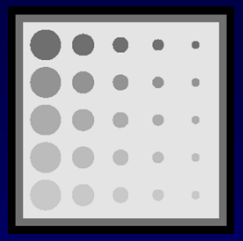

RADIOLOGY
PHYSICS

Patient Safety in Computed Tomography

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Patient Safety:

Right Dose

Right Image Quality

Right Positioning

Right Dose Tracking

Outline

- Alert and Notification values
- Protocol Optimization and Review
  - Pediatric Protocols
  - Low Dose Follow Up Protocols
- Patient Positioning
- Patient Shielding
- Tracking Patient Dose and Exams

Alert and Notification Values

- New Michigan CT Rules Require (May be Coming Soon to a State Near You!):
  - Annual Testing
  - Properly Trained CT Techs
- Establishment of Notification CTDI Values
  - Tech checks each scan before and after acquisition to confirm CTDI values
  - AAPM has recommended Notification Values
- Not as stringent as new rules in California

Alert and Notification Values

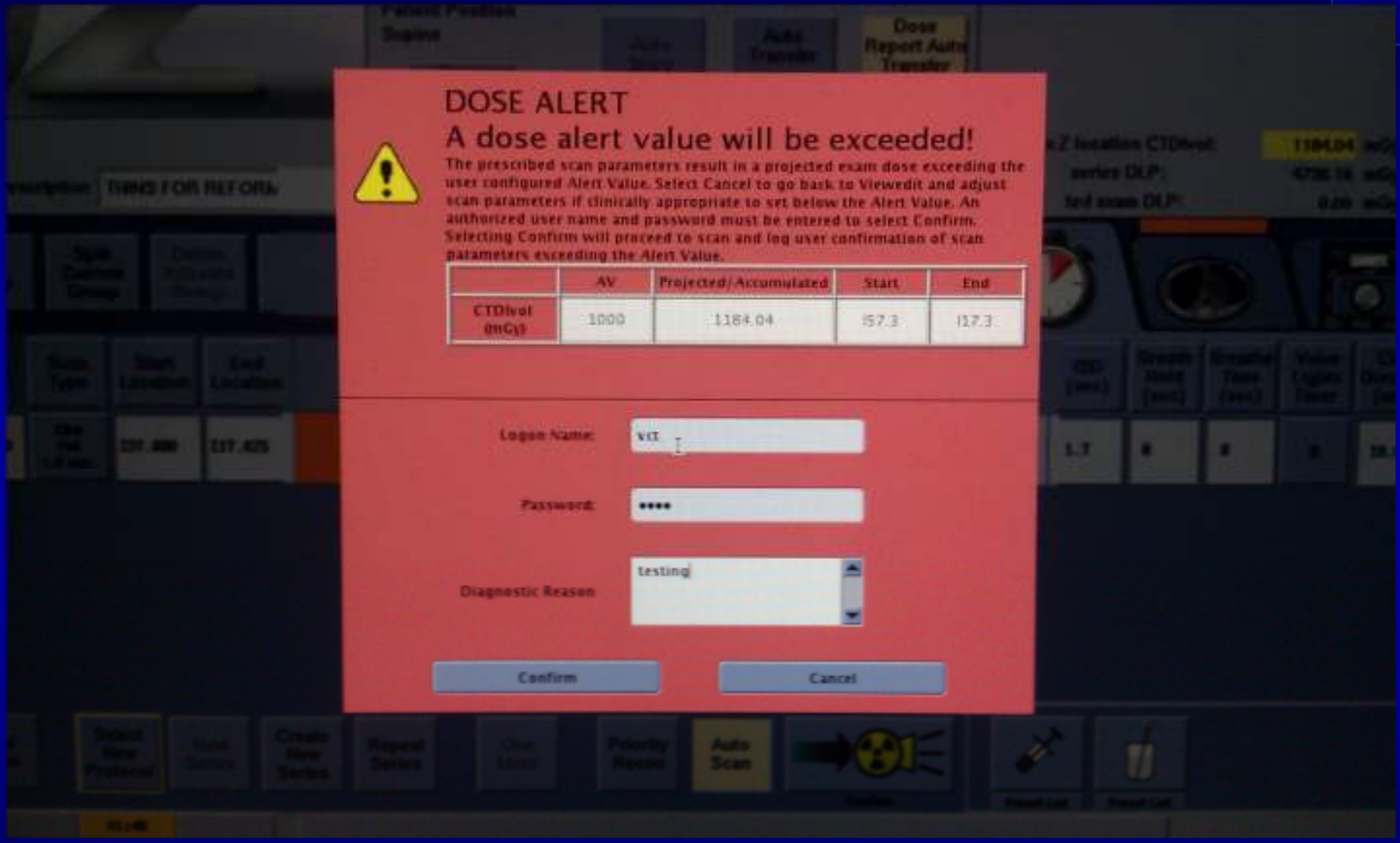
Notification Values recommended by the AAPM Working Group on Standardization of CT Nomenclature and Protocols

CT Scan Region (of ***each*** individual scan in an examination)	CTDIvol Notification Value (mGy)
Adult Head	80
Adult Torso	50
Pediatric Head <2 years old >2 years old	 50 60
Pediatric Torso <10 years old (16-cm phantom) ***GE, Toshiba*** <10 years old (32-cm phantom) ***Philips, Siemens***	 25 10
Brain Perfusion (examination that repeatedly scans the same anatomic level to measure the flow of contrast media through the anatomy)	600
Cardiac Retrospectively gated (spiral) Prospectively gated (sequential)	 150 50

Alert and Notification Values

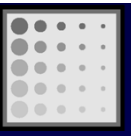
- Manufacturers are working with FDA to establish Alert Values for CTDI
  - Higher than notification values
  - Should be able to be adjust by Medical Physicist, as should notification values
  - Implementation via software upgrade may not be well communicated: Check With Your Vendor(s)!

Alert and Notification Values



Protocol Optimization and Review

- Protocols DO change
  - You can't just set it and forget it
  - Periodic Monitoring of Protocols and the Dose is key
- AAPM Working Group on Standardization of CT Nomenclature and Protocols
  - Published documents include CT Perfusion Protocol Recommendations and Lexicon of Terms
  - Forthcoming includes CT Head, CT Abdomen and CT Chest Protocol Recommendations



www.aapm.org/pubs/CTProtocols/

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We advance the science, education and professional practice of medical physics

CT Scan Protocols

Statement of Purpose | Model & Equipment Performance Questions | Role of the Qualified Physicist | CT Dose-Check Standard Guidelines | Protocols | Lexicon

Statement of Purpose

The American Association of Physicists in Medicine (AAPM) is a professional organization whose members include board-certified medical physicists who specialize in the safe and effective use of radiation in medicine. Medical physicists partner with radiologists, technologists, regulators, manufacturers, administrators and others to ensure that CT scans are performed using the minimum amount of radiation required to obtain the diagnostic information for which the CT scan was ordered.

The collection of settings and parameters that fully describe a CT examination is referred to as the exam *protocol*. These protocols specify how data collection and reconstruction, patient positioning and contrast administration are to be performed. The effect of these settings on the final exam quality or dose can be dramatic; a number of the settings are inter-related, where changing one parameter can require adapting several other parameters if image quality and/or dose are to be maintained at a specified level. Thus, the quality and dose of a CT exam are largely predetermined by the protocol used. In CT, there is however no single protocol that is "the correct protocol"; acceptable image quality and dose can be achieved using many different combinations of scan parameters.

In light of the increase in the number of CT exams performed in the US, concerns about variability in doses and/or image quality used by different practices or scanner models to accomplish similar diagnostic tasks, **and several unfortunate cases of patient injury due to the use of improper scan protocols**, the AAPM is committed to the publication of a set of *reasonable* scan protocols for frequently performed CT examinations, summarizing the basic requirements of the exam and giving several model-specific examples of scan and reconstruction parameters. This work is the charge of the **Working Group on Standardization of CT Nomenclature and Protocols**, whose membership includes academic and consulting medical physicists who specialize in CT imaging, representatives of each of the major CT scanner manufacturers, and liaisons to the American College of Radiology, American Society of Radiology Technologists, and the Food and Drug Administration.

The provided protocols are considered by the Working Group to be reasonable and appropriate to the specified diagnostic task. The settings provided are representative of typical clinical values and they may not always match default protocols.

The provided protocols represent a *sampling* of currently available scanner models. They are not intended to provide comprehensive information for all available scanner models.

Protocol Optimization and Review: Pediatric Protocols

- Manufacturers sometimes include Pediatric Protocols
- Reason for exam is often different from adult protocol
  - "Right-Sized" protocol adjusted from adult may not be enough
- Work with Radiologist to determine what image quality they need
- ACR is working to establish reference CTDI values for head and abdomen

Protocol Optimization and Review: Low Dose Follow Ups

- Example of Low Dose Exam:
  - CT Chest Study – NLST showed low dose chest CT more effective than Radiograph for lung cancer
- Other possibilities for low dose follow ups
  - Sinusitis
  - Hydrocephalus Imaging
    - Ventricle
    - Ventroperitoneal Shunt Placement

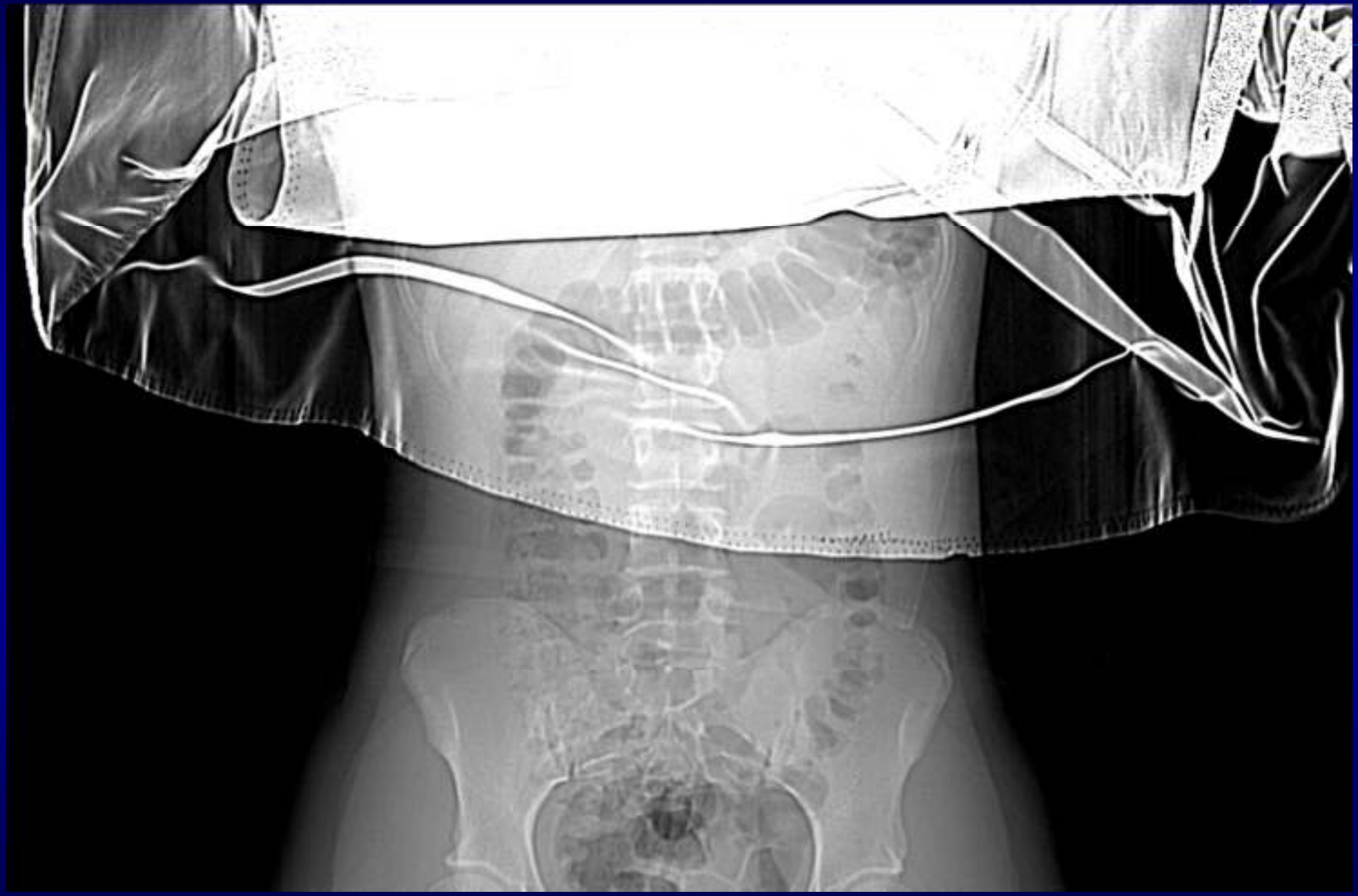
Patient Positioning

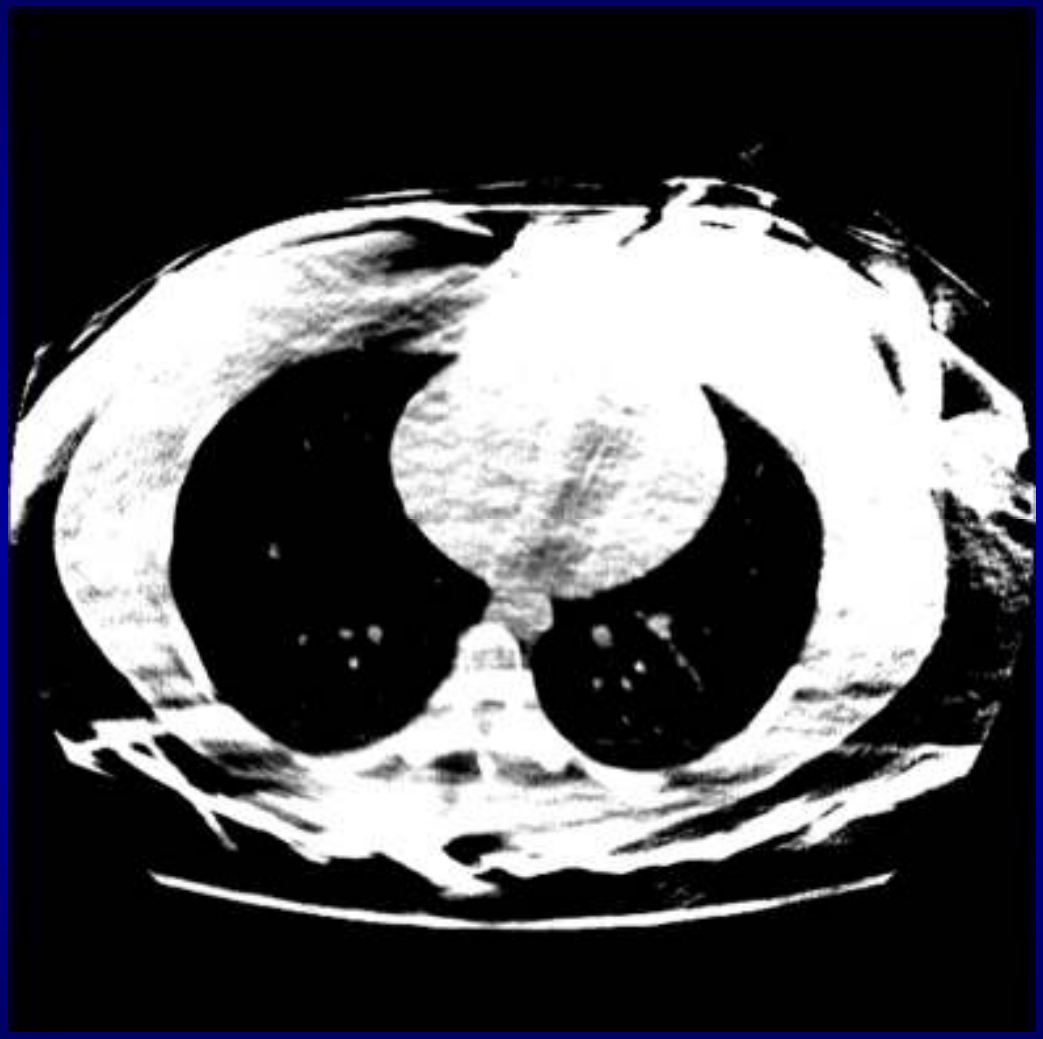
- Proper Training and Education of Techs
  - Position patient vertically at IsoCenter
    - Vital for proper implementation of tube current modulation
  - Angle patient anatomy or gantry to:
    - Avoid radiosensitive organs
    - Avoid artifacts
  - Screen patients for jewelry and move tubing aside if possible

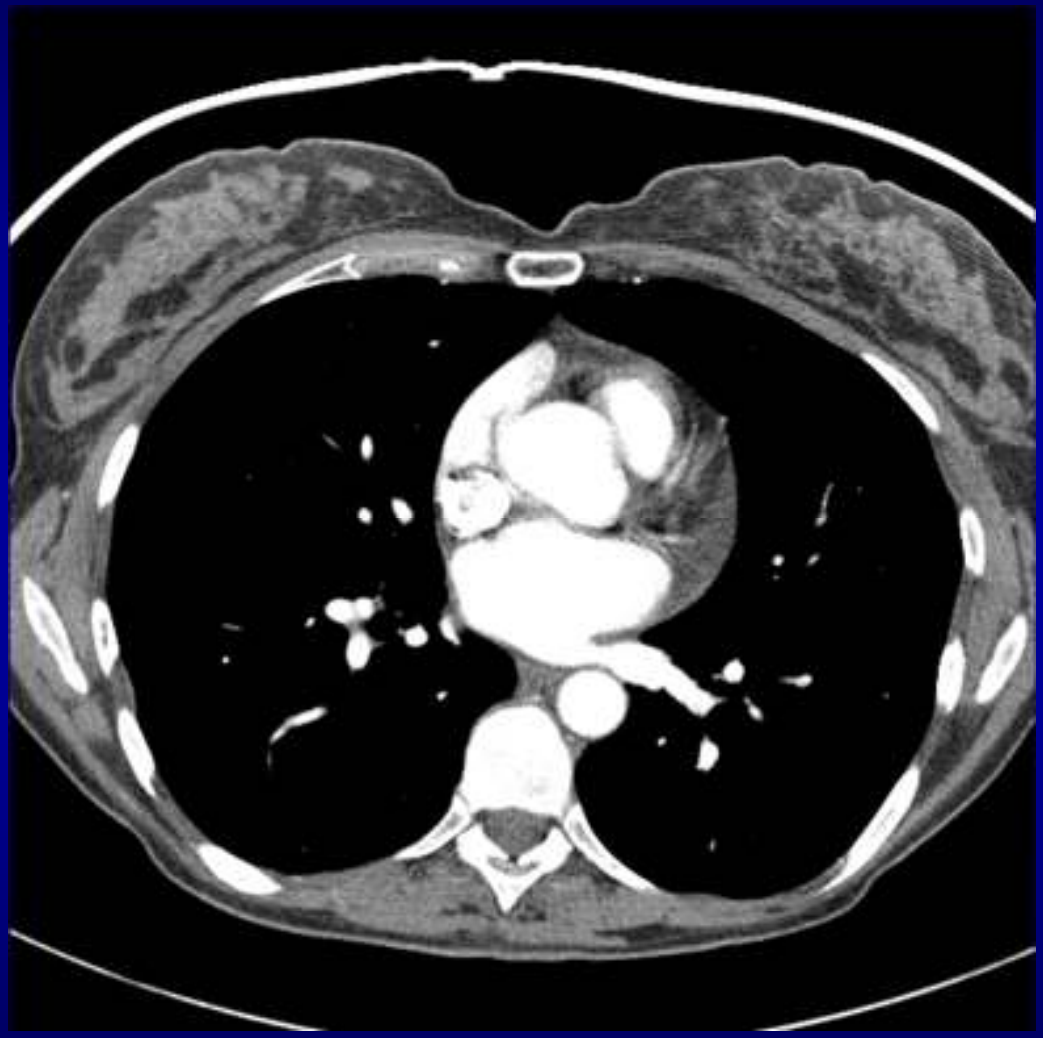
EYE LENSES ARE SENSATIVE TO RADIATION!

Patient Shielding

- AAPM is expected to issue position statement on Bismuth Breast Shielding soon
  - Expected to be against it
- Pitfalls of Breast Shielding
  - More dose to lungs (same weighting factor)
  - Added noise (TCM just as effective)
  - Utilization at proper time (NOT on Scout)







Tracking Patiend Dose and Exams

- IMPACT dose spreadsheet
- ACR Dose Index Registry
  - Nationwide comparison of procedure doses
  - Dose Structured Report
- Software Programs are available to Evaluate Patient Dose and/or send in RDSRs to ACR

Tracking Patient Dose and Exams

- Tracking of Cumulative Patient Dose may be in our future
  - Greatest risk is undiagnostic exam or not imaging patient due to radiation fears
- There is potential, via informatics to recognize "frequent fliers" and to identify patient populations receiving many CT exams
- How do you report dose from exam?
  - DLP
  - CTDI
  - Absorbed dose to organ
  - Effective dose?

Thank You!

Questions?