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PELVIC SHIELDING AND GONADAL DOSE

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Session Outline
- Challenges in teaching students best practices given the clinic reality
- Gonadal shielding and the research literature
- Findings of the experimental study on shielding and gonadal dose
- Strategies to reinforce best practices in the clinic setting

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Session Objectives
You will learn to:
- examine the disparity between best practices taught to students and clinic practice.
- identify the concerns regarding inconsistent gonadal shielding as discussed in the current research literature.
- report the findings of the experimental investigation on shielding and gonadal dose for pelvic imaging.
- develop strategies to reinforce best practices in the clinic setting.
ASRT Curriculum

Clinical Practice Objectives
- Demonstrate competency in the principles of radiation protection standards.

Radiation Protection Objectives
- Explain the relationship of beam-limiting devices to patient radiation protection.
- Use the appropriate method of shielding for a given radiographic procedure.

ARRT Content Specifications

A. Radiation Protection
2. Minimizing Patient Exposure
B. Shielding
C. Beam-restriction

ASRT Practice Standards

Clinical Performance Standards
- Standard Four - Performance
  1. Employs proper radiation safety practices.
  2. Uses pre-exposure collimation and proper field-of-view selection.
- Standard Eight - Documentation
  3. Documents the use of shielding devices and proper radiation safety practices per institutional policy.

Radiography Quality Performance Standards
- Standard One - Assessment
  5. Participate in radiation protection, patient safety, risk management and quality management activities.
ASRT Position Statements

Digital Imaging Cropping or Masking in Radiography

It is the position of the American Society of Radiologic Technologists that a digital image should not be cropped or masked such that it eliminates areas of exposure from the image that are presented for interpretation. Pre-exposure collimation of the x-ray beam is necessary to comply with the principle of as low as reasonably achievable (ALARA). To determine that exposed anatomy on an image is not significant or of diagnostic value is a medical decision and is therefore outside of the scope of practice for a radiologic technologist.

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ARE COLLIMATION AND SHIELDING ROUTINELY PRACTICED IN THE CLINIC?

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Radiation Safety Practices

- Research has demonstrated that common radiation safety practices such as collimation and gonadal shielding are not routinely practiced in the clinic. (Lacerda et al., Zetterberg and Espeland)

- Digital post-processing masking has replaced collimation as a routine practice by technologists. (Ullmann and Schade-Prekop)

- Pediatric chest imaging showed great variability in entrance skin exposure attributed to lack of collimation and shielding. (Konturek-Lefkina et al.)
Gonadal Shielding
- Gonadal shielding is inconsistent, inaccurate, or lacking in adults and pediatric pelvic imaging.
  (Fawcett et al, Gul et al, Kenny & Hill, Wainwright, Warlow et al, Frantzen et al, Gul et al)
- Gonadal shielding of female patients has been debated.
- Contradictions cited regarding value of gonadal shielding.
  (Mekis et al, Frantzen et al, Clancy et al)

Effectiveness
- Research disputing effectiveness
- Research confirming effectiveness

Disadvantages
- Inaccurate positioning
- Repeat exposure

High Dose Procedures
- Diagnostic x-ray imaging of the lumbar spine and pelvic region yield high radiation doses to patients.
  - The US, Nationwide Evaluation of X-ray Trends survey found that a range of exposures between 487 mR and 2154 mR had been used for anteroposterior lumbar spine images.
Stochastic effects such as cancer and hereditary diseases believed to be associated with low dose radiation exposure.
- Linear non-threshold dose response
- Little evidence to support low dose cancer risk
- May be due to the insensitivity of current laboratory techniques
- Uncertainties remain
  - Genomic instability
  - Bystander effects

Genomic instability
- Inheritable changes in the progeny of irradiated cells

Radiation induced bystander effects
- Damage occurs in cells that did not directly absorb the radiation such as double-strand breaks (DSB)

Paternal and Maternal preconception radiation exposure
- Risk to offspring uncertain
  - Spontaneous abortions, infertility, and increased risk of infant leukemia

Pelvic imaging of a male anthropomorphic phantom with thermoluminescent dosimeters (TLDs) placed in right and left testes.
- 10 exposures without flat contact shield
- 10 exposures with flat contact shield

Air Kerma Skin Exposure
- No shielding
- Shielding
**Data Analysis**

- A T-test was calculated for the two exposure groups and found to be significant, \( p < 0.05 \).
- The average exposure to the gonads:
  - No shield was 254.2 µGy
  - Shielded was 186.4 µGy

36.3% increase in exposure to the testes when no contact shield was used during pelvic imaging.

1 microgray is equal to 0.1 millirad.

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**Study Conclusions**

- Using a flat contact shield during pelvic imaging on males will significantly decrease radiation dose to the testes.
- Although the radiation dose to the testes during pelvic imaging is in the low range, it is a best practice to maintain exposures as low as reasonably achievable.

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**Theory to Practice**

Bridging the gap between academia and clinic practice:
- Best Practices
- Evidence-based practice
  "the conscientious, explicit, and judicious use of the current best evidence in making decisions about the care of individual patients" (Jyothi, 2012)
- Barriers

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**Enhancing the Clinical Experience**

- Clinic Orientation
- Resources
- Assessments
- Tutorials
- Feedback

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**Clinical Education Challenges**

- Historical perspective
- Changes in educational requirements
- Expansion of clinical services
- Clinical staffing turnover
- Faculty turnover
Radiation Safety Expectations

- Student Learning Outcomes
- Didactic course work and Lab simulation
- Clinic expectations
  - Technologist and clinical instructor evaluations
  - Master competency evaluations
  - Employer survey
- Clinic reality

Evidence Based Practice

Bridging the Gap

or

Professionalism?

Professionalism

- Best Practices
- Attitude
- Awareness
- Engagement