

Radiation Safety in the Operating Room

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Huge advances in diagnostic imaging capabilities in the past two decades have made radiology a crucial part of almost every case work-up in human medicine. Radiation safety, a critical part of our everyday working lives, is often ignored, however, because of time constraints or lack of training. Doctors and operating room nurses involved in interventional radiology,

cardiology, or fluoroscopy routinely receive radiation doses higher than those to which any other medical personnel are exposed—comparable to doses received by workers in the nuclear industry! Operating room nurses and radiological technicians receive the majority of their occupational exposure from fluoroscopy.

Equipment or training is rarely lacking; most often personnel simply do not realize or choose to ignore their peril. You can't see, feel, or smell radiation—so it must not be real! Unfortunately, people pay the price over time when they do not take a few moments to protect themselves before beginning a fluoroscopic, x-ray, or computed tomography study. Thyroid disease, skin problems, cataracts, and even cancer can result from constant exposure to radiation if radiosensitive cells are not protected.

When I teach radiation safety, I ask health care workers: Why don't we shield our brains? Is it because we don't care about them? They do not realize that we need to shield only the radiosensitive cells of our bodies (the fast-growing, undifferentiated ones). You always need to wear good shielding over the reproductive areas, lenses of the eye, and thyroid glands (especially when using fluoroscopy, in which the collar area gets 20 times more radiation than in a single exposure). You do not need to shield other areas unless they will be in the area where scatter radiation is produced during the actual exposure.

If you must work very close to the area where radiation is being produced during a fluoroscopy exam, you must shield your hands completely (top and bottom)—and never have them in the primary beam, even with gloves on. A protective curtain or panel of at least 0.25 mm lead equivalent must be positioned between the patient and those

performing the fluoroscopy. The collimator should show an unexposed border on the image monitor, and a cumulative timer should be in operation and make an audible signal to warn the operator when the fluoroscopy unit has been on continuously for five minutes. Total fluoroscopy time should be recorded for each procedure and beam-on time minimized for each procedure as much as possible.

The exposure control must be of the "dead-man" type, i.e., it must terminate automatically if a person lets up on the switch.

Often, nurses and doctors must give injections or place stents guided by fluoroscopy. "Radiation-resistant" rubber fluoroscopy gloves are frequently used, but they only block about 30% of the primary beam, so they tend to give a false sense of security. Nothing is as good as keeping your hands out of the primary beam! Regular 0.25–0.35 mm lead equivalent gloves must be in good shape, without cracks or holes in them that could inadvertently expose your hands if they must be near the primary beam. During just one exposure, a bare hand exposed to primary beam radiation has a measurable drop in the lymphocyte count in the peripheral blood as it circulates through the hand, because the lymphocyte is so sensitive to radiation. Imagine the effect to yourself if you do this over and over. Even if your radiation dose is being properly measured with a dosimeter, only people who consistently wear finger ring dosimeters are having the dose of radiation to their hands measured.

Your regular gloves are made only to protect you from scatter—the primary beam will penetrate them.

In the operating room, a unique problem is caused by having to wear protection under sterile clothing. It is heavy, uncomfortable and not welcomed by most operating room personnel. It is not easy to get protective garments on and off, so they may have to be worn for a long period of time. For this reason, if your work puts you in this situation frequently, you should have your own apron and thyroid shield that fits you well and is as comfortable as possible.

Before you take an exposure, look around the room and see if you are all safe. Pregnant women, if they choose to work with x-ray or fluoroscopy procedures, must have aprons that offer them complete protection (all the way around the body). By law, no one under 18 years of age is allowed in the room during an exposure. Anyone who is not needed should step out, and all others should take a moment to observe these simple safety precautions before each exposure. When you are done, hang up your gloves and aprons so they will last longer and will not crack and leave you vulnerable.

If you work with fluoroscopy, it is critical that you have good aprons and thyroid shields that offer 0.5 mm of lead equivalent protection and fit well. Each year make sure that you check your protective apparel for damage using fluoroscopy or high kVp radiography (120 kVp, 10 mAs). Make sure that you wear both your body dosimeter at the collar (outside the apron) and finger ring dosimeter and that every employee using fluoroscopy has one. When you are done for the day or leaving the building, leave your dosimeter behind so that heat and humidity in your car do not affect it. Take good care of each other, as well as your patients, so you can avoid becoming a patient yourself. Ensure that radiation safety is taken seriously in your hospital.

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