

FLUOROSCOPIC RADIATION EXPOSURE: ARE WE PROTECTING OURSELVES ADEQUATELY?

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BACKGROUND

While traditional intraoperative fluoroscopy protection relies on thyroid shields and aprons, recent data suggests that the surgeon's eyes and hands receive more exposure than previously understood. **Surgeons may be at greater risk for radiation exposure when fluoroscopy is used in hand surgery than other surgical procedures due to the need to manually position the extremity for imaging.** Procedures to insert a distal radial plate are routinely performed by hand surgeons and by all orthopaedic surgeons. Distal radial fracture treatment may be a high-radiation-exposure event, and thus can be used as a model to study surgeon safety.

OBJECTIVES/METHODS

An anthropomorphic model was fit with radiation-attenuating glasses, a thyroid shield, an apron, and gloves. Model placement was standardized for all procedures. "Exposed" thermoluminescent dosimeters overlaid the protective equipment at the eyes, thyroid, chest, groin, and index finger while "shielded" dosimeters were placed beneath the protective equipment. The exposed finger dosimeter was placed beneath a standard polyisoprene surgical glove on the left hand. The right hand was fitted with a radiation-attenuating glove. Fluoroscopy position and settings were standardized to 60 kVp. Three mini and three standard C-arms scanned a model of the patient's wrist continuously for fifteen minutes each. Using an open distal radial fracture surgery model, this study examined:

-  Radiation exposure to the eyes, thyroid, chest, groin and hands of a surgeon mannequin
-  The degree to which shielding equipment can decrease exposure
-  How exposure varies with fluoroscopy unit size

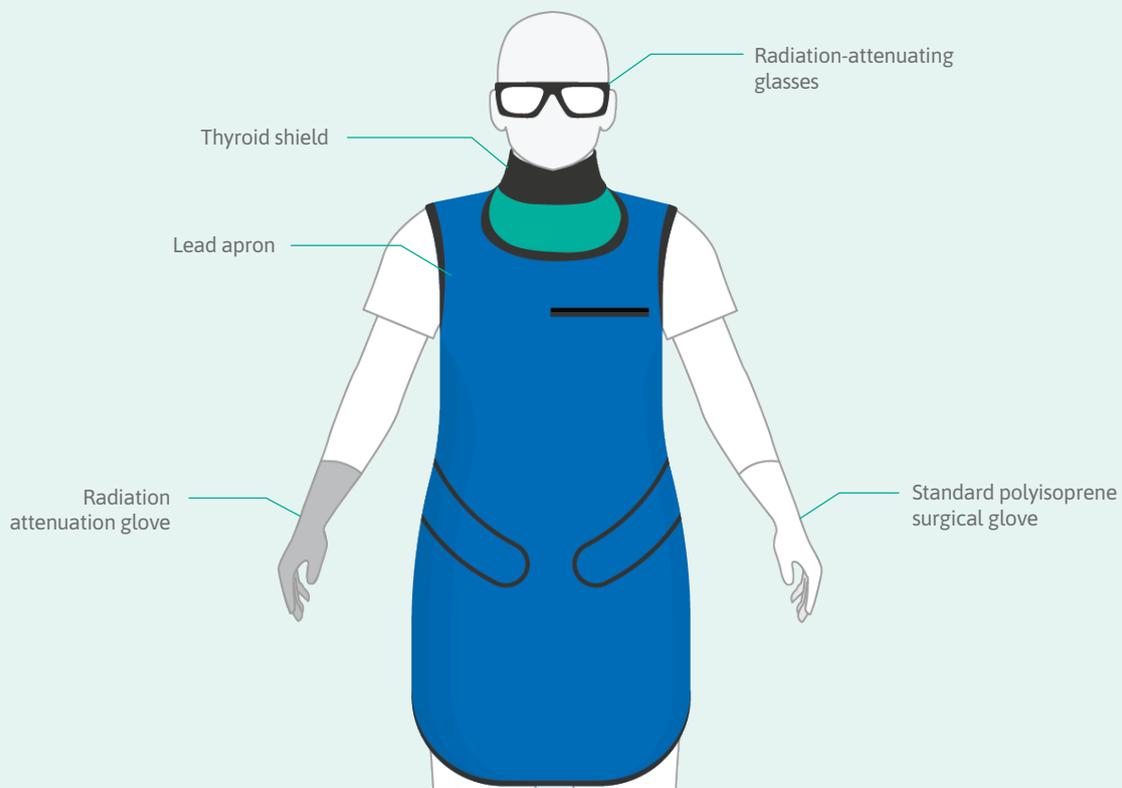


Figure 1: An anthropomorphic model with radiation-attenuating glasses, thyroid shield, apron, and gloves.

RESULTS

The hands showed statistical significance with exposure averaging 31 $\mu\text{Sv}/\text{min}$ (range, 22 to 48 $\mu\text{Sv}/\text{min}$), which was 13 times higher than other recorded exposures ($p < 0.0001$). Eye exposure averaged 4 $\mu\text{Sv}/\text{min}$, 2.2 times higher than the mean thyroid, chest, and groin exposure.

Table 1: Radiation exposure for exposed and shielded anatomic location

Location	Mean (Standard Deviation) ($\mu\text{Sv}/\text{min}$)		
	Exposed	Shielded	P Value
Eye	4.1 (4.3)	0.8 (1.1)	0.12
Thyroid	1.6 (0.8)	1.2 (0.3)	0.18
Chest	2.0 (1.7)	1.3 (0.0)	0.18
Groin	1.9 (2.1)	1.3 (0.0)	0.27
Hand	31.0 (9.2)	9.1 (2.7)	0.0001*

*Statistically significant difference

Additionally, radiation-attenuating gloves reduced hand exposure by 69.4%. Radiation-attenuating glasses decreased eye exposure by 65.6%. There was no significant difference in exposure between mini and standard fluoroscopy.



Radiation gloves reduced hand exposure by **69.4%**



Radiation glasses decreased eye exposure by **65.6%**

CONCLUSION

Surgeons' hands receive the most radiation exposure during distal radial plate fixation under fluoroscopy. Given the uncertainty regarding long-term hand exposure, personal protective equipment may have a role in decreasing the potential cumulative risk of long-term subclinical exposure. **Hand exposure was reduced by nearly 70% with the use of radiation-attenuating surgical gloves in this study.** This is a simple and effective intervention for reducing radiation exposure, particularly for procedures requiring greater fluoroscopy use.

APPLICATION FOR PRACTICE

Based on these findings, wearing both radiation protective glasses and gloves is recommended to mitigate exposure to surgeons' eyes and hands, in addition to protecting the thyroid, chest, and groin, during fluoroscopy procedures.

Routine protective equipment to mitigate exposure

1



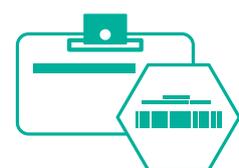
Radiation-attenuating gloves and glasses should be worn to reduce exposure by almost 70%

2



Protective shielding, including a lead apron and thyroid shield, should be routinely worn

3



Dosimeters should be worn with protective shielding to monitor exposure limits

Note: This clinical summary is written as an abbreviated version by clinicians at Ansell Healthcare Products, LLC. Please refer to the full text version for complete information.

References:

Hoffler CE, Ilyas AM. Fluoroscopic radiation exposure: are we protecting ourselves adequately? J Bone Joint Surg Am. 2015 May 6;97(9):721-5.

Link to access full text article: https://journals.lww.com/jbjsjournal/Abstract/2015/05060/Fluoroscopic_Radiation_Exposure_Are_We_Protecting.4.aspx

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