

Better Radiation Protection Through the Care and “Feeding” of Your Lead Apron

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I rarely wear a lead apron during our procedures. The reason is that we now have a large room shield, the Protego Radiation Protection System (Figure 1).¹ It's a liberating experience to be “lead free” but there are some cases that still require all of us to wear personal protective apparel (PPA), including lead aprons (2-piece or full body, thyroid shields, glasses, etc.). In addition, the circulating nurses/technologists that move from one side of the room to the other continue to wear lead aprons throughout the case.

Lead aprons have changed over the years to be more comfortable but I'm not sure they have achieved this despite great efforts. The most recent version of my lead is heavy despite using the thinner lead equivalent materials (I'm told). It has a top vest and bottom skirt, and more support straps than I remember from my old lead apron. It is still cumbersome to hang up in the crowded space we have on the racks (Figure 2).

Nonetheless, a good apron is a critical element of our profession and we should make every effort to maintain them for our safety. Moreover, I should have known this, but I just learned that the lead worn during a case should be cleaned well after each case. Because I was surprised by my own lack of knowledge on the care and ‘feeding’ of our PPA, I thought I would spend a few moments and share some of these rules with readers.

Radiation exposure is an unavoidable part of the cardiac cath lab occupational life. A recent documentary video by PBS, “Scattered Denial”, featuring Dr. David Rizik and colleagues,² highlights the occupation risks incurred by those spending their professional lives in the radiation imaging environment. Reducing radiation exposure and occupational hazards is strongly advocated by all professional societies and guidelines when addressing cath lab safety. There is an industry movement underway

to reduce the need to wear lead aprons with unique radiation protective devices in the cath lab such as the Protego, Rampart, and other devices.³ Unfortunately, we cannot yet completely discard our lead aprons, thyroid shields, eye guards, or protective lead caps.

Every lab has a collection of lead aprons of various ages, conditions, shapes, and sizes (Figure 3). There is a continuing need to keep these aprons functional and protective by eliminating problems that may cause the apron to break down or fail to shield the user in some way. In addition, it is important to the maintenance of sterile conditions in the lab that the aprons be cleaned in a uniform and organized approach.

Routine Surveillance

The periodic inspection of radiation protective devices and apparel is important to ensure the integrity of the equipment. The goal of radiation protection is to reduce exposure to a level which is as low as reasonably achievable (ALARA). For some procedures (eg, electrophysiology, ablations, etc.) exposure is many times more than our routine diagnostic coronary angiogram. At our VA cath lab, like many of the other hospitals around the country, we strive to achieve the ALARA goal. The monitoring of radiation exposures and checking adherence to safety policies is a shared responsibility among the nurses, technologists, manager, and operators. This practice is, in theory, overseen by our radiation safety officer. The radiation safety officer is also charged with compiling a master list of all the radiation protective apparel and confirms inspections of the PPA are performed annually. The radiation officer monitors the exposure of the personnel through commercial radiation exposure badges. Our lab also has a real-time radiation dosimeter system to show individual exposure during a case (Figure 4). We are delighted that the real time exposures

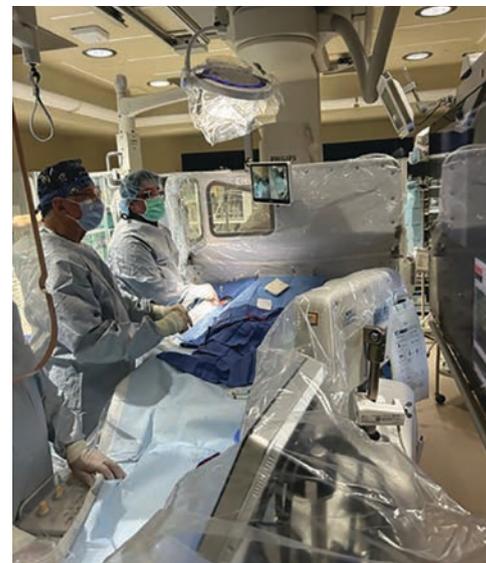


Figure 1. The Protego Radiation Protection System incorporates concepts of reducing scatter radiation with patient shield pads, lower table shields, an angled radiation barrier wall, and a mobile side shield. The patient is viewed through the 2 clear ports and on a television monitor attached to the shield. Staff on the safe side of the shield do not have to wear lead aprons.

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are <0.1 mSv with the Protego Shield, which would usually be >1.5 mSv wearing the aprons without the Protego shield. Unfortunately, not everybody gets to share the benefits of the lead-free case.

Gauging the Integrity of Lead Aprons

Gauging the integrity of lead aprons should be performed at least every 14 months. Visual and tactile assessment of the lead is the first step. The apron is placed out on a flat surface, visually inspected at the seams, surfaces and the outer and inner covers, looking for any damage, rips, tears, or perforations. Next the belts, fastening devices, and snaps are checked to confirm they are intact and working. The surface of the lead apron should be free of any lumps, cracks, or evidence of seam separation. In general, this will suffice for an initial inspection. If the integrity of the apron is questioned



Figure 2. Lead aprons stored on a hanging rack. Tight quarters make hanging a challenge in some cases. My lead is the one with the dancing skeletons.



Figure 3. Lead apron showing tears in fabric at neck from frequent use despite correct hanging on the lab's lead rack.

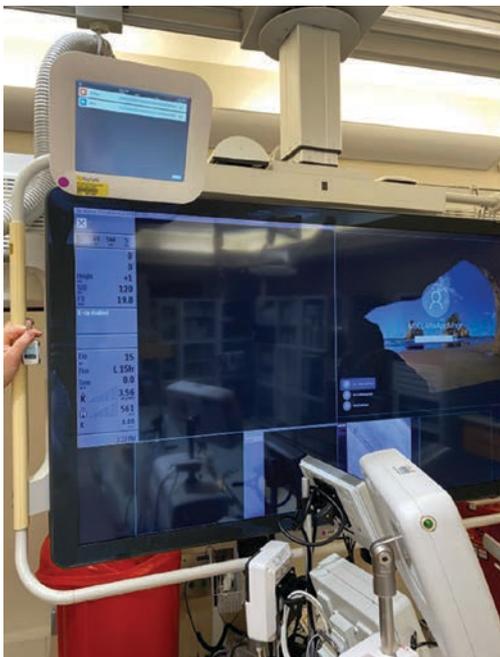
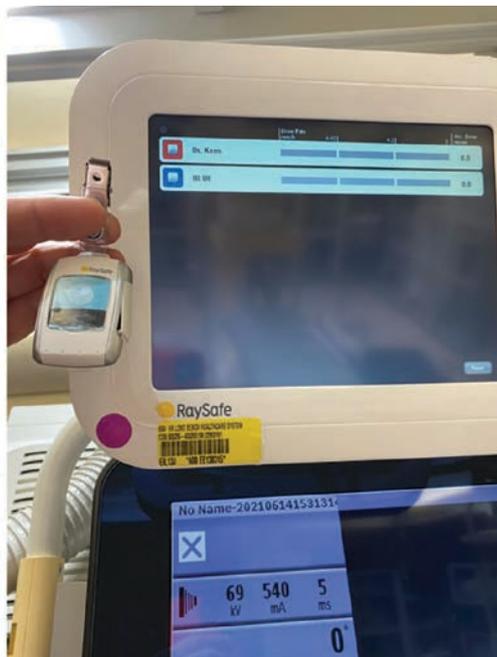


Figure 4. RaySafe real-time radiation monitor. Each member of the team wears a badge that transmits the dosage to the display for all to see and take appropriate steps to reduce exposure.



after the visual and tactile inspection, the next step will be to perform a radiographic examination, looking for cracks from the fluoro exposure using an x-ray machine set to manual mode with high kVp and low mA settings (Figure 5).⁴

The radiation safety officer or their designee should perform these inspections. The rules regarding the type of protective aprons state they should have at least a thickness of

>0.25 mm of lead equivalent. Aprons should have radiation attenuation of no less than 0.5 mm lead equivalent. Full aprons should cover the front of the body from the throat to within 10 cm of the knees, as well as the sides of the operator. If the user is wearing a lead apron, the dosimeter is placed on the collar. Additional shielding should be worn for the thyroid and for the eyes.

Storage

Aprons should never be folded or creased and should not be laid flat for storage (Figure 5). Lead aprons should be stored on approved hangers to prevent cracks in the protective shielding. Cracks in the lead lining can develop at the fold, reducing the useful life of the apron. Hook and loop fasteners must be secured to avoid snagging or tearing of the fabric, and always store the apron with fasteners completely secured.

Avoid exposing the apron to extreme temperatures. While this is a rare occurrence, sometimes the storage area may overheat or be extremely cold. Direct sunlight increases the temperature of a holding/storage area, possibly to a point of damage. In addition, avoid storing your lead in proximity to sharp objects and avoid keeping sharp objects in the pockets of your lead apron. Lead aprons can become damaged while leaning up against stored equipment that has sharp edges or pointed protrusions, thus creating perforations in the lead lining. Do not lay aprons over the chairs in the holding area or in the control room, again forming creases, cracking lead, and reducing its effectiveness.

Should You Sit in Your Lead Apron?

Cracks in the lead apron and lining can develop while wearing the lead, if seated. Lead aprons are not designed for seated procedures. Although there are some aprons that



Figure 5. Top left, lead aprons piled up. Bottom left, correct method of hanging lead aprons. Right panel shows x-ray image of cracked lead. Our technologist reminds us of why we hang lead.

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are available for this purpose, most are not. Those individuals that need to sit in lead during procedures include anesthesia support personnel, our echocardiology colleagues for structural heart cases, and the recording nurses for electrophysiology procedures if the physiologic recorder is not in the room.

Cleaning Your Lead Apron

Sanitizing the aprons per manufacturer's recommendation should be done after each patient procedure. Cleaning of the lead aprons should be performed by wiping the aprons down with approved wipes such as Clorox, hydrogen peroxide, or Ecolab quaternary-based wipes. Deep cleaning and sanitizing lead aprons should be done quarterly in accordance with the Association of periOperative Registered Nurses (AORN) recommendations for disinfection of high-touch objects. Deep cleaning uses friction (eg, scrubbing) which is required to eradicate biofilm and other contaminants on our aprons. Do not use products that contain bleach. Do not soak or submerge your x-ray apron in water or machine launder, autoclave, or dry clean. Once the cleaning is complete, hang the lead apron on a designated apron wall rack to air dry for proper storage.

The Bottom Line

The care and feeding of your lead apron will enhance its function and protect you better. While we would all like to do away with lead, this dream in part has come true for some, but sadly not yet for all. Let's continue to work to reduce the avoidable occupational risks of working in a radiation exposure environment. ■

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Disclosures: Dr. Morton Kern reports he is a consultant for Abiomed, Abbott Vascular, Philips, ACIST Medical, and Opsens Inc.

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