Ask EuroSafe Imaging
Tips & Tricks

IR Working Group

Hand Protection for Interventionalists

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Background

- Hands are often close to the primary beam and exposed to intense scatter radiation fields.

- The regulatory limit in the EU for the dose at workers’ hands is 500 mSv/year [1]

- Although the regulatory limit may seem “high”, it may be exceeded if protection means are not taken.

- The European regulation also claims for the optimisation of the occupational doses, therefore individual doses (including hands) should be ‘As Low As Reasonable Achievable’.
How to Protect Interventionalists Hands.

- Keeping Hands out of the radiation field is the best way to protect them.
- Leaded gloves may be of benefit, if the operator’s hands will be near, but not in the primary radiation beam.
- Disposable, protective patient drapes placed on the patient also helps to reduce hands doses.
- Where possible, use tubing extensions or needle holders so hands are away from the exposed field [2]
How to Protect Interventionalists Hands: Protection Gloves.

- Protection gloves are usually manufactured with 0.03 to 0.05 mm Pb equivalent thickness.

- They provide attenuations between 20 to 60% depending on the beam energy: the higher beam energy the lower protection.

- Note that some manufacturers provide attenuation information relative to low filtered beams, which is not the case in interventional practices, where high filtered X-ray beams with higher energy are often used.

- Then the attenuation for high filtered beams will be lower than for low filtered beams.
How to Protect Interventionalists Hands: Protection Gloves.

- In general the operator’s hands should never be exposed to primary radiation beam.

- Leaded gloves may seem useful for radiation protection on those rare occasions when the operator’s hands must be in the primary radiation beam, but they do not provide protection in this situation [2]

- Leaded gloves may be of benefit if the operator’s hands will be near, but not in, the primary radiation beam.
How to protect Interventionalists Hands: Protection Gloves.

- The presence of the metal glove in the primary beam unchains a reaction in the automatic exposure control of the X-ray system, increasing the kV and mA to keep constant the exposure at the entrance of the image detector.
- Then the protection expected to be provided by the gloves is partially or totally cancelled by the increase in dose rate.
- As a result, **the patient exposure is increased.**
How to protect Interventionalists Hands: Disposable protective drapes

- Made with metallic elements (bismuth, tungsten, antimony)
- They have been shown to reduce operator dose substantially: 29-fold for the hands [3]
- Drapes should be considered for complex procedures and procedures where the operator’s hands must be near the radiation field (eg: management of dialysis fistulas and grafts; biliary; and genitourinary interventions) [2]
- As with the protection gloves, keep in mind that they must not be placed in the primary X-ray beam, otherwise the skin dose to the patient will increase.

CT Fluoroscopy

- The radiation protection concerns for CT fluoroscopy differ somewhat, particularly in terms of avoiding an excessive radiation dose to the interventional radiologist’s hands [2]

- Step and shoot technique should be preferred

- In some cases for real time intervention the use of needle holders in CT fluoroscopy is of particular importance.

- Hands must be kept outside the isocentre plane. Dose rates might be as high as 5 mGy/s = 18000 mGy/h [5]

Image from Buls et al. Health physics 2003; 85(2); pg 166.
Hand Dose Monitoring: Wear your dosimeters and know your own doses

- Remember, the best way to know your doses is to correctly use your personal dosimeters.

- It is not possible to accurately estimate an operator’s hand dose using a body dosimeter because of the proximity of the hands to the X-ray beam.

- A ring badge is recommended to estimate hand dose [2]
Summary

- Keep your hands as far as possible from the source of scatter radiation.

- Gloves can offer hands protection but not when placed in the primary X-ray beam.

- Disposable drapes can also help to reduce the dose to Hands. Keep them outside the primary X-ray beam.

- CT Fluoroscopy: Step and shoot technique or use of needle holders is advised.

- Wear your dosimeters and know your own doses.
REFERENCES

1. COUNCIL DIRECTIVE 2013/59/EURATOM of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.


