the CME requirement will be considered fulfilled.

STANDARD – Technical Director

- 1.2 The Technical Director must be a qualified CT technologist or a physician as described in 1.2.1.3.

A qualified Technical Director (i.e.: supervisor, chief technologist, manager, etc.) is designated for the laboratory.

The Technical Director must have appropriate training, technical certification as noted and documented experience in the field of computed tomography imaging.

Note: In a laboratory with no technologists, the Medical Director or a member of the medical staff may serve as Technical Director for conditions as outlined in Section 1.2.1.3 only. In this case, the Medical Director or medical staff must meet the requirements of the Technical Director and submit appropriate documentation of radiation safety and scanner training. Effective January 1, 2014, all Technical Directors must be qualified imaging technologists.

- 1.2.1 Technical Director required training and experience:

The Technical Director must meet ONE of the following criteria:

- 1.2.1.1 American Registry of Radiologic Technologists (ARRT) or the Canadian Association of Medical Radiation Technologists (CAMRT) certification in computed tomography imaging (i.e. RT (CT)).

OR

- 1.2.1.2 An appropriate credential in another medical imaging field as well as radiation safety training (i.e.: CNMT, RT (MR), RT).

AND

One year of full-time equivalent experience as a CT technologist and performance of a minimum of 100 CT examinations.

OR

- 1.2.1.3 A qualified licensed physician may operate a volume or cone beam CT scanner (for sinus and temporal bone imaging only) if that person has received a minimum of at least 3 hours of documented, specific training in radiation safety provided by a medical physicist or qualified expert and received a 100% score on a written examination administered by the provider of the radiation safety training program.

AND

Received a minimum of at least four (4) hours of documented, specific training in the operation of the scanner.

The Technical Director, including a physician Technical Director, MUST have an appropriate imaging credential as outlined in 1.2.1.1 and/or 1.2.1.2 by January 1, 2014.

1.2.2 **Technical Director responsibilities:**

The Technical Director reports directly to the Medical Director or his/her delegate. Responsibilities include, but are not limited to:

- 1.2.2.1 **All laboratory duties delegated by the Medical Director.**
- 1.2.2.2 **Performance of CT examinations in the laboratory.**
- 1.2.2.3 **Supervision of the technical staff and/or ancillary staff, if applicable.**
- 1.2.2.4 The delegation, when warranted, of specific responsibilities to the technical staff and/or the ancillary staff.
- 1.2.2.5 **Daily technical operation of the laboratory (e.g.: laboratory record keeping, calibration log, quality assurance, scanning protocols, etc.).**
- 1.2.2.6 **Operation and maintenance of laboratory equipment.**
- 1.2.2.7 **The compliance of the technical staff to the *ICACTL Standards* outlined within this document.**
- 1.2.2.8 **Working with the Medical Director, medical staff and technical staff to ensure quality patient care.**
- 1.2.2.9 **Technical training, if applicable.**
- 1.2.2.10 **Monitoring radiation safety.**

1.2.3 **Continuing Education requirements:**

- 1.2.3.1 **The Technical Director must document at least 15 hours of Category I AMA or Recognized Continuing Education Evaluation Mechanism (RCEEM) approved CT related continuing education (CE) over a period of three years.**
- 1.2.3.2 **A minimum of three hours of the documented 15 hours of CE must be related to radiation safety.**
- 1.2.3.3 **Yearly accumulated continuing education must be kept on file and available to ICACTL, when requested.**

Comment: If the Technical Director has successfully acquired an appropriate CT credential within the past three years, the continuing education requirement will be considered fulfilled.

STANDARD – Medical Staff

1.3 All members of the medical staff must be licensed physicians and American Board of Medical Specialists (ABMS) board certified in a relevant specialty, or board certified in a relevant specialty recognized by the American Osteopathic Association, Royal College of Physicians and Surgeons of Canada or Le College des Mediciens du Quebec.

1.3.1 Medical staff required training and experience:

The medical staff must meet ONE of the following criteria:

1.3.1.1 Cardiac CT

Completion of Level 2 or equivalent training meeting ACCF/AHA/ACP guidelines for cardiovascular CT (which includes attendance in at least 20 hours of CT classes relevant to the specialty, a portion of which are in radiation safety) with SCCT letter of verification or a letter of verification from the program director.

OR

Diplomat of the Certification Board of Cardiovascular Computed Tomography (CBCCT) or Certificate of Advanced Proficiency in Cardiac CT offered through the American College of Radiology (ACR).

OR

1.3.1.2 Non-cardiac CT

Interpretation of at least 150 studies (with at least 50 where the candidate is physically present and involved in the acquisition and interpretation of the case) and attendance in at least 20 hours of CT classes relevant to the specialty, a portion of which are in radiation safety, with a letter of verification from program director.

OR

1.3.1.3 Established Practice

A physician who has been interpreting computed tomography studies for at least five years, has acquired 150 hours Category I CME and has interpreted a minimum of 500 computed tomography examinations relative to the organ system(s) with self attestation.

AND

40 hours of CT relevant CME. The majority of the 40 hours should be Category I. A minimum of three hours of documented continuing education must be in radiation safety. If 15 of the 40 hours have been obtained within the past three years the CME requirement will be considered fulfilled.

1.3.2 Medical staff responsibilities:

The medical staff interprets and/or performs clinical CT examinations in compliance with the requirements established by the Medical Director. If not generating final reports, the medical staff member must provide documentation of review and acceptance or amendment of findings.

- 1.3.3 **Continuing Medical Education (CME) requirements:**
- 1.3.3.1 **The medical staff must document at least 15 hours of Category I AMA or PRA CME credits in CT over a period of three (3) years.**
 - 1.3.3.2 **A minimum of three hours of the documented 15 hours of CME must be related to radiation safety.**
 - 1.3.3.3 **Yearly accumulated continuing education must be kept on file and available to the ICACTL, when requested.**

Comment: If the medical staff has completed training or certification as specified under 1.3.1.1 or 1.3.1.2 in the past three years, the CME requirement will be considered fulfilled.

STANDARD –Technical Staff

- 1.4 All members of the technical staff must be qualified imaging technologists.

Note: In a laboratory with no technologists, a member of the medical staff may serve as technical staff for conditions as outlined in Section 1.4.1.4 only. In this case, the medical staff must meet the requirements of the technical staff and submit appropriate documentation of radiation safety and scanner training.

Effective January 1, 2014, all technical staff must be qualified imaging technologists.

- 1.4.1 **Technical staff required training and experience:**

All members of the technical staff must meet ONE OR MORE of the following criteria:

- 1.4.1.1 American Registry of Radiologic Technologists (ARRT) or the Canadian Association of Medical Radiation Technologists (CAMRT) certification in CT imaging (i.e. RT (CT)).

OR

- 1.4.1.2 An appropriate credential in another medical imaging field (i.e.: CNMT, RT (MR), RT).

OR

- 1.4.1.3 Completion of 12 months full-time (35 hours/week) clinical CT experience under direct supervision of a credentialed technologist plus ONE of the following:

- Completion of a formal two-year program or equivalent in another medical imaging profession, with concentration in radiation physics.
- Completion of a bachelor's degree in another medical imaging specialty, with concentration in radiation physics.

OR

- 1.4.1.4 A qualified licensed physician may operate a volume or cone beam CT scanner (for sinus and temporal bone imaging only) if that person has received a minimum of at least 3 hours of documented, specific training in radiation safety provided by a medical physicist or qualified expert and received a 100% score on a written examination administered by the provider of the radiation safety training program.

AND

Received a minimum of at least four (4) hours of documented, specific training in the operation of the scanner.

1.4.2 **Technical staff responsibilities:**

1.4.2.1 The technical staff member(s) reports to the Technical Director. The technical staff member(s) assumes the responsibilities specified by the Technical Director and, in general, is responsible for the performance of clinical CT examinations and other tasks assigned.

1.4.3 **Continuing Education requirements:**

1.4.3.1 **The technical staff must document at least 15 hours of Category I AMA or RCEEM approved CT related continuing education (CE) over a period of three (3) years.**

1.4.3.2 **A minimum of three hours of the documented 15 hours of CE must be related to radiation safety.**

1.4.3.3 **Yearly accumulated continuing education must be kept on file and available to ICACTL, when requested.**

Comment: If the technical staff member has successfully acquired an appropriate CT credential within the past three (3) years, the continuing education requirement will be considered fulfilled.

STANDARD – Medical Physicist or Qualified Expert

1.5 **The medical physicist must be board certified by the American Board of Radiology, the American Board of Medical Physics, or the Canadian College of Medical Physics in a discipline that includes diagnostic imaging. In states where medical physicists or qualified experts are licensed, registered or otherwise state-approved to measure dose and evaluate image quality at CT scanning facilities, these credentials are acceptable.**

1.5.1 Other personnel, deemed by the medical physicist as competent to perform the assigned tasks, may assist the medical physicist or qualified expert in the collection of data.

1.5.2 Continuing Education requirements:

1.5.2.1 **The medical physicist must document at least 15 hours of Category I AMA, Commission on Accreditation of Medical Physicists Educational Programs (CAMPEP) or the American College of Radiology (ACR) Medical Education for Physicists (MEP) approved physics related continuing education (CE) over a period of three (3) years.**

1.5.2.2 **A minimum of three hours of the documented 15 hours of CE must be related to radiation safety.**

1.5.2.3 **Yearly accumulated continuing education must be kept on file and available to ICACTL, when requested.**

STANDARD – Supervising Personnel for Contrast and/or Medication Administration

- 1.6 If the Medical Director or medical staff are not present during the CT examination, delegation of contrast and/or medication administration supervision and safety duties may be relegated to alternative licensed providers (i.e.: RN, NP or PA) that meet the following criteria:
 - 1.6.1 Are knowledgeable of patient preparation, and training in the recognition/treatment of adverse effects of contrast materials for these studies.
 - 1.6.2 Are responsible for supervising the use, dosage and rate of administration of contrast agents, per the laboratory's protocol.
 - 1.6.3 Possess familiarity with radiation safety, and the conscious sedation policies and procedures (if used) that are performed relative to CT.
 - 1.6.4 Are responsible for supervising the administration of beta-blockers, nitrates, and/or other cardio active and/or other medications per the laboratory's protocol.

STANDARD – Support Services

- 1.7 **Ancillary personnel (i.e.: clerical, nursing, transport, etc.) necessary for safe and efficient patient care are provided.**
 - 1.7.1 **Supervision:**
 - 1.7.1.1 **The Medical Director must ensure that appropriate support services are provided in the best interest of patient care.**
 - 1.7.2 **Support Services:**
 - 1.7.2.1 **Clerical and administrative support must be sufficient to ensure efficient operation and record keeping.**
 - 1.7.2.2 **Nursing and ancillary services must be sufficient to ensure quality patient care and are available when necessary.**
 - 1.7.2.3 The use of a qualified medical physicist is encouraged for initial acceptance testing, to establish and monitor the quality control program and radiation safety policies and procedures.

SECTION 2 Physical Facilities

STANDARD – Examination Areas

- 2.1 **Examinations must be performed in a setting providing patient and technical staff safety, comfort and privacy.**
 - 2.1.1 **The adequate performance of a CT examination requires the proper positioning of the patient. For this reason, adequate spacing is required for inclusion of a CT imaging system and patient privacy.**
 - 2.1.1.1 **Patient privacy must be assured with the use of appropriate curtains or doors.**
 - 2.1.1.2 **A sink and antiseptic soap must be readily available and used for hand washing in accordance with the infection control policy of the laboratory.**
 - 2.1.1.3 **Direct visualization and audible monitoring of the patient must be available through a leaded glass window, while protecting the personnel from radiation exposure.**
 - 2.1.1.4 **Post testing is available for patient observation, as indicated clinically.**

Note: All examinations, regardless of the location, must be performed with adequate room for patient positioning and equipment use.

STANDARD – Interpretation and Storage Space

- 2.2 **Designated space must be provided for the interpretation of the CT examination and the preparation of reports.**

Space should be provided for data evaluation, interpretation and discussion of the study with the technologist and/or referring physician, as needed. **Space permitted for storage of records and supplies must be sufficient for the patient volume of the laboratory.**

SECTION 3

Examination Data Archiving, Examination Reports and Laboratory Records

STANDARD – CT Examination Data

- 3.1 **Provisions must exist for the generation and retention of examination data for all CT examinations performed.**
 - 3.1.1 **A system for recording and archiving CT data (images, measurements and final reports) obtained for diagnostic purposes must be in place.**
 - 3.1.2 **A permanent record of the images and interpretation must be made and retained in accordance with applicable state or federal guidelines for medical records. Critical reconstructed CT data should be readily retrievable for comparison with new examinations. A complete series of digital axial images, reconstructed in at least one phase for gated studies, must be permanently stored in a format that will allow future multiplanar reformatting.**
 - 3.1.3 **Archiving media must include loss-less digital storage and a system for long-term, off-line digital storage.**
- 3.2 **Provisions must exist for the timely reporting of examination data.**
 - 3.2.1 **All CT examinations must be reviewed promptly after the study is completed, as appropriate for the risk of clinically significant results at least within one working day. Results of examinations with critical findings must be communicated to the referring physician as quickly as clinically indicated. A record of the communication should be maintained.**
 - 3.2.2 **If preliminary results are provided by an interpreting physician, the final report should be generated within two working days. A mechanism for communicating any significant changes must be defined for those situations in which the final interpretation differs significantly from the preliminary report.**
 - 3.2.3 **CT examinations must be interpreted and reported by the Medical Director or by a member of the medical staff of the CT laboratory. Final physician interpretations of routine CT examinations must be available within two working days. An interpretation can be in the form of paper, digital storage or an accessible voice system. The final verified, signed report must be available in a timely fashion, generally within four working days.**

SECTION 4

Laboratory Safety and Patient Confidentiality

STANDARD – Laboratory Safety

- 4.1 **Patient and employee safety is ensured by written policies and procedures, approved by the Medical Director.**
 - 4.1.1 **All CT laboratory professionals must have an understanding of the radiation exposure involved in CT to advise patients who may be undergoing CT imaging.**
 - 4.1.2 Radiation dose for CT acquisition should be set at the lowest values that are consistent with satisfactory image quality for the study ordered.
 - 4.1.3 **There must be at least one BLS certified staff member on site for all CT exams.**
 - 4.1.4 **Standard CT examinations must be safe to both patients and technologists. The laboratory must have a written procedure in place for handling acute medical emergencies. A CT laboratory providing CT procedures with contrast, exams with drug administration and/or exams with sedation must have the following emergency supplies readily available:**
 - 4.1.4.1 **Posting of emergency phone number(s).**
 - 4.1.4.2 **An Automated External Defibrillator (AED) or a fully equipped cardiac arrest cart (crash cart).**
 - 4.1.4.3 **Equipment for starting and maintaining intravenous access.**
 - 4.1.4.4 **Oxygen tank or wall mounted oxygen sources with appropriate cannulae and/or masks.**
 - 4.1.4.5 **Personnel trained and available to use the above emergency equipment.**
 - 4.1.5 **The laboratory must meet the standards set forth by the Occupational Safety and Health Administration (OSHA) and by The Joint Commission on Accreditation of Healthcare Organizations (JCAHO), where applicable.**
 - 4.1.6 The laboratory should comply with the ALARA recommendations of the Radiological Society of North America. The use of higher than recommended radiation doses should be justified. **For pediatric patients, protocols must be modified to reduce radiation exposure, where appropriate or possible.**
 - 4.1.7 **A separate, radiation shielded control room or area must be used by staff during acquisitions. No staff should routinely enter the CT room or area when the x-ray tube is active.**
 - 4.1.8 **Staff radiation exposure must be monitored, and reviewed by the QA Committee. The results must be communicated to the staff member.**
 - 4.1.9 **There must be restriction of the public to radiation areas.**
 - 4.1.10 All laboratories conducting contrast-enhanced studies should be equipped with remote infusion devices.

4.1.11 A policy for documentation of adverse events must be in place.

STANDARD – Patient Confidentiality

4.2 All laboratory personnel must ascribe to professional principles of patient-physician confidentiality, as legally required by federal, state, local or institutional policy or regulation.

SECTION 5

Multiple Sites and Mobile Services

STANDARD – Multiple Sites

- 5.1 **When testing is performed at more than one physical facility, the laboratory may be eligible to apply for a single accreditation as a multiple site laboratory if the following criteria are met:**
- 5.1.1 **All facilities have the same Medical Director.**
 - 5.1.2 **All facilities have the same Technical Director.**
 - 5.1.3 **All CT examinations are interpreted by medical staff included in the application.**
 - 5.1.4 **All facilities utilize the same medical physicist or qualified expert.**
 - 5.1.5 **All CT examinations are performed by technical staff included in the application.**
 - 5.1.6 **Technical and interpretive quality assessment, as outlined in Part II, Section 7, must be evaluated for all CT testing sites.**

STANDARD – Mobile Service

- 5.2 **A mobile service is comprised of one or more units (technologist and equipment) that provide CT testing services at one or more locations if all the following criteria are met:**

Comment: Some laboratories provide only mobile services and do not have a primary site laboratory. These mobile service laboratories are required to complete the entire accreditation application.

- 5.2.1 **The entire mobile service has the same Medical Director.**
- 5.2.2 **The entire mobile service has the same Technical Director.**
- 5.2.3 **All mobile CT examinations are interpreted by medical staff included in the application.**
- 5.2.4 **All facilities utilize the same medical physicist or qualified expert.**
- 5.2.5 **All mobile CT examinations are performed by CT technical staff included in the application.**
- 5.2.6 **CT scanners that are used in a mobile setting must meet the same instrument quality assurance standards as described for fixed scanners in Part II, Section 2.**
- 5.2.7 **Technical and interpretive quality assessment as outlined in Part II, Section 7 must be evaluated for all CT testing performed by the mobile service.**

Bibliography

American College of Radiology (ACR). (2005). Practice guideline for the use of intravascular contrast media. *Journal of American College of Radiology*, 21-25. Website: <http://www.acr.org>.

Budoff, M. J., Cohen, M. C., Garcia, M. J., & et al. (July 2005). American College of Cardiology Foundation/American Heart Association (ACCF/AHA) Clinical competence statement on cardiac imaging with computed tomography and magnetic resonance. American College of Physicians Task Force on Clinical Competence and Training. *Journal of American College of Cardiology*, 46(2), 283-402.

Gray, J. E., Archer, B. R., Hobbs, B. B., Mettler, F. A., & et al. (2005). Reference values for diagnostic radiology: application and impact. *Radiology*, 235, 354-358.

Limacher, M. C., Douglas, P. S., Germano, G., & et al. (March 1998). Radiation safety in cardiology. *Journal of American College of Cardiology*, 31(4), 892-913.

Prasad, K. N., Cole, W. C., & Haase, G. M. (February 2004). Radiation protection in humans: Extending the concept of as low as reasonably achievable (ALARA) from dose to biological damage. *British Journal of Radiology*, 914, 97-9.

Appendix

Table 3. Requirements for CCT Study Performance and Interpretation to Achieve Level 1, 2, and 3 Clinical Competence

	Cumulative Duration of Training	Minimum Number of Mentored Examinations Performed	Minimum Number of Mentored Examinations Interpreted
Level 1	4 weeks*	—	50†
Level 2—non-contrast	4 weeks*	50	150†
Level 2—contrast	8 weeks*	50	150†
Level 3	6 months*	100	300†

*This represents cumulative time spent interpreting, performing, and learning about CCT, and need not be a consecutive block of time, but at least 50% of the time should represent supervised laboratory experience. In-lab training time is defined as a minimum of 35 h/week. †The case load recommendations may include studies from an established teaching file, previous CCT cases, journals and/or textbooks, or electronic/on-line courses/CME.

Table 5. Documentation and Maintenance of Clinical Competence in CCT

Documentation of Competence	Training Guidelines	Proof of Competence
Training completed after July 1, 2008	Level 2 or Level 3 training as outlined	Letter of certification from training supervisor OR letter attesting to competence from Level 2- or 3-trained physician
Training completed before July 1, 2008	Level 2 training OR interpretation of at least 150 studies (in which 50 where the candidate is physically present, involved in the acquisition and interpretation of the case) and attendance in at least 20 h of devoted CCT classes Level 3 training OR interpretation of at least 300 studies (in which 100 where the candidate is physically present, involved in the acquisition and interpretation of the case) and attendance in at least 40 h of classes devoted to CCT	
Maintenance of competence	Contrast CCT examinations per year be performed and interpreted: Level 2: 50 Level 3: 100	

PART II

CT TESTING

SECTION 1

Instrumentation

STANDARD – Instrumentation

- 1.1 All CT imaging devices in use must be appropriate for the organ systems being imaged, and must be FDA approved for the specific imaging task.
- 1.2 The CT equipment specifications and performance must meet all state, federal and local requirements, as well as the manufacturer's published performance specifications and current standards of medical practice for the types of examinations performed.
- 1.3 The CT systems utilized for diagnostic studies must include, at a minimum, adequate hardware and software to perform and store organ specific procedures.

1.3.1 Coronary Calcium Scoring

CT scanners that will be used for coronary calcium scoring must meet the following minimum specifications:

1.3.1.1 Electron Beam CT Systems:

1.3.1.1.1 $\leq 100\text{msec}$

OR

1.3.1.2 Multi-detector CT Systems

1.3.1.2.1 **4 slice system or greater**

1.3.1.2.2 Should have ≤ 0.5 sec rotation speed

1.3.2 Coronary Computed Tomography Angiography (CTA)

CT scanners used for coronary arteries and coronary bypass grafts must meet the following minimum specifications:

1.3.2.1 Multi-detector CT Systems:

1.3.2.1.1 **64 slice system or greater**

1.3.2.1.2 ≤ 0.5 sec rotation speed

1.3.2.1.3 **Dual auto injector system**

1.3.3 Vascular or Other CTA

CT scanners that will be used for CTA (abdomen; pelvis; chest, non-coronary; neurovascular (including carotids); and peripheral vascular) must meet the following minimum specifications:

1.3.3.1 Multi-detector CT Systems:

- 1.3.3.1.1 **16 slice system or greater**
 - 1.3.3.1.2 Should have ≤ 0.5 sec rotation speed
 - 1.3.3.1.3 **Automatic infusion injector system**
 - 1.3.3.2 **Electron Beam CT**
- 1.3.4 Neurological CT (excluding CTA)
 - CT scanners that will be used for neurological imaging must meet the following minimum specifications:**
 - 1.3.4.1 **Single or Multi-detector CT Systems:**
 - 1.3.4.1.1 Should have ≤ 0.5 sec rotation speed
- 1.3.5 Sinus and Temporal Bone CT
 - CT scanners that will be used for dedicated sinus and temporal bone imaging must meet the following minimum specifications:**
 - 1.3.5.1 **Volume or Cone Beam CT System**
 - 1.3.5.2 **Single or Multi-detector CT Systems:**
 - 1.3.5.2.1 Should have ≤ 2 sec rotation speed
- 1.3.6 Body CT (Chest, Abdomen, Pelvis, Extremities, excluding CTA)
 - CT scanners that will be used for body imaging (excluding CTA), must meet the following minimum specifications:**
 - 1.3.6.1 **Single, Electron Beam or Multi-detector CT Systems**
 - 1.3.6.1.1 Should have ≤ 2 sec rotation speed
- 1.4 **The computer software and reconstruction systems used for CT procedures must be appropriate for the study performed and must meet the following minimum specifications:**
 - 1.4.1 Coronary Calcium Scoring
 - 1.4.1.1 **Must be capable of providing a visual representation of coronary calcium exceeding protocol thresholds.**
 - 1.4.1.2 **Must be capable of quantitating coronary calcium using Agatston, mass and/or volume scoring methodologies.**
 - 1.4.1.3 **Must be capable of providing user interaction with a quantitative program to allow for selecting or de-selecting coronary calcifications based on visual inspection.**
 - 1.4.2 Coronary CTA
 - 1.4.2.1 **Must be capable of displaying data as Maximum Intensity Projection (MIP), thick or thin slices.**
 - 1.4.2.2 **Must be able to display data as multi-planar reformat.**

- 1.4.2.3 **Must be able to display data in a curve plane reformat.**
- 1.4.2.4 **Must be able to present data in a three dimension format with the ability to display data rotated about all three axes.**
- 1.4.2.5 **Must be able to extract relevant measurements as described in laboratory specific protocol.**
- 1.4.2.6 **Must be able to load simultaneously multiple phases.**
- 1.4.2.7 **Must be able to perform quantification of coronary calcium.**
- 1.4.3 Vascular or Other CTA (Abdomen; Pelvis; Chest (non-coronary); Neurovascular (including carotids) and Peripheral Vascular)
 - 1.4.3.1 **Must be capable of displaying data as Maximum Intensity Projection (MIP), thick or thin slice.**
 - 1.4.3.2 **Must be able to display data as multi-planar reformat data.**
 - 1.4.3.3 Should be able to present data in a three dimension fashion with the ability to display data rotated about all three axes.
 - 1.4.3.4 **Must be able to extract relevant measurements as described in the laboratory specific protocol.**
- 1.4.4 Neurological CT (excluding CTA)
 - 1.4.4.1 **Must be capable of image processing appropriate to the imaging task.**
- 1.4.5 Sinus and Temporal Bone CT
 - 1.4.5.1 **Must be capable of image processing appropriate to the imaging task.**
- 1.4.6 Body CT (Chest, Abdomen, Pelvis, Extremities, excluding CTA)
 - 1.4.6.1 **Must be capable of image processing appropriate to the imaging task.**
- 1.5 **For all systems:**
 - 1.5.1 All data are to be reviewed in a digital, on-screen medium.
 - 1.5.2 If images are transmitted to another location for interpretation, the original resolution should be maintained.
 - 1.5.3 **Monitor specifications must be sufficient to prevent any loss of resolution of CT images and to display the thinnest reconstructed images available.**
 - 1.5.4 **Must have capability to display data in standard contrast settings (Lung field, bone, chest, etc.).**
 - 1.5.5 **Must have capability to adjust brightness and contrast settings manually.**
 - 1.5.6 **Datasets used for archiving must be DICOM compatible.**
 - 1.5.7 **Must have the capability to optimize the field of view based on patient size and protocol implemented.**

SECTION 2

Instrument Quality Assurance

STANDARD – Quality Assurance (QA)

- 2.1 **There must be a written comprehensive quality assurance program to provide a standard of measurement for system performance and the documentation of any variance thereof. A Quality Assurance Committee should be appointed as an oversight to these procedures.**
 - 2.1.1 The Quality Assurance Committee should, at minimum, consist of the Technical Director, Medical Director, service engineer, and/or site-appointed medical physicist. **The use of a site appointed medical physicist or qualified expert is required for an annual survey of the scanner image quality and dose, and for oversight of the quality control (QC) program.**
 - 2.1.2 Quality control (QC) tests, standards, thresholds, timelines and results should be reviewed and discussed on a quarterly basis by the Quality Assurance Committee. **Results of all QC tests must be documented, archived and stored on film, in digital format, or on other suitable media according to state requirements if applicable.**

- 2.2 **The quality assurance program must consist of CT system installation acceptance testing and major upgrade acceptance testing.**
 - 2.2.1 **Acceptance testing must include a comprehensive evaluation of the system components, the QC parameters included in sections 2.3 and 2.4, image performance and system performance as outlined in 21 CFR and applicable FDA guidance documents and performance of a radiation survey to verify the adequacy of installed lead shielding, if applicable.**
 - 2.2.2 The CT site-appointed medical physicist or qualified expert should perform the acceptance testing.
 - 2.2.3 **The system parameters must be compared to the manufacturer’s system specifications and reviewed by the Quality Assurance Committee.**
 - 2.2.4 **A written report of the acceptance tests must be maintained at the CT laboratory. The report must be signed and dated by the person performing the tests.**
 - 2.2.5 **The medical physicist or qualified expert must perform the shielding design to ensure that occupational workers and members of the public are shielded according to NCRP Report 147, state regulation, or other equivalent industry standards. This must be performed prior to installation of each new scanner.**
 - 2.2.6 **Dose and image quality assessment of representative exams as compared to professional standards must be performed.**

- 2.3 **Routine (daily and periodic) QC tests are to be conducted according to performance measurements as outlined by the manufacturer. Federal standards require that CT manufacturers provide quality assurance testing instructions, recommended testing frequency, a quality control test phantom appropriate for the scanner and acceptable variations in parameter measurements.**
 - 2.3.1 Daily quality control tests should include, at a minimum:
 - 2.3.1.1 Mean CT number for water of representative components;
 - 2.3.1.2 Mean CT number of other reference material;

- 2.3.1.3 Image noise;
- 2.3.1.4 Artifact assessment;
- 2.3.1.5 Proper function of audible and visual patient safety equipment.
- 2.3.2 Periodic quality assurance tests should include all from Section 2.3.1 and:
 - 2.3.2.1 Spatial resolution for high and low contrast objects.
 - 2.3.2.2 Image uniformity;
 - 2.3.2.3 Slice thickness;
 - 2.3.2.4 Alignment light accuracy;
 - 2.3.2.5 Image display and storage devices;
 - 2.3.2.6 Air calibration, if required.
- 2.4 **Annual system performances measures must be evaluated using an appropriate phantom(s), determined by the medical physicist or qualified expert and should include, where appropriate to the scanner:**
 - 2.4.1 Contrast scale;
 - 2.4.2 Mean CT number of water and reference materials;
 - 2.4.3 Linearity;
 - 2.4.4 Internal and external laser light alignment;
 - 2.4.5 Gantry tilt (tilt gantry systems only);
 - 2.4.6 Slice localization;
 - 2.4.7 Table incrementation accuracy;
 - 2.4.8 Slice thickness;
 - 2.4.9 Image quality as noted in 2.3;
 - 2.4.10 Image display and storage devices;
 - 2.4.11 **Measurement and assessment of patient dose for representative examinations using CT dosimetry phantom(s) and instrumentation, in accordance with current professional standards and regulatory guidelines.**
 - 2.4.12 Safety analysis including an inspection of audible and visual equipment.
- 2.5 **The Quality Assurance Committee must evaluate the medical physicist or qualified expert's recommendations for which quality control tests should be performed on the CT scanner and ancillary equipment, the frequency of the testing, and designate personnel to perform the test(s).**
 - 2.5.1 **Preventive maintenance (PM) service is required per the manufacturers' recommendations but not less than annually for each CT scanner at the laboratory.**

- 2.5.2 Scanner ancillary equipment inspection (e.g.: ECG gating, other monitoring equipment, injectors, processors, workstations, PACS, etc.) should also be included in the PM.
- 2.5.3 **A complete log of the PM, quality control tests and service records for all CT scanners and ancillary equipment must be maintained at the CT laboratory. The reports must be signed and dated by the person(s) performing the tests.**
- 2.6 The quality assurance program should also include a process for evaluating indicators such as backlog for scheduled examinations, late reporting, long patient waiting times and utilization review.
- 2.7 **All QC and QA results must be documented.**
 - 2.7.1 **Quality assurance documentation (policies, reports, records, etc.) must be maintained at the CT laboratory and made available to all personnel.**

SECTION 3

Indications, Ordering Process, Scheduling and Patient Preparation

STANDARD – Indications

- 3.1 CT testing is performed for appropriate indications.
 - 3.1.1 For patients presenting with acute stroke symptoms refer to the Acute Stroke Appendix.
 - 3.1.2 **Verification of the indication: A process must be in place in the laboratory for obtaining and recording the indication. Before a CT study is performed, the indication must be verified and any additional information needed to direct the examination must be obtained.**

STANDARD – Ordering Process and Scheduling

- 3.2 CT testing is appropriately ordered and scheduled.
 - 3.2.1 **Ordering process: The CT order and requisition must clearly indicate the type of study to be performed, the reason(s) for the study and the clinical question(s) to be answered. The order/requisition must be present in the medical record of the patient.**
 - 3.2.2 **Sufficient time for patient assessment, preparation and testing must be allotted for each study according to the procedure type.**

STANDARD – Patient Identification and Preparation*

* Imminent life threatening situations may override the patient preparation and identification at the discretion of the treating physician.

- 3.3 **Patient identification – For all clinical procedures there must be a process that assures accurate patient identification prior to initiating the procedure. It is preferable that this be done using at least two pieces information that are provided by the patient and compared with existing documents.**
- 3.4 **Pregnancy screening – For all clinical procedures there must be a process that assures that patients who could be pregnant are identified. This must be documented and should contain the signature/initials of the patient and/or technologist verifying the information. This procedure must include an explanation of the proper steps to be taken if a patient may be or is pregnant.**
 - 3.4.1 **If a diagnostic CT examination is needed for a patient who is pregnant, knowledgeable staff (e.g. Medical Director or other designee) must discuss the potential risk to the fetus and document the general content of the discussion.**
 - 3.4.2 **If determined that the study will not be performed, then the patient must receive options for alternative care.**

- 3.5 **There must be a policy in place for determining and administering any necessary pretest preparations including:**
 - 3.5.1 **Education/instructions such as dietary or medication restrictions, examination specific preparation or other relevant information.**
 - 3.5.2 **Sufficient time must be allowed for adequate patient preparation.**
 - 3.5.3 **There must be a policy in place for performing CT examinations in patients with documented or possible sensitivity to contrast.**
 - 3.5.4 **There must be a policy in place that addresses patients with increased risk of renal toxicity.**
 - 3.5.4.1 If contrast is used serum creatinine and BUN should be obtained if clinically indicated and **the results reviewed prior to the CT examination.**
- 3.6 **There must be a policy in place that addresses medication and contrast administration that includes, but is not limited to:**
 - 3.6.1 **IV access including location of insertion site and size of catheter;**
 - 3.6.2 **Medications, including contrast, used in the procedure (i.e.: beta blockers, conscious sedation);**
 - 3.6.3 **Dosage, timing, route of administration;**
 - 3.6.4 **Patient instruction;**
 - 3.6.5 **Patient monitoring;**
 - 3.6.6 **Any precautions or restrictions needed;**
 - 3.6.7 **Treatment of adverse reactions;**
 - 3.6.8 **Consent form (if required);**
- 3.7 **Any other types of necessary pretest preparation must be assessed prior to the start of the examination.**

SECTION 4

Elements and Components of CT Examination Performance

STANDARD – Elements of CT Examination Performance

4.1 Examination performance must include proper technique.

All procedures must be explained to the patient and/or parents or guardian and informed consent obtained, if required.

4.1.1 Elements of examination performance include as appropriate, but are not limited to:

4.1.1.1 Proper patient positioning.

4.1.1.2 Optimization of image acquisition parameters inclusive of dose reduction techniques, if appropriate.

4.1.1.3 Appropriate protocol selection based on:

4.1.1.3.1 Clinical diagnosis;

4.1.1.3.2 Patient age;

4.1.1.3.3 Body habitus/weight;

4.1.1.3.4 Surgical history;

4.1.1.3.5 Patient clinical presentation;

4.1.1.3.6 Contraindications;

4.1.1.4 Utilization of the appropriate protocol.

4.1.2 The laboratory must have a complete, written description of each protocol that is being utilized for each CT examination and the protocol(s) must include as appropriate:

4.1.2.1 The indication for the study.

4.1.2.2 Anatomical region(s) to be imaged.

4.1.2.3 Utilization of the correct scanner for the indication.

4.1.2.4 Clear criteria for deviating from protocols.

4.1.2.4.1 **Modifications to the manufacturer's default protocols that increase patient dose above the site appointed physicist recommendation must be reviewed by a medical physicist prior to implementation of the proposed change(s) in order to assess impact on radiation dose and image quality.**

4.1.2.4.2 **If the physicist deems that the proposed change(s) is appropriate, the laboratory must maintain documentation of the protocol change(s) that includes the rationale for the change, including the details of the change (exactly what changes were made to the technical parameters for the scans) and the physicist review of impact on dose and image quality.**

- 4.1.2.5 **Adherence to established practice guidelines. There may be allowance for exceptions, if validated.**
- 4.1.2.6 **All orientations/views that will be displayed.**
- 4.1.2.7 **Scanner settings or acquisition parameters to include:**
 - 4.1.2.7.1 **Acquisition mode;**
 - 4.1.2.7.2 **Patient orientation;**
 - 4.1.2.7.3 **KV;**
 - 4.1.2.7.4 **mA/mAs;**
 - 4.1.2.7.5 **Dose modulation, if used;**
 - 4.1.2.7.6 **Collimation;**
 - 4.1.2.7.7 **Rotation time;**
 - 4.1.2.7.8 **Slice thickness;**
 - 4.1.2.7.9 **Increment;**
 - 4.1.2.7.10 **Table speed/pitch;**
 - 4.1.2.7.11 **FOV;**
 - 4.1.2.7.12 **Gantry angle, if used;**
 - 4.1.2.7.13 **Representative exposure or dose as recorded by the CT System.**
- 4.1.2.8 **Filming instructions to include window level and contrast settings, views, format and magnification.**
- 4.1.2.9 **Reconstruction algorithm and filter.**
- 4.1.2.10 **Reconstruction interval.**
- 4.1.2.11 **Phase(s) of cardiac cycle reconstructed.**
- 4.1.2.12 **Indication for IV contrast to include: type of contrast, amount, injection rate and scan delay protocol.**
- 4.1.2.13 **Other medications used including dose and route of administration.**
- 4.1.2.14 **Instruction on data archiving and transmission of images including what files are to be stored/transmitted.**
- 4.1.3 **Separate pediatric protocols must be established based on patient age or weight. Pediatric protocols must be modified to reduce radiation exposure where appropriate or possible.**
- 4.1.4 **Use of appropriate radiation dose reduction devices OR techniques for appropriate moderation of exposure must be documented or their lack of use justified when applicable. Dose reduction techniques include but are not limited to prospective gating, tube modulation (kVp and/or mAs), manufacturer dose reduction protocol and/or dose modulation.**

SECTION 5

Examination Interpretation

- 5.1 **CT examination reporting must be standardized in the laboratory. All physicians interpreting CT examinations in the laboratory must agree on a standardized report format.**
 - 5.1.1 **The final report must accurately reflect the content and results of the study. The report must include, but may not be limited to:**
 - 5.1.1.1 **Date of the examination.**
 - 5.1.1.2 **Clinical indications leading to the performance of the examination.**
 - 5.1.1.3 **An adequate description of the test performed including:**
 - 5.1.1.3.1 **Name of the examination;**
 - 5.1.1.3.2 **Protocol used in the examination;**
 - 5.1.1.3.3 **Quality of the study;**
 - 5.1.1.3.4 **Details of drug and or medication administration (include the name, dose administered and route);**
 - 5.1.1.3.5 **Administration of contrast, if used. (include the name, type, and amount of IV contrast administered);**
 - 5.1.1.3.6 **Details of any non-standard patient preparation or treatment if required should be included.**
 - 5.1.1.4 **An overview of the results of the examination including pertinent findings. Where appropriate, this must include localization and quantification of abnormal findings.**
 - 5.1.1.5 **Appropriate recommendation for follow up of incidental findings.**
 - 5.1.1.6 **The reasons for limited examinations.**
 - 5.1.1.7 **A summary of the test findings.**
 - 5.1.1.8 **Comparison with previous studies, if available.**
 - 5.1.1.9 **Reports must be typewritten.**
 - 5.1.1.10 **Physician signature line (the printed name of the interpreting physician) and be manually or electronically signed by the interpreting physician and include the date of signature and/or verification.**
 - 5.1.1.11 **Documentation of dose reduction technique if used (e.g.: prospective gating, low energy and/or dose modulation) is recommended in the report.**

SECTION 6

Procedure Volumes

STANDARD – Procedure Volumes

- 6.1 **The annual procedure volume must be sufficient to maintain proficiency in examination performance and interpretation.**

A laboratory should perform a minimum of 300 CT examinations annually. Each member of the medical staff should interpret a minimum of 300 CT examinations annually. Each member of the technical staff should perform a minimum of 300 CT examinations annually. The total volume of studies interpreted and performed by each staff member may be combined from sources other than the applicant laboratory. Lower volumes than those recommended here, however, should not dissuade a laboratory that is otherwise compliant with the *ICACTL Standards* from applying for accreditation.

SECTION 7

Technical and Interpretive Quality Assessment (QA)

A quality assessment (QA) program must be in place and implemented to provide a standard of measurement of the technical and interpretive components of laboratory performance and the documentation of any variance.

STANDARD – Technical Quality Assessment

- 7.1 Under the supervision of the Medical Director and the Technical Director, and with the guidance of the Medical Physicist or qualified expert, the laboratory must have a defined quality assessment program that evaluates the ongoing technical quality and radiation dose information (i.e. Computed Tomography Dose Index (CTDI), Dose Length Product (DLP)), of the CT procedures performed in the laboratory. **Each facility must document the available dose reduction techniques and clinical indications/contraindications for their use.**
- 7.2 The program should have predefined indicators of quality and predefined thresholds that indicate the need for corrective action. The laboratory should maintain reports of quality assessment evaluations and corrective actions taken.
- 7.2.1 Indicators may include, but not limited to:
- 7.2.1.1 Adverse effects (i.e.: contrast reactions, repeat exams, patient incidents)
 - 7.2.1.2 **Image quality (i.e.: field of view; contrast enhancement; artifacts; extent of coverage; adherence to protocol)**
 - 7.2.1.3 Reproducibility of image quality and computer processing (i.e.: reformats; electronic transfers)
- 7.2.2 **Radiation dose review and assessment must be included in the program.**
- 7.2.3 **Documentation of dosimetry data ranges (DLP;CTDIvol;; or dose(mGy) per sequence or cumulative per examination) for protocols used in the laboratory based on patient age and habitus.**
- 7.2.4 Thresholds are to be determined for each indicator.
- 7.2.5 Corrective actions should be taken to improve the operation of the laboratory.
- 7.3 **Appropriate Use Criteria (AUC)**
- 7.3.1 As part of the ongoing quality improvement program, facilities providing computed tomography should incorporate the measurement of the appropriate use of this diagnostic imaging examination based on criteria published and/or endorsed by professional medical organization(s).
 - 7.3.2 Overall results should be documented. The percentage of appropriate, inappropriate and uncertain indications for testing should be measured.
 - 7.3.3 A program for education and reporting should be developed and may include but is not limited to:
 - i. **Patterns of adherence to AUC**

- ii. [Baseline rates of adherence](#)
- iii. [Goals for improvement of adherence to appropriate use criteria](#)
- iv. [Measurement of improvement rate](#)
- v. [Confidential comparison reports on patterns of adherence in aggregate by ordering physician, ordering practice and interpreting practice.](#)

STANDARD – Interpretive Quality Assessment

- 7.4 **Under the supervision of the Medical Director, the laboratory must have a defined quality assessment program that evaluates the ongoing quality of the interpretation of the CT examinations.**
- 7.5 This program should have predefined indicators of quality and predefined thresholds that indicate the need for corrective action. The Medical Director should maintain reports, as necessary, of quality assessment evaluations and document, if applicable, corrective measures taken.

7.5.1 Peer review

Intermittent peer review of both the performance and interpretation of examinations should be performed to determine the quality, accuracy and appropriateness of the examination. Peer review may also be used to compare reproducibility of interpretation with previous interpretation, or with interpretation of the same study by other qualified interpreting physicians. Both physicians and technologists should be involved in the peer review process in order to achieve standardized protocols and reporting. Results of peer review should be discussed in an appropriate manner to assure correction of negative results as well as to preserve physician, technologist and patient confidentiality. (Strict attention must be paid to physician, staff and patient confidentiality as required by federal, state, local or institutional policy or regulation).

7.5.2 Correlation and confirmation of results

For those patients who have undergone CT examinations and other diagnostic procedures (such as cardiac catheterization, invasive angiography, nuclear perfusion examinations or other diagnostic imaging) or surgical intervention, the results of CT examination and other procedures must be routinely compared. A process for reviewing variations between CT examination results and results of other procedures must be in place.

7.6 **Quality Assessment review and documentation**

The results of the technical and interpretive quality assessments must be reviewed and disseminated to the medical and technical staff at a minimum of two times per year.

7.7 **Quality Assurance record keeping**

Records must be maintained of the quality assurance process. These records should include, but not be limited to, peer review, correlation data and information gained from the areas outlined in Section 7. **The records must include a description of how the information is used to improve quality in the CT laboratory.**

ACUTE STROKE APPENDIX

Requirements for Emergent CT Studies for Patients Presenting With Acute Stroke Symptoms

The following criteria are required for those laboratories performing CT studies for patients presenting with acute stroke symptoms:

- 1) Qualified board certified physicians are required to interpret the study.**
- 2) A written procedure must be available outlining the identification of these emergent CT studies (i.e.: code stroke) on the study request so that a timely interpretation is done.**
- 3) A written preliminary report of the CT head should be sent to the treating physician within 45 minutes of the patient's arrival to the facility. Alternatively, a direct verbal report to the treating physician can be done within 45 minutes of the patient's arrival to the facility with a follow up written preliminary report documenting the time of this verbal report exchange. A goal of reading the CT head within 15 minutes of the completion of the study is recommended. If the interpreting and treating physician is the same, a preliminary written report should be noted within the medical record.**
- 4) The written preliminary report should include comments on major CT head findings (at a minimum, presence or absence of hemorrhage, mass lesion, or acute infarction must be mentioned) as well as whether this study fulfills neurological imaging criteria for inclusion or exclusion of acute stroke therapies based on available published neurological imaging guidelines.**
- 5) The physician providing the preliminary interpretation must be the same person providing the final official interpretation of the CT study.**
- 6) When the CT interpreter and the treating physician are different individuals who both render written opinions regarding neurological imaging criteria for inclusion or exclusion of acute stroke therapies, the CT laboratory must track this information as a part of quality assurance.**
- 7) The final CT interpretation must conform to available published acute stroke neuroimaging guidelines (at a minimum for head CTs, presence or absence of hemorrhage, mass lesion, or acute infarction must be mentioned and the inclusion or exclusion of acute stroke therapies based on neurological imaging criteria).**
- 8) The final CT study interpretation must be dictated within 24 hours of completion of the study.**

**** The above guidelines are applicable to any CT study used to guide emergent treatment decisions.**

Acute Stroke Bibliography

- Albers, G. W., Bates, V.E., Clark, W. M., Bell R, Verro P., & Hamilton S. A. (March 2000). Intravenous tissue-type plasminogen activator for treatment of acute stroke: the standard treatment with alteplase to reverse stroke (STARS) study. *Journal of American Medical Association*, 283(9), 1145-50.
- Alberts, M. J., Hademenos G., Latchaw, R. E., Jagoda A., Marler, J. R., Mayberg, M. R., & et al. (June 2000). Recommendations for the establishment of primary stroke centers. Brain attack coalition. *Journal of American Medical Association*, 283(23), 3102-9.
- Alberts, M. J., Latchaw, R. E., Selman, W. R., Shephard, T., Hadley, M. N., Brass, L. M., & et al. (July 2005). Recommendations for comprehensive stroke centers: A consensus statement from the brain attack coalition. *Stroke*, 36(7), 1597-616.
- Centers for Medicare and Medicaid Services (CMS). (2007). Physician quality reporting initiative (PQRI) physician quality measures. <http://www.cms.hhs.gov/PQRI/Downloads/PQRI MeasuresList.pdf>
- Culebras, A., Kase, C. S., Masdeu, J. C., Fox, A. J., Bryan, R. N., Grossman, C. B., & et al. (July 1997). Practice guidelines for the use of imaging in transient ischemic attacks and acute stroke. A report of the stroke council, American Heart Association. *Stroke*, 28(7), 1480-97.
- Grotta, J.C. (December 1996). Acute hospital care: Resource utilization. Proceedings of a national symposium on rapid identification and treatment of acute stroke. Retrieved from: http://www.ninds.nih.gov/news_and_events/proceedings/stroke_proceedings/grotapnl.htm
- Köhrmann, M., Jüttler, E., Huttner, H. B., Nowe, T., & Schellinger, P. D. (June 2007). Acute stroke imaging for thrombolytic therapy--An update. *Cerebrovascular Disease*, 24(2-3), 161-9.
- Lansberg, M.G., Thijs, V. N., Bammer, R., Kemp, S., Wijman, C.A., Marks, M. P., & et al. (August 2007). Risk factors of symptomatic intracerebral hemorrhage after tPA therapy for acute stroke. *Stroke*, 8, 2275-8.
- Latchaw, R. E., Yonas, H., Hunter, G.J., Yuh, W.T., Ueda, T., Sorensen, A.G., & et al. (April 2003). Council on cardiovascular radiology of the American Heart Association. Guidelines and recommendations for perfusion imaging in cerebral ischemia: A scientific statement for healthcare professionals. *Stroke*, 34(4), 1084-104.
- Larrue, V., Von Kummer, R. R., Müller, A., & Bluhmki, E. (February 2001). Risk factors for severe hemorrhagic transformation in ischemic stroke patients treated with recombinant tissue plasminogen activator: A secondary analysis of the European-Australasian acute stroke study (ECASS II). *Stroke*, 32(2), 438-41.
- Masdeu, J. C., Irimia, P., Asenbaum, S., Bogousslavsky, J., Brainin, M., Chabriat, H., & et al. (December 2006). Guideline on neuroimaging in acute stroke. Report of an EFNS task force. *European Journal of Neurology*, 13(12), 1271-83.
- Sylaja, P. N., Dzialowski, I., Krol, A., Roy, J., Federico, P., & Demchuk, A. M. (March 2006). Calgary stroke program role of CT angiography in thrombolysis decision-making for patients with presumed seizure at stroke onset. *Stroke*, 37(3), 915-7.
- Stroke study group. (December 1995). Tissue plasminogen activator for acute ischemic stroke. The National Institute of Neurological Disorders and Stroke rt-PA. *New England Journal of Medicine*, 333(24), 1581-7.
- Tanne, D., Kasner, S.E., Demchuk, A.M., Koren-Morag, N., Hanson, S., Grond M., & et al. (April 2002). Markers of increased risk of intracerebral hemorrhage after intravenous recombinant tissue plasminogen activator therapy for acute ischemic stroke in clinical practice: the multicenter rt-PA stroke survey. *Circulation*, 105(14), 1679-85.

Bibliography

American Association of Physicists in Medicine report No.3. Assessment of display for medical imaging systems. Website: http://www.aapm.org/pubs/reports/OR_03.pdf

American Association of Physicists in Medicine report No. 1. Phantoms for performance evaluation and quality assurance of CT scanners. Website: http://www.aapm.org/pubs/reports/OR_03.pdf

American College of Radiology (ACR). Committee on Drugs and Contrast Media. (2004). Manual on Contrast Media (version 5.0). Reston, VA:ACR. Website: <http://www.acr.org>.

American College of Radiology (ACR). (2005). Practice guideline for the use of intravascular contrast media. *Journal of American College of Radiology*, 21-25.
Website: <http://www.acr.org>.

Budoff, M. J., Achenbach, S., Fayad, Z., Berman, D. S., et al. Task Force (2006). Training in advanced cardiovascular imaging (computed tomography). *Journal of American College of Cardiology*, 47, 915-20.

Budoff, M.J., Fischer, H., Gopal, A.(November 2006). Incidental findings with cardiac CT evaluation – Should we read beyond the heart? *Catheterization and Cardiovascular Interventions*, 68, 965-973.

Cardiac Computed Tomography and Cardiac Magnetic Resonance Imaging (CCT/CMR) Writing Group. Appropriateness criteria for cardiac computed tomography and cardiac magnetic resonance imaging. (October 2006). *Journal of American College of Cardiology*, 48 (7), 1475-1497.

Cochran, S. T., Bomyea, K., & Sayre, J. W. (001). Trends in adverse events after IV administration of contrast media. *American Journal of Radiology*, 176, 1385-1388.

Gray, J. E., Archer, B. R., Hobbs, B. B., Mettler, F. A., & et al. (2005). Reference values for diagnostic radiology: Application and impact. *Radiology*, 235, 354-358.

International Commission on Radiation Protection (ICRP) Publication 84. Pregnancy and Medical Radiation. Website: http://www.icrp.org/educational_area.asp

International Commission on Radiation Protection (ICRP) Report 87. CT Dose Management. Website: http://www.icrp.org/educational_area.asp

National Council on Radiation Protection & Measurements (NCRP).(2004). Structural shielding design for medical x-ray imaging facilities report 147.

New Jersey Department of Environmental Protection. (2001). Compliance guidelines for computed tomography quality control. Website: <http://www.state.nj.us/dep/rpp/download/ctcgd.pdf>

U.S. Food and Drug Administration Center for Devices and Radiological Health (CDRH). (2006). Performance standards for ionizing radiating products. Code of Federal Regulations: 21 CFR Sect. 1020.33. Website: <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcr/CFRSearch.cfm?fr=1020.33>.