Crucial Elements In Radiation Safety For Non-Radiology Interventionists: Advice From A Radiologist

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Disclosures

• None

The non-radiologist

• No or less formal training in radiation protection
• Increase in number of image guided procedures/hybrid rooms
• Radiation protection
  – (Patient)
  – Physician

Effects of radiation

• Stochastic effects
  – Tumour induction/carcinogenesis and genetic effects
  – No threshold
• Deterministic (non-stochastic) effects
  – Lens
  – Threshold

How to reduce radiation exposure

• Reduction of exposure time
• Reduction scatter radiation
• Distance
• Collimation
• Lead protection

How to reduce radiation dose

• Try to avoid exposure and reduce exposure to a minimum
• Stay away from the radiation source as much as possible
  – Stand on side of transmitted beam (at the detector side); only 1-5% of radiation entering the patient come out
  – Step outside the room during angiographic runs
  – No hands in primary beam
Scatter radiation

How to reduce scatter radiation

- Positioning of C-arm
  - Most scattered radiation occurs at tube side
  - X-ray tube under the table
- Position of detector
  - Close to the patient
  - Decrease steep angled projections

Distance and collimation (FOV)

Lead protection

- Protective clothing
- Lead curtains/shields

Protective clothing

- Lead apron
- Thyroid protection
- Leaded eye-wear
- Protective helmet/cap (?)

Protective clothing

- Proper use of protective clothing
- Use dosimeter (at chest level)
- Do not use patient protective clothing
- Pay attention to direction of radiation
Eye protection

- Posterior subcapsular lens changes found in 50% of interventional cardiologists as compared to <10% in controls
- Most lens injuries result after several years of work without eye protection

Vano E et al, JVR 2013;24:197-204
Ann ICRP 2012;41:1-322

Brain protection?

A no brainer?

Protective shielding

Additional considerations

- DSA vs. fluoroscopy
  - Phantom study
    - 6 second DSA series of 3 frames per second: effective dose between 0.91 and 1.46 mSv
    - 6 second fluoroscopic imaging: effective dose between 0.14 and 0.20 mSv
    - Step out of the room or at least back when performing diagnostic angiography

Additional considerations

- Antegrade vs. retrograde procedure
  - Distance to object irradiated increases typically in antegrade procedures
  - Shorter catheter/guidewire exchange times
- Avoid use of short devices (e.g. dialysis fistulae)
  - Distance to object automatically increases

Reduces scatter radiation exposure to operator by 90%
Recent developments

• Dose reduction algorithms (software based image processing; e.g. Clarity); up to 73% dose reduction
• Use of new flat detector systems (e.g. Q.zen); up to 50% dose reduction

Summary-how to protect

• Protect yourself with appropriate clothing/screens
• Minimize time, maximize distance
• Reduce the field of view/collimate
• Use equipment with dose-reduction techniques

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