Radiation Therapy Exam Study Guide

• Review basic safety information, including:
  o Acceptable patient identifiers
    ▪ Acceptable ways a patient can be identified include the patient’s name, date of birth, social security number, address, telephone number, assigned identification number, or other patient-specific identifier.
    ▪ Identifiers refer to the ways a patient can be identified and not the source of the information such as another person.
    ▪ A room number is not an acceptable identifier.
  o Correction of an error in handwritten charting
    ▪ Place a line through the error, initial it, and insert the correct information.
    ▪ Prevent the spread of infection by washing hands between patients.

• Review radiation therapy safety and procedures, including:
  o Radiation safety
    ▪ Maximizing distance represents one of the simplest and most effective methods for reducing radiation exposure to workers.
  o Isotopes used in permanent implants
    ▪ Iodine-125 and Gold-198 are ideally suited for permanent implants because of their short half-life.
  o Simulation
    ▪ Calculation of the Magnification factor using source-film distance (SFD) and source-to-object distance (SOD) = SFD/SOD
    ▪ Positioning:
      ▪ The supine position should be used during simulation whenever possible because it is more comfortable for the patient and easier to document reproducibility.
      ▪ If possible one position should be established for all treatment fields, including boost fields. Internal structures can change dramatically if the patient’s position is changed (e.g., from supine position for one field to prone position for another).
  o Treatment Planning
    ▪ Angling the beam to avoid treating sensitive tissue
    ▪ 3D conformal radiation therapy (CRT) planning process. Planning target volume (PTV) is a geometrical volume; it has dimensions believed to always contain the clinical target volume (CTV), taking into account all possible geometric uncertainties set as set-up uncertainties of patient or organ motion.
  o Technique
    ▪ Applying bolus
    ▪ Bolus must conform to the treatment surface without air gaps.
    ▪ Positioning
- Position the patient with the epicenter of the treatment plan as close as possible to the center of the table to provide the maximum clearance for techniques that require 360° gantry rotation around the patient.
- Customized shielding blocks
  - The most common material used to create customized shielding blocks is Cerrobend (lipowitz metal). It contains lead and cadmium which are potentially carcinogenic. Care must be taken to prevent ingestion and inhalation of fumes.
- Orthogonal imaging
  - For multiple field treatment techniques using nonvertical or horizontal beam orientations, verification of the isocenter is achieved through orthogonal imaging. Two images are taken at a 90 degree angle from one another, localizing isocenter in all planes.
- Techniques for correcting internal movement
  - Fiducial markers, rectal balloon, or transabdominal ultrasound (B-mode acquisition technology [BAT]).

**Equipment**

- The **optical distance indicator** (ODI) sometimes called a range finder, projects a scale on the patient’s skin which corresponds to the skin-source distance (SSD). The ODI projects a graduated light beam, in centimeters, on the patient’s skin, which allows for accurate measurement of the SSD.
  - When using a **transmission filter**, daily fraction and total doses for each area must be written in the prescription and documented separately in the daily treatment record.
- All **beam-shaping and modification devices for photon beams** must be secured a minimum of 15 cm from the surface area of the patient. Low-energy electrons are absorbed in 15 cm of air.
- **Electronic portal imaging device (EPID)**. With portal image technology, correct positioning of internal anatomic structures can be observed during the entire treatment process or checked with pretreatment imaging with the aid of computer software.
- The **upper collimator** moves during treatment to create a dynamic wedge effect. Dynamic wedges are designed in such a way that wedge-dose distributions using varying field sizes yield excellent wedged-isodose distributions compared with physical wedges.

**Therapies**

- **Hyperfractionation** - Radiation therapy that gives smaller doses (fractions) of radiation more often than standard radiation therapy so that the full treatment course can be given with fewer side effects. In hyperfractionation, individual doses are given more often than the standard dose of once a day. Also called hyperfractionated radiation therapy and superfractionated radiation therapy.
- **Intensity modulated radiotherapy** (IMRT) conforms radiation therapy to the exact size and shape of the tumor volume. IMRT is an advanced technique...
which specifies the chosen dose to the tumor as well as acceptable dose levels for surrounding normal structures.

- **Total Body Irradiation (TBI)** is a radiotherapy technique used to ablate the bone marrow and immune system prior to bone marrow transplantation or peripheral blood stem cell transplantation. It may be used as part of high-dose treatment of some leukemias and lymphomas. The aim of this type of ablative therapy is to prevent rejection of the transplanted cells.

**Patient care**

- Patients undergoing treatment for CNS neoplasms can expect specific side effects, most commonly fatigue. Reassurance helps the patient to cope. The body requires rest to heal from the effects of the disease and daily treatments. Suggesting that the patient pamper himself and take a nap rather than fighting off fatigue is an option.

- **Quality control, including American Association of Physicists in Medicine (AAPM) recommendations**
  - To reduce the risk of the patient being simulated or treated with faulty equipment it is best to perform the daily quality checks in the morning before the first patient is simulated or treated.
  - Audio and video monitors are checked daily. The tolerance is “functional.” Monitors must be functioning before treatment can proceed. Findings should be documented including action taken to resolve any deviations beyond tolerance limits and retesting results.
  - Checks for the medical accelerator:
    - Recommended daily checks: include lasers; distance indicator; x-ray output constancy; electron output; door interlock; audiovisual monitor.
    - Recommended tolerance for X-ray output constancy is +/-3%.
    - Monthly mechanical checks include: field size indicators; gantry/collimator angle indicators; light/radiation field coincidence; wedge position; tray position; application position; cross-hair centering; treatment couch position indicators; latching of wedges, blocking tray; jaw symmetry; field light intensity.