



# Computed Tomography

The purpose of Continuing Qualifications Requirements (CQR) is to assist Registered Technologists to document their continued qualifications in the categories of certification and registration held. To accomplish this purpose the continuing qualifications requirements are presented in three parts: the professional profile, the structured self assessment (SSA) and continuing education (CE).

The purpose of the CQR Structured Self-Assessment is to assist Registered Technologists identify gaps in the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required for practice within the categories of certification and registration held and help direct their professional development efforts.

The *Structured Self Assessment Content Specifications for Computed Tomography* is provided to assist computed tomography (CT) technologists during their CQR compliance period. Its purpose is to prepare CT technologists for the SSA and to help education providers develop coursework for the CT technologists who need to address specified areas with targeted continuing education. Targeted CE is assigned only if a standard is not met in a category on the SSA.

The SSA is composed of sets of questions that are designed to evaluate an individual’s knowledge in topics related to current practice. Participants have a maximum of 70 minutes to complete the SSA. Please allow an additional eight minutes for the tutorial, two minutes for the non-disclosure agreement (NDA), and 10 minutes for a follow-up survey.

The table below presents the major categories and subcategories covered on the SSA. The number of questions in each category are listed in bold and number of questions in each subcategory in parentheses. The potential number of targeted CE credits that would be prescribed if the standard is not met, are across from each subcategory, with the maximum amount listed at the bottom. Specific topics within each category are addressed in the content outline, which makes up the remaining pages of this document.

<b>Content Category</b>	<b>Number of Questions</b>	<b>Potential CE Credits</b>
<b>Patient Care</b>	<b>10</b>	
<i>Patient Interactions and Management (10)</i>		4
<b>Safety<sup>1</sup></b>	<b>10</b>	
<i>Radiation Safety and Dose (10)</i>		4
<b>Image Production</b>	<b>20</b>	
<i>Image Formation (10)</i>		5
<i>Image Evaluation and Archiving (10)</i>		4
<b>Procedures</b>	<b>30</b>	
<i>Head, Spine, and Musculoskeletal (10)</i>		4
<i>Neck and Chest (10)</i>		4
<i>Abdomen and Pelvis (10)</i>		5
	<b>Total 70</b>	<b>Max. CE 30</b>

<sup>1</sup>. SI units are the primary (principal) units of radiation measurement used on the computed tomography SSA.



## Patient Care

### 1. Patient Interactions and Management

- A. Patient Assessment and Preparation
  1. patient history
  2. interpersonal communication (e.g., patient care team, physician)
  3. scheduling and screening
  4. patient education
  5. consent (e.g., informed, oral, implied)
  6. positioning aids to eliminate motion artifacts and for patient safety (e.g., velcro straps, padding)
  7. patient monitoring
    - a. level of consciousness
    - b. fall prevention
    - c. vital signs
    - d. heart rhythm and cardiac cycle
    - e. oximetry
    - f. medical emergency
  8. ergonomics and patient transfer techniques
  9. management of accessory medical devices
    - a. oxygen delivery systems
    - b. chest tubes
    - c. in-dwelling catheters
  10. lab values
    - a. renal function (\*e.g., eGFR, creatinine, BUN)
    - b. other (e.g., d-dimer, LFT, INR)
  11. medications and dosage
    - a. current
    - b. pre-procedure medications (e.g., steroid, anti-anxiety)
    - c. post-procedure instructions (e.g., diabetic patient)
- B. Contrast and Medication
  1. contrast media types and properties
    - a. ionic, nonionic
    - b. osmolarity
    - c. barium sulfate
    - d. water soluble (iodinated)
    - e. air
    - f. water
    - g. other
  2. special contrast considerations
    - a. contraindications
    - b. indications
    - c. pregnancy
    - d. lactation
    - e. dialysis patients
  3. noncontrast medications (e.g., lidocaine, nitroglycerin)
  4. administration routes and dose calculations
    - a. IV
    - b. oral
    - c. rectal
    - d. intrathecal
    - e. catheters (e.g., central line, PICC line, Foley)
    - f. other (e.g., stoma, intra-articular)
  5. venipuncture
    - a. site selection
    - b. medical aseptic and sterile technique
    - c. documentation (e.g., site, amount, gauge, concentration, rate, and number of attempts)
  6. injection techniques
    - a. safety
    - b. manual
    - c. power injector options
      1. single or dual head
      2. single phase
      3. multi-phase
      4. flow rate
      5. timing bolus
      6. bolus tracking
  7. post-procedure care
    - a. complications (e.g., extravasation/infiltration)
    - b. documentation
  8. adverse reactions
    - a. recognition and assessment
    - b. treatment
    - c. documentation
  9. infection control

\* The abbreviation "e.g.," is used to indicate that examples are listed in parenthesis, but that it is not a complete list of all possibilities.



## Safety

### 1. Radiation Safety and Dose

- A. Radiation Physics
  - 1. x-ray production
  - 2. target interactions
    - a. bremsstrahlung
    - b. characteristic
  - 3. x-ray beam
    - a. frequency and wavelength
    - b. beam characteristics
      - 1. quality
      - 2. quantity
      - 3. primary versus remnant (exit)
    - c. inverse square law
    - d. fundamental properties of x ray
    - e. acquisition (geometry)
  - 4. photon interactions with matter
    - a. photoelectric
    - b. Compton
    - c. coherent (classical)
    - d. attenuation by various tissues

### B. Radiation Protection

- 1. minimizing patient exposure
  - a. kVp
  - b. mAs
  - c. pitch
  - d. collimation/beam width
  - e. filtration
  - f. gating
  - g. image reconstruction (e.g., iterative, retrospective, artifact suppression software)
  - h. detector efficiency
  - i. overranging
  - j. dose modulation techniques (e.g., SMART mA, auto mA, CARE dose, SURE Exposure)
  - k. dose notification/dose alert
- 2. shielding (e.g., lead apron)
- 3. patient considerations
  - a. positioning
  - b. removal of radiopaque materials and radiosensitive devices
  - c. communication (e.g., breathing instructions)
  - d. pediatric
  - e. adult (e.g., BMI)
  - f. pregnancy
- 4. dose measurements
  - a. absorbed dose (mGy)
  - b. effective dose (mSv)
  - c. CT dose index (CTDI) [mGy]
  - d. dose length product (DLP) [mGy-cm]
  - e. documentation
- 5. personnel protection
  - a. controlled access
  - b. education



## Image Production

### 1. Image Formation

- A. Components of a CT Unit
  - 1. gantry
    - a. tube
      - 1. x-ray production
      - 2. warm-up procedures
    - b. generator
    - c. detectors
      - 1. detector configuration
      - 2. detector collimation
    - d. data acquisition system (DAS)
    - e. slip rings
  - 2. array processor and host computer
- B. Imaging Parameters
  - 1. kVp
  - 2. mAs
  - 3. pitch
  - 4. collimation/beam width
  - 5. acquisition slice thickness
  - 6. x, y, z planes
  - 7. scan field of view (SFOV)
- C. Methods of Data Acquisition
  - 1. axial/sequential
  - 2. helical
  - 3. volumetric
  - 4. shuttle/continuous/cine
  - 5. dual energy/dual source
- D. Image Reconstruction
  - 1. filtered backprojection reconstruction
  - 2. iterative reconstruction
  - 3. prospective/retrospective reconstruction
  - 4. raw data versus image data
  - 5. reconstruction algorithm
  - 6. reconstruction slice thickness
  - 7. reconstruction interval
  - 8. interpolation
- E. Post Processing
  - 1. multi-planar reformation (MPR)
  - 2. 3D rendering (e.g., MIP, SSD, VR)
  - 3. quantitative analysis (e.g., distance, diameter, calcium scoring, ejection fraction)

### 2. Image Evaluation and Archiving

- A. Image Display
  - 1. pixel, voxel
  - 2. matrix
  - 3. image magnification
  - 4. display field of view (DFOV)
  - 5. window level (W/L), window width (W/W)
  - 6. cine loop/matrix
  - 7. geometric distance or region of interest (ROI) (e.g., mean, standard deviation [SD])
- B. Image Quality
  - 1. spatial resolution
  - 2. contrast resolution
  - 3. temporal resolution
  - 4. noise and uniformity
  - 5. quality assurance and accreditation
  - 6. CT number (Hounsfield units [HU])
  - 7. linearity
- C. Artifact Recognition and Reduction
  - 1. beam hardening or cupping
  - 2. partial volume averaging
  - 3. motion
  - 4. metallic
  - 5. edge gradient
  - 6. patient positioning (out-of-field)
  - 7. equipment artifacts
    - a. rings
    - b. streaks
    - c. tube arcing
    - d. cone beam
- D. Informatics
  - 1. hard/electronic copy (e.g., DICOM file format)
  - 2. archive
  - 3. PACS/MIMPS and electronic medical record (EMR)
  - 4. networking



## Procedures

### TYPE OF STUDY

#### 1. Head, Spine, and Musculoskeletal

##### A. Head

1. temporal bones/internal auditory canal (IACs)
2. orbits
3. sinuses
4. maxillofacial and/or mandible
5. temporomandibular joints (TMJs)
6. brain/cranium
7. brain perfusion

##### B. Spine

1. cervical
2. thoracic
3. lumbar
4. sacrum/coccyx
5. post myelography

##### C. Musculoskeletal

1. upper extremity
2. lower extremity
3. bony pelvis and/or hips
4. shoulder and/or scapula
5. arthrography

### FOCUS OF QUESTIONS

Questions about each of the studies listed on the left may focus on any of the following:

#### Anatomy and Physiology

- cross sectional anatomy
- pathological considerations/recognition
- landmarks
- vasculature

#### Factors

- imaging planes
- protocol considerations
- patient considerations (e.g., pediatric, geriatric, bariatric)
- post-processing presentations

#### Contrast Media

- indications
- scan/prep delay
- effect on images

#### Additional Procedures

- vascular (CTA, CTV) (e.g., PE, dissection, runoff, venogram)
- biopsies
- drainages
- aspirations
- trauma

(Procedures continue on the following page.)



## Procedures (continued)

### TYPE OF STUDY

#### 2. Neck and Chest

- A. Neck
  - 1. larynx/airway
  - 2. soft tissue neck
- B. Chest
  - 1. mediastinum
  - 2. lung
  - 3. heart
  - 4. airway
  - 5. chest wall
  - 6. low dose lung screening

#### 3. Abdomen and Pelvis

- A. Abdomen
  - 1. liver
  - 2. biliary
  - 3. spleen
  - 4. pancreas
  - 5. adrenals
  - 6. kidneys and/or ureters
  - 7. GI tract
- B. Pelvis
  - 1. bladder
  - 2. colorectal
  - 3. reproductive organs

### FOCUS OF QUESTIONS

Questions about each of the studies listed on the left may focus on any of the following:

#### Anatomy and Physiology

- cross sectional anatomy
- pathological considerations/recognition
- landmarks
- vasculature

#### Factors

- imaging planes
- protocol considerations
- patient considerations (e.g., pediatric, geriatric, bariatric)
- post-processing presentations

#### Contrast Media

- indications
- scan/prep delay
- effect on images

#### Additional Procedures

- vascular (CTA, CTV) (e.g., PE, dissection, runoff, venogram)
- biopsies
- drainages
- aspirations
- trauma