Proton Beam Radiation Therapy

Alternative Forms of Recognition

The purpose of ARRT’s alternative forms of recognition (AFR) programs is to provide a mechanism for individuals to document completion of activities that are prerequisite to the professional performance of a role in areas for which ARRT does not currently offer certification and registration, but which are within ARRT’s scope of interest as described by its mission. The proton beam radiation therapy recognition program is the first AFR offered by ARRT.

Related Documents

The practice analysis process and resulting task inventory that serve as the foundation for the recognition program are described in the Proton Beam Radiation Therapy Task Inventory document. The Proton Beam Radiation Therapy Clinical Standard and Requirements are described in a separate document by that name.

Body of Knowledge Standard

The purpose of the Body of Knowledge Standard is to identify a comprehensive listing of the knowledge supporting the professional performance of the role of a radiation therapist in proton beam radiation therapy. The task inventory developed from the practice analysis lists the job responsibilities typically required of a radiation therapist working in proton beam radiation therapy. An advisory committee composed of subject matter experts working under the guidance of ARRT identified the body of knowledge necessary to perform the responsibilities included on the task inventory. The committee organized the knowledge areas into a content outline. Every content category in the outline can be linked to one or more job responsibilities on the task inventory.

Body of Knowledge Requirements

The purpose of the Body of Knowledge Requirements is to document that candidates have completed educational activities covering a significant portion of the Proton Beam Radiation Therapy Body Of Knowledge as listed in the Standard. Whereas the Body of Knowledge Standard represents a comprehensive listing of the knowledge supporting the professional performance of the role of a radiation therapist in proton beam radiation therapy, the Body of Knowledge Requirements represent evidence that the individual has had the opportunity to learn that body of knowledge. The Body of Knowledge Requirements identify the activities that must be documented (Note: More to come here).

Content Category

Patient Care

Patient Interactions and Medical Record Management

Safety

Radiation Physics, Equipment, and Quality Assurance
Radiation Protection

Procedures

Treatment Sites
Simulation
Prescription, Geometric Parameters, and Dose Calculation
Treatments
Patient Care

1. Patient Interactions and Medical Record Management
   
   A. Patient Education
      1. simulation and treatment preparation (*e.g., bowel, bladder, NPO)
      2. timeframe to begin treatment
         a. typical timeframe
         b. scheduling considerations
      3. variances in daily treatment delivery times
      4. explanation of quality assurance imaging
         (e.g., evaluation scanning, adaptive scanning)
      5. explanation of treatment procedure
         a. imaging requirements
         b. removal of materials in the beam’s path
      6. explanation of beam delivery system downtime
   
   B. Assessment
      1. patient’s ability to maintain treatment position (e.g., anesthesia, respiratory motion)
      2. dietary counseling (e.g., reduction of air in bowels and stomach)
      3. routine monitoring
         a. weight
         b. skin
   
   C. Documentation of Procedures
      (e.g., detailed set-up instructions)

* 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 Physics, Equipment, and Quality Assurance
   A. Basic Characteristics of Particles
      1. Bragg peak
      2. entrance dose (e.g., no skin sparing)
   B. Components and Operation
      1. cyclotron/synchrotron
      2. beam transport system
      3. treatment room design
         a. gantry
         b. fixed beam room (FBR) or stationary beam room (SBR)
      4. robotic patient positioning system (PPS)
      5. imaging equipment
      6. treatment software
      7. nozzle/treatment snout
   C. Method of Beam Delivery
      1. passive scatter (e.g., single scatter, double scatter)
         a. aperture
         b. compensator
         c. spread out bragg peak (SOBP)
         d. range modulator wheel
      2. pencil beam (e.g., IMPT, spot scanning)
         a. scanning magnets
         b. bending magnets
         c. energy layers
         d. range shifter
         e. range uncertainty
         f. relative biological effectiveness (RBE)
         g. water equivalent thickness (WET)
         h. motion
   D. Quality Control Procedures
      1. evaluation of quality assurance results
      2. sign off from appropriate personnel when measures are outside tolerance
      3. verify treatment plan quality assurance has been performed

2. Radiation Protection
   A. Radiation Tissue Tolerance
      1. dose to critical structures (no exit dose)
      2. adverse effects (e.g., consequences of misalignment)
   B. Occupational Radiation Exposure
      1. neutron area monitoring (e.g., fixed monitors, portable neutron survey meters)
      2. neutron dosimeters
      3. search button
      4. handling of radioactive material
         a. activation of equipment
         b. activation of beam modifiers
Procedures

1. Treatment Sites
   A. CNS
      1. primary brain
      2. craniospinal
   B. Head and neck
   C. Thorax
      1. lung
      2. mediastinum
      3. thymus
   D. Breast
   E. Abdomen, pelvis, GI, and GU
      1. esophagus, stomach, small bowel, large bowel, rectum, and anus
      2. pancreas, adrenals, liver, and gallbladder
      3. ureters, kidneys, bladder, and urethra
   F. Reproductive
      1. prostate, testicles
      2. endometrium, cervix, ovaries, uterus, vagina, and vulva
   G. Skeletal
      1. spine
      2. extremity
   H. Miscellaneous
      1. lymphoma (Hodgkin and non-Hodgkin)
      2. sarcoma (bone and soft tissue)
      3. ocular
      4. pediatric
      5. metastases

2. Simulation
   A. Patient positioning and immobilization
      1. review of patient records (e.g., previous radiation)
      2. collaboration with anesthesia care team
      3. fabrication of non-beam attenuating immobilization devices
      4. minimize material in the path of the beam
   B. Image acquisition (e.g., include skin contour and immobilization device in treatment area)
   C. Scan with contrast
   D. 4D gating scan for tumor motion evaluation for treatment eligibility
   E. Voluntary breath hold device
   F. Evaluation and adaptive scanning
   G. Collaboration with other team members (e.g., physician, physicist, dosimetrist)
   H. Modalities
      1. CT
      2. PET/CT
      3. MRI
      4. PET/MRI

(Procedures continue on the following page.)
Procedures (continued)

3. Prescription, Geometric Parameters, and Dose Calculation

A. Treatment Prescription
   1. total target dose
   2. treatment volume (e.g., robust optimization, range uncertainty)
   3. number of fields
      a. single field optimization (SFO)
      b. multiple field optimization (MFO)
   4. field orientation
   5. beam modifiers
   6. contribution from other sources (e.g., previous photon treatment)

B. Geometric Parameters
   1. field size and shape
   2. target depth (e.g., tumor versus $D_{\text{max}}$)

C. Dose Calculation
   1. isodose curve characteristics (e.g., lateral penumbra)
   2. inhomogeneity correction factors
   3. beam energy (e.g., variable MeV)
   4. air gap
   5. medical factors (e.g., artificial implants)

4. Treatments

A. Verification and Application of the Treatment Plan
   1. accessory equipment (e.g., aperture, compensator)
   2. image guided radiation therapy (IGRT)
   3. treatment unit capabilities and limitations
      a. 360-degree treatment delivery system
      b. robotic PPS (e.g., pitch, roll, rotation)

B. Treatment Administration
   1. position within beam queue (e.g., beam priority)
   2. equipment malfunctions
      a. collaboration with main control room
      b. communication with patient and staff
      c. downtime