Computed Tomography Examination

The purpose of The American Registry of Radiologic Technologists® (ARRT®) Computed Tomography Examination is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of the technologists who perform computed tomography. Using a nationwide survey, the ARRT periodically conducts a practice analysis to develop a task inventory which delineates or lists the job responsibilities typically required of computed tomography technologists. An advisory committee then determines the knowledge and cognitive skills needed to perform the tasks on the task inventory and these are organized into the content categories within this document. The document is used to develop the examination. The results of the most recent practice analysis have been applied to this document. Every content category can be linked to one or more activities on the task inventory. The complete task inventory is available at arrt.org.

The following table presents the four major content categories covered on the examination, and indicates the number of test questions in each category. The remaining pages list the specific topics addressed within each category, with the approximate number of test questions allocated to each topic appearing in parentheses.

This document is not intended to serve as a curriculum guide. Although ARRT programs for certification and registration and educational programs may have related purposes, their functions are clearly different. Educational programs are generally broader in scope and address the subject matter that is included in these content specifications, but do not limit themselves to only this content.

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<th>Content Category</th>
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<td>Abdomen and Pelvis</td>
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<td>Total</td>
<td>165</td>
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</table>

^1 A special debt of gratitude is due to the hundreds of professionals participating in this project as committee members, survey respondents and reviewers.

^2 Each exam includes an additional 20 unscored (pilot) questions.

^3 SI units are the primary (principal) units of radiation measurement used on the computed tomography examination.
Patient Care

1. Patient Interactions and Management

A. Patient Assessment and Preparation
   1. Clinical History
   2. Scheduling and Screening
   3. Education
   4. Consent
   5. Immobilization
   6. Monitoring
      a. level of consciousness
      b. vital signs
      c. heart rhythm and cardiac cycle
      d. oximetry
   7. Management of Accessory Medical Devices
      a. oxygen delivery systems
      b. chest tubes
      c. in-dwelling catheters
   8. Lab Values
      a. renal function (*e.g., BUN, eGFR, creatinine)
      b. blood coagulation (e.g., PT, PTT, platelet, INR)
      c. other (e.g., D-dimer, LFT, INR)
   9. Medications and Dosage
      a. current (reconciliation)
      b. pre-procedure medications (e.g., steroid, anti-anxiety)
      c. post-procedure instructions (e.g., diabetic patient)

B. Contrast Administration
   1. Contrast Media
      a. ionic, nonionic
      b. osmolality
      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. Administration Route and Dose
      Calculations
      a. IV
      b. oral
      c. rectal
      d. intrathecal
      e. catheters (e.g., peripheral line, central line, PICC line)
      f. other (e.g., stoma, intra-articular)
   4. Venipuncture
      a. site selection
      b. aseptic and sterile technique
      c. documentation (e.g., site, amount, gauge, concentration, rate and number of attempts)
   5. Injection Techniques
      a. manual
      b. power injector options
         1. single or dual head
         2. single phase
         3. multi-phase
         4. flow rate
         5. timing bolus
         6. bolus tracking
   6. Post-Procedure Care
      a. treatment of contrast extravasation
      b. documentation
   7. Adverse Reactions
      a. recognition and assessment
      b. treatment
      c. documentation

*e.g., This is used here and in the remainder of this document to indicate examples of the topics covered, but not a complete list.
Safety

1. Radiation Safety and Doseimetry

   A. Radiation Physics
      1. Radiation Interaction with Matter
      2. Acquisition (geometry)
      3. Physical Principles (attenuation)

   B. Radiation Protection
      1. Technical Factors Affecting Minimizing Patient Exposure Dose
         a. kVp
         b. mAs
         c. pitch
         d. collimation/beam width
         e. multi-detector configuration
         f. gating

2. Personnel Protection
   a. controlled access
   b. education

3. Radiation Protection and Shielding
   a. traditional (e.g., lead apron)
   b. non-traditional (e.g., bismuth)

4. Dose Measurement
   a. CT Dose Index (CTDI)
   b. Dose Length Product (DLP)
   c. documentation

5. Patient Dose Reduction and Optimization
   a. pediatric
   b. adult
   c. dose modulation techniques (e.g., SMART mA, auto mA, CARE dose, and SURE exposure)
   d. iterative reconstruction
   e. dose notification
   f. dose alert

Moved from the
Image Production
Section

Moved from the
Patient Care
Section

Moved from the
Patient Care
Section
Image Production

1. Image Formation
   A. CT System Principles, Operation, and Components
      1. Tube
         a. kVp
         b. mA
         c. warm-up procedures
      2. Generator
      3. Detectors Configuration
         a. detector configuration
         b. detector collimation
      4. Data Acquisition Systems (DAS)
      5. Collimation/Beam Width
      6. Computer and Array Processor
   B. Imaging Parameters and Data Acquisition
      1. Parameters
         a. kVp
         b. mAs
         c. pitch
         d. image thickness
         e. x, y, z planes
         f. scan field of view (SFOV)
      2. Acquisition
         a. axial/sequential
         b. helical/spiral
         c. volumetric
   C. Image Processing
      1. Reconstruction
         a. filtered backprojection reconstruction
         b. iterative reconstruction
         c. interpolation
         d. reconstruction algorithm
         e. raw data versus image data
         f. prospective/retrospective reconstruction
         g. reconstruction interval
      2. Post-Processing
         a. Multi-Planar Reformation (MPR)
         b. 3D rendering (MIP, SSD, VR)
         c. quantitative analysis (e.g., distance, diameter, calcium scoring, ejection fraction)

2. Image Evaluation and Archival
   A. Image Display
      1. Pixel, Voxel
      2. Matrix
      3. Image Magnification
      4. Display Field of View (DFOV) (scan, reconstruction, and display)
      5. Window Level, Window Width
      6. Cine
      7. 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)
      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 Induced
         a. rings
         b. streaks
         c. tube arcing
         d. cone beam
         e. capping
   D. Informatics
      1. Hard/Electronic Copy (e.g., DICOM file format)
      2. Archive
      3. PACS and Electronic Medical Record (EMR)
      4. Security and Confidentiality
      5. Networking
Procedures

TYPE OF STUDY

1. Head, Spine and Musculoskeletal
   A. Head
      1. temporal bones/\(\text{IAC}\)
   C. Temporal Bones
      2. pituitary fossa
      3. orbits
      4. sinuses
      5. maxillofacial and/or mandible
      6. temporomandibular joint (TMJ)
   7. Pituitary fossa base of skull
   8. brain
   9. cranium
   L. Vascular
      10. brain perfusion
   B. Spine
      1. cervical
      2. thoracic
      3. lumbar
      4. sacrum/coccyx
      5. post myelography
      6. discography
   C. Musculoskeletal
      1. upper extremity
      2. lower extremity
      3. spine
      3. bony pelvis and/or hips
      4. shoulder girdle and/or scapula
      5. sternum and/or ribs
      6. vascular
      6. arthrography

FOCUS OF QUESTIONS

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

Sectional Anatomy
   - sagittal plane
   - transverse plane (axial)
   - coronal plane
   - off axis (oblique)
   - imaging planes
   - pathological considerations/recognition
   - protocol considerations
   - patient considerations
      (e.g., pediatric, geriatric, bariatric)
   - post-processing presentations
   - landmarks

Contrast Media
   - indications
   - types of agents
   - contraindications
   - dose calculation
   - administration route
   - scan/prep delay (e.g., bolus timing, test bolus)
   - effect on images

Special Other Procedures
   - 3D studies vascular (CTA, CTV)
      (e.g., PE, dissection, runoff, venogram)
   - biopsies
   - radiation therapy planning
   - drainage
   - colonography or virtual colonography
   - aspirations
   - transplant studies

(Moved from Other Procedures)
(Moved from Other Procedures)
(Procedures continue on the following page.)
Procedures (continued)

**TYPE OF STUDY**

2. Neck and Chest
   A. Neck
      1. larynx
      2. soft tissue neck
   C. Vascular
   B. Chest
      1. mediastinum
      2. lung
      3. heart
      4. airway
      E. vascular
      5. 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
   H. Vascular
   B. Pelvis
      1. bladder
      2. colorectal
      3. reproductive organs
   D. Vascular

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  - post-processing presentations
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- **Contrast Media**
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Moved from Other Procedures

Topics moved to the Patient Care Section

Separate listings of vascular studies were combined