Radiation Dose Management for Fluoroscopically-Guided Interventional Procedures, NCRP Report No. 168, 2010, 325 pp., $150.00/$120.00 PDF, National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Suite 400, Bethesda, MD 20814-3095; www.ncrponline.org.

THE [3]NATIONAL Council on Radiation Protection & Measurements (NCRP) released NCRP Report No. 168 in February 2011 (NCRP 2010). The report, Radiation Dose Management for Fluoroscopically-Guided Interventional Procedures, provides recommendations and supporting information on radiation dose management for patients and medical staff during the use of fluoroscopic systems for guiding diagnostic and therapeutic medical procedures. It was prepared by Scientific Committee 2–3 on Radiation Safety Issues for Image-Guided Interventional Medical Procedures (well represented by current scientific experts on the subject). It builds upon the wealth of theoretical background information, considered guidance, literature review, and guidance information reports that the NCRP has been issuing recently on both general and specific radiation protection issues associated with medical uses of radiation and radiation-producing equipment.

Fluoroscopically-guided interventional procedures (e.g., diagnostic angiography, angioplasty, stent placement, biopsy, ablations, and microsphere placements) are now commonly performed in the United States and worldwide. Such procedures are often less invasive and less costly and typically result in shorter hospital stays than surgical procedures. They are performed by radiologists and other medical specialists (e.g., cardiologists, orthopedic surgeons) with the assistance of medical support staff.

NCRP Report No. 168 includes specific recommendations, as well as detailed discussion on the following: diagnostic and therapeutic procedures, benefit-risk discussions, radiation health effects (cancer risks, tissue reactions, in utero irradiation, and heritable effects), fluoroscopy equipment and facilities, room design, patient dose-management and protection, staff dose-management and protection, personal radiation protective equipment, education and training, credentials and clinical privileges, graded examples of skin reactions to radiation, theory of operation of equipment, pediatric considerations, dose documentation procedures, and a simple list of practical actions to reduce unnecessary radiation exposure to patients and staff during fluoroscopically-guided interventional procedures.

In addition to the thorough treatment of each of the subject areas noted above (as well as many others), the report also offers unique approaches for implementing and assessing radiation protection programs in general, especially in six specific ways. First, the report offers an exceptional discussion on how to conduct comprehensive justification, appropriateness, and benefit-risk analyses associated with medical procedures using radiation, concluding that a worker's exposure is justified if the procedure is clinically justified for the patient. Second, the report rightly emphasizes that optimization requires serious and specific education and hands-on experience for operators and others in the suite, noting that privileges to use imaging equipment should be limited to those who have current training. Third, the report takes a holistic approach to risk management for the patient, interventionalists, and staff, including assessments of overall benefit (patient, operators, and society), procedure risk, radiation risk, and ergonomic risks (to interventionalists). Fourth, the report acknowledges the weight of the recent human epidemiological data suggesting that opacification of the lens of the eye may occur following exposure to significantly lower doses of ionizing radiation (perhaps without a threshold). This is markedly different than the previous deterministic belief that radiation-induced cataracts required a threshold of about 2 to 5 Gy. In light of these findings, current NCRP and ICRP occupational guidelines for dose limits to the lens of the eye (150 mGy y^{-1}) may need to be reevaluated. Indeed, the ICRP has recently suggested that for the lens of the eye, the threshold in absorbed dose is now considered to be 0.5 Gy, and they recommend an equivalent dose limit to the lens of the eye of 20 mSv in a year, averaged over defined periods of 5 years, with no single year exceeding 50 mSv (ICRP 2011). Fifth, the report makes the case that personnel dosimeter readings that are either too high (optimization is not working) or too low (operator is probably not wearing the badge) should both trigger a compliance investigation. Sixth, Table 2.4 of the report provides the medical health physicist with a useful classification nomenclature for the potential risks at varying dose levels (i.e., <0.1 mSv = negligible, 0.1–1 mSv = minimal, 1–10 mSv = minor, 10–100 mSv = low, >100 mSv = acceptable in context of the expected benefit). The adoption of such a scheme could provide consistency when communicating benefits and risks of medical imaging with patients, a notoriously and increasingly difficult prospect (Balter 2011; Dauer et al. 2011).

NCRP Report No. 168 will be of benefit to radiologists and other medical specialists, physicians and support staff, as well as medical physicists, health physicists, and radiation safety officers. The report is particularly useful for those who currently participate in fluoroscopically-guided interventional procedures but do not have sufficient training in the practical radiation protection aspects of the use of the equipment for the procedures (e.g., knowledge of equipment operation, optimal imaging techniques, radiation dose management for patients and medical staff, benefit-risk tradeoffs, and the potential for early or late detrimental radiation effects). The report serves as a detailed complement to various other international and professional guidance documents and studies (e.g., ICRP 2000; Stecker et al. 2009).

The report is clearly also intended for policymakers who can place radiation-dose management requirements on those who conduct fluoroscopically-guided interventional procedures with regard to optimizing imaging protocols, managing procedure time, using available radiation protective equipment and dose-management features, tracking and trending radiation doses to patients and medical staff, and credentialing and privileging physicians to use the fluoroscopic equipment for these specialized procedures.

The NCRP and Scientific Committee 2–3 are to be praised for an exceptionally comprehensive (encyclopedic even) treatment of the subject area and for providing specific, practical guidance as well as useful relevant materials. Fluoroscopically-guided interventional radiation protection programs will likely be improved if interventionalists and medical health physicists use NCRP Report No. 168 as the basis for programmatic self-assessments, audits, and reviews.

NCRP Report No. 168 is available from the NCRP web site in electronic, soft- and hard-copy formats. HPS members

The author declares no conflicts of interest.

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