RADP 215: Radiation Protection

Protecting the Patient

MRT Program

Reducing Patient Dose

- Many methods can be used to reduce patient dose
  - Technical factors
  - Collimation
  - Filtration
  - Equipment (e.g., grids, immobilization devices)
  - Quality Control
  - Communication

Technical Factors

- Appropriate techniques are essential in order to achieve a diagnostic image with minimal patient dose.
- Anatomically Programmed Radiography (APR) and room technique charts:
  - Standardized for each generator
  - Consult technique charts before exposure when not using Automatic Exposure Control (AEC)
  - Lists the body part and size to give you a starting technique for a specific room
  - Allows for an accurate educated guess

Technical Factors

- High kVp and low mAs equals less dose
- kVp controls quality
  - Penetration or power of the beam
  - Higher power, more photons
  - Less absorption by patient
  - Less mAs is required to maintain density of image
- mAs is the quantity
  - Directly related to dose
  - More photons, more dose

Technical Factors

- High kVp and low mAs combination may produce a poor-quality image
- Reducing radiographic **contrast**
- Technique used must balance image quality and dose
- Using the **highest practical** kVp and **lowest** mAs that will produce an **optimal** image for each exam
- Maintains the radiographic contrast

Source to Image Distance (SID)

- Important to have an accurate SID when positioning
- Technique charts and settings are developed using a specific SID
  - Usually 100 cm, 110 cm, 180 cm
- Too short – Overexposure
  - Extra unnecessary dose
- Too long – Underexposure
  - Mottled, grainy or noisy images
    - May require repeat exposures

Collimation

- The first and most important step in gonadal protection.
- An appropriately collimated beam will reduce dose more effectively than shielding.
- Primary x-ray beam can not be larger than the size of the image receptor (IR) being used for the exam.
  - Decreased field size = Decreased dose
  - Also, less scatter = improved image contrast

Beam Limitation Devices

- **PBL** – Positive Beam Limitation
  - Sensors in a detector that automatically send a signal to the collimators about the field size
- Additional Equipment
  - Aperture diaphragm, cones and cylinders
  - Equipment attaches to tube housing
  - Usually for specific exams like skull work, sinuses, dental units, etc.

Beam Filtration

- Purpose:
  - Absorbs most of the lower-energy photons from x-ray beam
  - Reduces exposure to patient's skin and superficial tissue
  - 'Hardens' the beam
- Photons remaining in beam are more penetrating and less likely to be absorbed
  - Low-energy photons would contribute only to dose and not to the image process
- Different filters for different equipment, depending on purpose
  - E.g., mammography – soft tissue images

Filtration

- Compensating filters
  - When imaging anatomy that has large variance in thickness or tissue composition
  - Can help to even out the density on the image
  - All anatomy visualized on one image, instead of having to take two images

Grids

- Purpose:
  - Remove scattered photons from the patient before reaching the image receptor (IR)
- Placed between patient and IR
- Device made of parallel or focused radiopaque strips alternating with a low-attenuation material (plastic, aluminum)
- Advantage:
  - Significantly improves contrast and detail

Grids

- Disadvantages:
  - Increases patient dose, as additional technique needs to be used
  - Patient dose increases as grid ratio increases
- But, the benefit in improved image quality greatly outweighs the additional dose!
  - Greater quantity of diagnostic information made available with grid usage

Immobilization

- Patient movement during an exposure will result in a blurry image.
  - Little/no diagnostic value
- Two types of motion:
  - Voluntary
  - Involuntary

Immobilization (cont'd)

- Purpose:
  - Eliminate voluntary motion
  - Minimize repeat images
- Use equipment to effectively immobilize the patient or the body part:
  - Sponges
  - Tape
  - Support Stands
  - Pigg-o-Stat
  - Octostop
  - Sandbags

Quality Control

- Absolutely essential!
- Monitoring and maintenance of all processing and imaging display equipment in the facility.
- Ensures production of optimal quality images.
  - Equipment function and monitoring
- Includes procedures for performance, monitoring and quality control.

Quality Control

- Without a program, additional images may be needed.
  - What if the technique you set is not what was actually produced?
  - What if your collimation was off?
  - What if the centering was off?
- Results in a repeated image and additional unnecessary dose to your patient.

Communication

- What can good communication with your patient do?
  - Reduce anxiety and stress
  - Enhance your professional image as a healthcare professional
  - Increase the chance of a successful x-ray examination
    - Dose reduction!
  - If you ask a question, listen to the answer

Communication

- Explain procedures, especially lengthy exams—the unknown is scary!
- Do not lie to the patient if something is going to be uncomfortable or painful—tell them, don't let it be a surprise.
- Don't overemphasize that aspect of the exam.
- Patient must understand what you need from them and you must understand any patient limitations (e.g., unable to stand, cannot lay on side, etc.).

Communication

- Allow the patient to ask questions.
- Listen to them and answer truthfully in an appropriate tone of voice.
- Always answer in accordance with ethical guidelines.
- This will create trust between the patient and technologist.

Gonadal Shielding – past practice example



