CARECORE CARDIOLOGY MANAGEMENT CARDIAC CT SPECIALTY CENTER (CCTSC) [1-5]

(Revised 5/30/2007)

This document defines the education, training, and experience guidelines required by CareCore Cardiology Management for a physician to be privileged to perform Cardiac CT and Coronary Computed Tomographic Angiography (CCTA) based on recommendations of its panel of nationally/internationally recognized cardiac imaging experts who have all met the standards in Cardiac CT and CCTA established by the credentialing professional organizations (AHA, ACC, NASCI and/or SCCT). Those physicians becoming privileged to perform CCTA as part of a Cardiac CT examination according to these requirements will be referred to as Cardiac Imaging Specialists (CIS) in this document. This document also covers the equipment standards, nursing, and technician standards for a CIS to perform CCTA and other forms of application-specific cardiac CT examinations at a CCTSC facility.

CT angiography is a proven and useful procedure for the detection and characterization of vascular anatomy and diseases affecting the arteries and veins. CTA may be used as the primary modality for detecting vascular disease as an adjunctive tool to better characterize known disease and to assess changes in a disease state over time.

Cardiac CT examinations, and in particular CCTA are forms of medical imaging that expose patients to ionizing radiation and should only be performed under the supervision of a physician with the necessary training in radiation safety. Trained technical staff must also be available. In addition, the CT scanner should be calibrated in accordance with regulations and periodically checked by a medical physicist.

CCTA is defined as a CTA examination that is primarily performed for assessment of the heart and its coronary vessels. It requires at a minimum an electrocardiogram (ECG)-gated, thin-slice helical (spiral) CT acquisition coupled with an intravenous bolus injection of iodinated contrast medium. Three-dimensional (3-D) renderings, maximal intensity projections (MIPs), and multi-planar reformations (MPRs) are important components of many CCTA examinations. Indications for this examination are listed in **Exhibit 1**.

EXHIBIT 1. INDICATIONS FOR CARDIAC CT AND CCTA PROCEDURES

- Evaluation of the anatomy of the cardiac chambers, heart valves, and pericardium by means of static 2-D tomographic and 3D reconstructed displays of non-contrast and/or contrast-enhanced multi-detector CT.
- 4-D dynamic contrast-enhanced CT assessment of cardiac motion including left and right ventricular function.
- Evaluation of the coronary arteries and veins, aortic root and proximal ascending aorta, proximal pulmonary arteries, superior and inferior vena cavae, and pulmonary veins for acquired or congenital abnormalities of the heart or great vessels.

CCTA Physician Credentialing Standards

PHYSICIAN QUALIFICATIONS*

Since CCTA is a multidisciplinary procedure it creates unusual challenges in obtaining adequate experience during training. The cardiologist is unlikely to have been trained extensively in radiological techniques, image analysis and general thoracic imaging, while the radiologist is unlikely to have been sufficiently exposed to the diagnosis and management of cardiovascular diseases. **Exhibit 2** lists the cognitive skills required for competency in CCTA.

EXHIBIT 2. COGNITIVE SKILLS REQUIRED FOR COMPETENCY IN CCTA

General

- Knowledge of the physics of CT including radiation generation and exposure.
- Knowledge of CT principles and scanning techniques for non-contrast and contrast-enhanced cardiac imaging using multi-detector CT equipment.
- Knowledge of the principles of intravenous iodinated contrast administration for safe and optimal cardiac imaging including knowledge of contraindications to, as well as recognition and treatment of adverse reactions to, iodinated contrast.

Cardiac

- Clinical knowledge of coronary artery disease and other cardiovascular diseases.
- Knowledge of normal cardiac anatomy, including variations in coronary, systemic, and pulmonary arterial and venous structures.
- Knowledge of pathologic changes in cardiac and coronary anatomy due to acquired or congenital heart disease.
- Knowledge of ECG interpretation including recognition of artifacts and arrhythmias.

Great Vessels

- Knowledge of normal thoracic arterial and venous anatomy.
- Knowledge of pathologic changes in central arterial and venous anatomy due to acquired or congenital vascular disease.

*** The following physician qualifications may vary among participating health plans but are to be used for completion of the CCTSC PPPA application.**

- All Cardiac CT studies which include CCTA examinations must be performed at an approved site that is under the direct supervision of a CIS, who is responsible for all operational aspects, including site quality assurance, equipment standards, and technical requirements.
- A radiologist who qualifies as a CIS may perform CCTA/Cardiac CT examinations independently. A cardiologist who qualifies as a CIS can perform and interpret CCTA/Cardiac CT examinations but the results of the imaging data and reported findings must be confirmed and signed by a board-certified radiologist specifically for the interpretation of all structures not related to the heart and coronary arteries.

The minimum requirements for a radiologist or cardiologist to qualify as a CIS are as follows:

1) For physician currently performing CCTA/Cardiac CT:
   - Documentation of a minimum of 300 CCTA examinations performed independently within the last two years. Documentation that the physician was physically present and involved in the acquisition and interpretation of the cases.
   - Proof of 40 hours of category I CME credits in CCTA
   - For maintenance of a CIS status, a minimum of 150 CCTA cases per year must be documented as well as 40 hours of category I CME credits in CCTA every 3 (three) years.
   - All CCTSC facilities will agree to submit all CCTA reports produced by their sites for the purpose of data collection and research. The reports must comply with the reporting format required by CCCM.
   - A CIS is limited to concurrent supervision of no more than three (3) sites performing Cardiac CT/CCTA.
   - All applicants must satisfy the general appropriate requirements below.

2) For physicians applying after 6/30/2007:
   - Documentation of a minimum of 100 CCTA examinations to be done independently in a site that is under the direct supervision of a CIS or CIS-equivalent mentor. This must be in the form of a letter from a supervising CIS physician attesting that the applicant has successfully and independently performed a minimum of 100 CCTA examinations. Documentation that the applicant was physically present and involved in the acquisition and interpretation of the cases.
   - Documentation of at least 200 CCTA cases in which the candidate was involved in the interpretation of the examination.
   - Proof of 40 hours of category I CME credits in CCTA.
   - For maintenance of a CIS status, a minimum of 150 CCTA cases per year must be documented as well as 40 hours of category I CME credits in CCTA every 3 years.
   - All CCTSC facilities will agree to submit all CCTA reports produced by their sites for the purpose of data collection and research. The reports must comply with the reporting format required by CCCM. The consent form for CCTA and cardiac CT must include HIPAA waivers to allow use of data for the purpose of research.
   - A CIS is limited to concurrent supervision of no more than three (3) sites performing Cardiac CT/CCTA.
   - All applicants must satisfy the general appropriate requirements below.

Radiologists

- All examinations must be performed by registered technologists and be supervised by board-certified radiologists in attendance during the performance of each exam.
- Those supervising CCTA examinations will be required to document training in the performance of these studies, including the use of all necessary pharmaceuticals. Acceptable experience will be cardiovascular imaging or vascular radiology fellowship training including CCTA/Cardiac CT, or documentation of supervised experience in the performance of catheter or CT-based angiograms that is acceptable to the Quality Management Committee.
- The CIS must have certification in ACLS and must be on site whenever CCTA/Cardiac CT examinations are performed.

- Those radiologists interpreting CCTA examinations will be required to document prior training in the interpretation of such exams. Acceptable experiences will be cardiovascular imaging or vascular radiology fellowship training including CCTA/Cardiac CT, specialized "mini-fellowships" in CCTA sponsored by a North American medical college, or documentation of some other form of specialized training and/or experience in CCTA/Cardiac CT that is acceptable to the Quality Management Committee.

Cardiologists

1. Candidates for competency in CCTA shall have completed an approved cardiology fellowship and be board-eligible or certified in cardiology.
2. Cognitive Skills Required for Competency in CCTA listed in **Exhibit 2**.
3. The CIS must have certification in ACLS and must be on site whenever CCTA/Cardiac CT examinations are performed.
4. Documentation of Cardiology Board certification or eligibility, and valid medical license.

EXHIBIT 2. COGNITIVE SKILLS REQUIRED FOR COMPETENCY IN CCTA

General

- Knowledge of the physics of CT including radiation generation and exposure.
- Knowledge of CT principles and scanning modes for noncontrast and contrast-enhanced cardiac imaging using multi-detector methods.
- Knowledge of the principles of intravenous iodinated contrast administration for safe and optimal cardiac imaging including knowledge of recognition and treatment of adverse reactions to iodinated contrast.

Cardiac

- Clinical knowledge of coronary artery disease and other cardiovascular diseases.
- Knowledge of normal cardiac anatomy, including variations in coronary, systemic, and pulmonary arterial and venous structures.
- Knowledge of pathologic changes in cardiac and coronary anatomy due to acquired or congenital heart disease.
- Knowledge of ECG interpretation including recognition of artifacts and arrhythmias.

Aorta

- Knowledge of normal thoracic arterial and venous anatomy.
- Knowledge of pathologic changes in central arterial and venous anatomy due to acquired or congenital vascular disease.

CCTA Technical Standards

I. CT TECHNICIAN REQUIREMENTS

A. Senior Cardiac CT/CCTA Technologist

1) The senior technologist must be certified by the American Registry of Radiologic Technologists (ARRT) and/or have the appropriate unrestricted state license and documented training and experience in CT. In addition, the technologist is required to have passed the advanced examination for the CT registry. The technologist should be experienced and specifically trained in cardiac CT and CCTA.
2) The senior technologist should be fully trained to operate CT equipment and be knowledgeable in radiation physics and protection, with documented evidence of such training and experience.
3) The senior technologist should be fully trained to perform daily calibration of the scanners to be used for CCTA and Cardiac CT.
4) The senior technologist should oversee the training and supervision of additional CCTA and Cardiac CT technologists at their facility.
5) The senior technologist should comply with the ARRT requirements for continuing education appropriate to his or her practice, which are 24 credits in a two-year period including a minimum of 6 (six) credits specifically in CCTA.
6) The senior technologist must have certification in BLS.
7) The senior technologist must have documentation of training in the use of a powered dual-head contrast injector.

B. Cardiac CT/CCTA Technologist

1) The technologist must be certified by the American Registry of Radiologic Technologists (ARRT) and/or have the appropriate unrestricted state license, and documented training and experience in CT. The technologist is required to pass the advanced examination for the CT registry within 12 months of beginning training. The technologist should be experienced and specifically trained to **include a minimum of 50 CCTA exams under the direct supervision of a senior technologist.**
2) The technologist should be fully trained to operate CT equipment and be knowledgeable in radiation physics and protection, with documented evidence of such training and experience.
3) The technologist should comply with the ARRT requirements for continuing education appropriate to his or her practice, which are 24 credits in a two-year period including a minimum of 6 (six) credits specifically in CCTA.
4) The technologist must have certification in BLS.
5) The technologist must have documentation of training in the use of a powered dual-head contrast injector.

II. MEDICAL PHYSICIST

A. Initial Qualifications

1) A qualified medical physicist is an individual who is competent to practice independently one or more of the subfields in medical physics. The ACR considers that certification and continuing education in the appropriate subfield(s) demonstrate that an individual is competent to practice in one or more of the subfields in medical physics and to be a qualified medical physicist. The ACR recommends that the individual be certified in the appropriate subfield(s) by the American Board of Radiology (ABR) or the American Board of Medical Physics (ABMP).

2) The appropriate subfields of medical physics for CT accreditation are Diagnostic Radiological Physics, Diagnostic Imaging Physics, and Radiological Physics.

3) The physicist should be fully qualified and licensed with and experience and knowledge in multi-detector CT scanning specific to the devices being used.

4) The qualified medical physicist must be familiar with the principles of imaging physics and of radiation protection, the guidelines of the National Council on Radiation Protection and Measurements, laws and regulations pertaining to the performance of the equipment being tested, the function, clinical uses, and performance specifications of the imaging equipment, and calibration processes and limitations of the instruments used for performance testing.

5) Properly trained individuals may assist the qualified medical physicist in obtaining data. These individuals must be approved by the qualified medical physicist in the techniques of performing tests, the function and limitations of the imaging equipment and test instruments, the reason for the tests, and the importance of the test results. The qualified medical physicist is responsible for, and must be present during, initial and annual surveys and must review, interpret, and approve all data and provide a signed report of conclusions. The qualified medical physicist should be available for consultation regarding patient dosimetry. While issues of correct patient dosimetry are in question, no further exam should be performed on this equipment until analyzed and correct by the medical physicist.

B. Continuing Education

The Medical Physicist should comply with the American Board of Radiology requirements for continuing education. Included in the continuing education requirements necessary to maintain board certification in your sub-specialty shall be 15 category one credits in CT (including CTA and multi-slice CT) every three (3) years.

III. NURSING REQUIREMENTS

A. Nurses or physician assistants must have documentation of appropriate state licensure.

B. Nurses or physician assistants must have documentation of current ACLS training.

C. Nurses or physician assistants must have documentation of training in the use of a powered dual-head contrast injector.

D. Nurses or physician assistants must have knowledge of indications for, and the administration of drugs used during CCTA procedures as well as their side effects and emergent treatment that may be required for any toxicity.

Equipment Standards

A. A multi-detector CT scanner capable of creating a minimum of 64 slices per gantry rotation is required for CCTA.

B. Complete gantry rotation should take no longer than 0.42 seconds.

C. Tube heat capacity must allow for a single > 20 second acquisition.

D. Minimum section thickness should be no greater than 1.0 mm.

E. The CT scanner used for CTA must allow display and interpretation of the full 12 bits (from - 1000 to 3095 Hounsfield Units) of attenuation information.

F. The display field of view must be sufficient to allow an assessment of the vasculature of interest, the end-organ, and adjacent tissues.

G. For cardiac and some ascending aortic CTA, an ECG-gated acquisition should be performed that allows retrospective reconstruction of the scan volume at multiple phases through the cardiac cycle.

H. A powered dual-head contrast medium injector that allows programming of both the volume and flow rate must be used for CTA examinations.

I. An independent workstation capable of creating volume renderings or shaded-surface displays, MIPs, and MPRs must be available for CT examination analysis.

J. The workstation should also allow the direct measurement of vascular dimensions and, when appropriate, path lengths and angles.

K. All studies reconstructed must be saved in DICOM format with appropriate backup for a minimum of seven (7) years.

REFERENCES

1. Weinreb, et al. Clinical statement of noninvasive cardiac imaging, *J ACR,* 2005.
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4. CT accreditation program requirements, *ACR*, 2005.
5. Accuracy of 16-row multidetector computed tomography for the assessment of coronary artery disease, *JAMA*, July 26, 2006; Vol. 296: No.4.
6. Coleman R, et al. ACR practice guideline for the performance of cardiac scintigraphy, *ACR*, 2004.

