Anesthesiologists in the Neurointerventional Suite

What Is Appropriate Radiation Protection?

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IN their article on radiation exposure of anesthesiologists, Anastasian *et al.*[1] recommend that anesthesiologists follow the practice of radiologists and wear leaded glasses to prevent cataracts when monitoring patients during neurointerventional cases. This recommendation was based on radiation exposure to the anesthesiologist detected by a dosimeter placed on the forehead; the dosimeter measured, on average, more than three times the exposure of the radiologist, the differential being because of the configuration of the horizontal fluoroscopy beam that subjected the anesthesiologist to more scatter radiation. The study found the exposure to the anesthesiologist to be small, averaging only 6.5 μSv per procedure. This low figure is likely because of placement of a leaded glass shield between the anesthesiologist and the fluoroscopy apparatus.

Given the low concentration of exposure, should it be argued that anesthesiologists forget about the use of protective eyewear? Hardly. A guideline for occupational protection in interventional radiology,[2] prepared collaboratively by the Cardiovascular and Interventional Radiology Society of Europe and the Society of Interventional Radiology in the United States and published in 2010, states that combining various types of shielding results in dramatic dose reduction for the operator (and other nearby personnel, such as the anesthesiologist) and that this method should be the norm rather than the exception. There are three categories of radiation shielding. (1) Architectural shielding primarily denotes the lead shielding built into the walls of a radiology suite and includes rolling and stationary shields made of transparent leaded plastic that are particularly well suited for use by anesthesia personnel. (2) Equipment-mounted shielding includes leaded drapes suspended from the fluoroscopy table and the ceiling and is designed to primarily shield the operator (*i.e.*, the radiologist). (3) Personal shielding includes aprons, thyroid shields, eyewear, and gloves.

However, so that anesthesiologists can make reasoned decisions about how to best protect themselves, further discussion of methods to reduce exposure and the evolving relationship between radiation exposure to the lens of the eye and the development of cataracts is warranted. The guideline mentioned previously deals with the issue of eye protection by recommending that interventional radiologists wear leaded glasses if ceiling-suspended shields cannot be used continuously during the entire procedure. To be maximally effective, such glasses should have large lenses and protective side shields. Unfortunately, some interventional radiologists ignore this recommendation. For the anesthesiologist, a reasonable alternative would be to remain constantly behind a leaded glass shield. Even the increased exposure during interventions, such as drug injections or infusion rate setting alterations, it would seem, could be minimized by slight increases in the length of tubing, allowing placement of injection ports and pumps behind the shield. Even better, the anesthesiologist can work with the interventional radiologist in a team approach, requesting a pause in fluoroscopy when interventions are necessary, assuming the procedure is not in a critical phase. In other words, the anesthesiologist needs to be fully cognizant of whether the fluoroscopy beam is on or off when emerging from the protection of the shield. Furthermore, because exposure is inversely related to the square of the distance from the beam, another protective factor is the distance between the anesthesiologist and the fluoroscopic beam. One study[3] of an orthopedic surgical team found that those working within 24 inches of the beam received significant amounts of radiation, whereas those 36 inches or more away from the beam were only minimally exposed. Finally, as noted in the study by Anastasian *et al.*,[1] the positioning of the anesthesiologist on the same side of the table as the radiograph tube for the horizontal beam exposes the anesthesiologist to more scatter radiation than that expe-

Accepted for publication November 3, 2010. The author is not supported by, nor maintains any financial interest in, any commercial activity that may be associated with the topic of this article.

 Anesthesiology 2011; 114: 477–8

◆ This Editorial View accompanies the following article: Anastasian ZH, Strozyk D, Meyers PM, Wang S, Berman MF: Radiation exposure of the anesthesiologist in the neurointerventional suite. ANESTHESIOLOGY 2011; 114:512–20.

rienced by the radiologist, who is working from the side of the image intensifier. Current rooms can be reconfigured, and new interventional rooms can be planned, to allow the anesthesiologist to be positioned beside the radiologist or at the head of the table, with resultant lower exposures.

As stated by Anastasian *et al.*,[1] the current International Commission on Radiation Protection occupational guidelines for radiation exposure to the eye (150 mSv/yr) are believed by some to be too high; a special report is anticipated that may reduce this limit. If the occupational limit remains in the range of ±100 mSv, a single 6.5-μSv exposure, as reported in this study, would likely be safe because it is lower than threshold by a factor of approximately 10,000. However, because radiation exposure is cumulative, those anesthesiologists who frequently work in the neurointerventional or other interventional radiology suites should consider their frequency of exposure. On the other hand, there are investigators[4] who believe that there may be no threshold dose for cataracts and that radiation-induced cataracts may be a stochastic effect rather than a deterministic one, as believed previously. In such a scenario, even the small exposures to the eye found in the current study might result in cataracts in the distant future.

Discussions of ionizing radiation and its potential ill effects often spawn yawns and shrugs. Radiation is invisible and without thermal signature. Although some deterministic effects, such as skin redness and ulceration, can occur within hours or days, most ill effects will not be experienced for years or even decades. Furthermore, there are no histologic markers to prove that cataracts or tumors are radiation induced, as opposed to arising *de novo*. The evidence linking exposure to ionizing radiation with an increased incidence of cataracts and tumors is convincing. In addition, the rule guiding any exposure should be the one familiar to all radiologists: ALARA (As Low As Reasonably Achievable).

E. Stephen Amis, Jr., M.D., Department of Radiology, The Albert Einstein College of Medicine and Montefiore Medical Center, Bronx, New York. e-stephen.amis@einstein.yu.edu

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