

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]



From Kloec et al. Eur J Vasc and Endovasc Sur
2014.

- 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

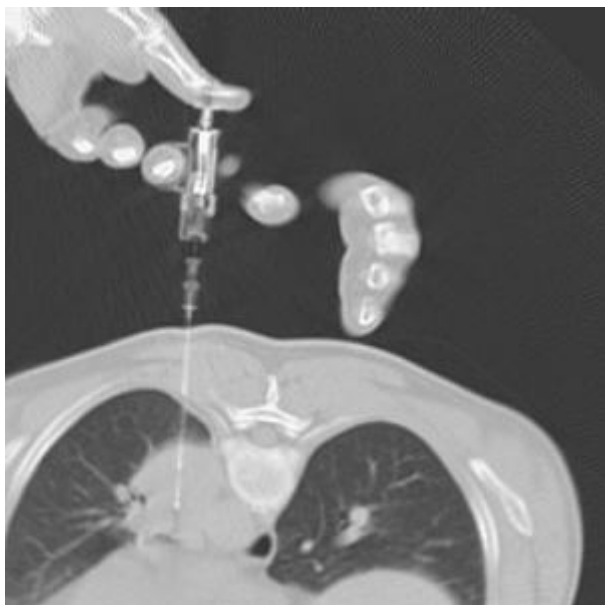


Image from Buls et al. Health physics 2003; 85(2); pg 166.

- 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 $5 \text{ mGy/s} = 18000 \text{ mGy/h}$ [5]

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



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