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Radiation to Surgeon’s Hands Wearing and Not Wearing Lead Gloves

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Introduction: It is common for interventionalists to wear lead shielding to their body and thyroid, but not lead gloves to perform procedures. Some postulate that the efficacy of lead gloves in general is exaggerated because experimental testing does not account for backscatter radiation from the glove surface on the far side of the surgeon’s hand. There are few studies to specifically compare the radiation doses of hands received during fluoroscopy with and without lead gloves. The purpose of this study was to compare the absorbed radiation doses of hands during fluoroscopically controlled procedures in surgeons wearing and not wearing lead gloves, then make recommendations on lead glove usage.

Materials and methods: This study was carried out prospectively. Radiation time and dose to the dominant hand were measured in two separated periods. For two months, the surgeon performed endoscopic and spinal injection procedures without lead gloves. Then, the surgeon performed the procedures with lead gloves the next two months. The surgeon wore a lithium fluoride thermoluminescent dosimeter ring on his ring finger of the right (dominant) hand, in addition to a lead apron, thyroid shield and lead glasses.

Results:
1. Not wearing lead gloves: 21 endoscopic surgeries and 109 spinal injections were performed during this period. The total cumulative fluoroscopy time was 1 hour 28 minutes and 21 seconds. The cumulative radiation dose on reading of dosimeter ring was 290 mrem.
2. Wearing lead gloves: Total 26 endoscopic surgeries and 94 spinal injections were performed. The total cumulative fluoroscopy time was 1 hour 32 minutes and 41 seconds. The cumulative radiation dose on reading of dosimeter ring was 140 mrem.

The data demonstrates that with the approximate same exposure time, the radiation dose of hand can significantly attenuate 52% by wearing lead gloves.

Discussion: When using a fluoroscope, the surgeon’s hands can be exposed both directly from the primary X-ray beam and secondly from scattered radiation. Some studies did not recognize the risk of radiation exposure to the hands, concluding that the radiation dose to the hands is far below the published exposure limits. A few studies concluded that radiation dose to the hands could be underestimated. One study reported that fluoroscopically assisted thoracolumbar pedicle screw placement exposes the spine surgeon to 10-12 times greater radiation levels than nonspinal musculoskeletal procedures. Wagner concluded that forward-scattered and backscattered x-rays reduce the effectiveness of radiation-attenuating gloves, and lead gloves did not protect the surgeon’s fingers. Our study, however, demonstrated that wearing lead gloves can reduce the radiation dose to the hands and fingers by 52%, which strongly supports using lead gloves for hand protection during endoscopic discectomy and spinal injections. Studies by Rampersaud (2000) and Mroz on radiation exposure to the hands for vertebroplasty and pedicle screw insertion estimated that surgeons would exceed the extremity dose limits without protection at approximately 300 procedures per year. Using lead shielding to protect the hands might allow a surgeon to perform double the procedures or more per year within safe limits.

Conclusion: Based on our study demonstrating a decrease in radiation exposure to the hands, wearing lead gloves during endoscopic surgery and spinal injections is recommended.