The Boice Report #35

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The Rooster and Medical Radiation

The rooster crows and the sun rises. Therefore, the crowing caused the sunrise! My classically educated children tell me that this is an example of the *post hoc ergo propter hoc* fallacy! I'd simply call it reverse causation—the rooster didn't cause the sun to rise, but the sunrise caused the rooster to crow! Initial studies in the United Kingdom and Australia of children given computerized tomography (CT) exams reported high rates of subsequent cancer, but causal interpretations were tempered by the likelihood of reverse causation (confounding by indication). The United Nations Scientific Committee on the Effects of Atomic Radiation, the National Council on Radiation Protection and Measurements (NCRP), and others raised concerns that the conditions prompting the exam, family history, or other predisposing factors (not accounted for in the studies) may have been the cause of the increased cancer occurrence and not the CT exams, i.e., the conditions caused the CT. Two recent studies in France and Germany support these early concerns in that once these cancer-related conditions were accounted for, there was little evidence for a meaningful association. Recognizing the limitations of epidemiologic research does not mean that doctors should perform exams indiscriminately and without concern for dose, and programs such as Image Gently should be strenuously supported in the medical community.

The greatest source of population exposure in the United States comes from medical uses or radiation in the healing arts (NCRP Report No. 160). Accordingly, NCRP has a broad-based program on Radiation Protection in Medicine (Program Area Committee 4). Scientific committees (SCs) are addressing radiation protection in dentistry, managing substantial dose procedures associated with fluoroscopically guided interventions (FGI), evaluating and communicating radiation risks for studies involving human subjects, and improving patient dose utilization in CT.

Dentistry (SC 4-5). During the past 10 years, imaging modalities for dentistry have evolved and include cone-beam CT (CBCT), digital radiography, and handheld dental x-ray units. I was startled to learn that some handheld dental x-ray units could deliver annual radiation doses to the hands of operators on the order of 40 Sv! A report is urgently needed as there are no formal guidelines for the safe and effective use of these modalities in the United States. Further, every dental practitioner acts as an independent radiologist, which complicates the delivery of practical guidance.

Fluoroscopically Guided Interventions (SC 4-6). Radiation-induced hair loss and injuries of the skin—collectively termed "tissue reactions"—are rare complications of FGI procedures. Nonetheless, the impact on a patient's quality of life from severe injuries can be devastating. Skin doses of >15 Gy have resulted in such serious complications. NCRP has provided general guidance in the management of FGI injuries in Report No. 168 and Report No. 172. SC 4-6 recently condensed this guidance into a uniform policy that can be implemented with minimal changes by health care providers and facilities (NCRP Statement No. 11).

Evaluating and Communicating Radiation Risks for Studies Involving Human Subjects (SC 4-7). Tens of thousands of individuals participate annually in clinical trials and research studies involving human subjects and ionizing radiation, often through imaging examinations. There is limited guidance available to assist researchers and institutional review boards (IRBs) in preparing protocols that involve radiation exposure in humans. The report will provide researchers and IRB members guidance on assessing proper use of radiation, estimating radiation risks and benefits, and ensuring that informed-consent statements have consistent and comprehensible language—no small task! SC 4-7 met this February in Sacramento, California (photo below).

Improving Patient Dose Utilization in CT (SC 4-8). CT exams are the largest source of radiation exposure to the population, with 76 million exams performed each year. Because of the widespread use of CT exams, the relatively high exposures compared with previous diagnostic procedures, and the rising public concerns, dose-optimization techniques have been developed and reported. Nonetheless, there remain gaps in knowledge as to the practical ways to understand CT radiation dose-optimization processes, particularly in light of new reduction techniques and dose-tracking capabilities. This timely report will cover practical aspects of CT radiation dose optimization and error prevention for practicing physicians, other health care providers, physicists, and technologists.

On the Fourth Anniversary of the Fukushima Tragedy: I am writing this column on 11 March 2015, the fourth anniversary of the Japanese earthquake and tsunami that caused the Fukushima Daiichi nuclear reactor accident. Apropos of today, the Radiation Research Society released a video on Fukushima titled "No Threshold for Fear" (an eight-minute interview with me in 2012).

NCRP Scientific Committee 4-7 on Evaluating and Communicating Radiation Risks for Studies Involving Human Subjects: Guidance for Researchers and Reviewing Bodies

February 2015, Sacramento, California

Left to right, Tony Seibert (University of California, Davis), Linda Kroger (University of California, Davis), Mike Grissom (NCRP staff consultant), Robert Reiman (Duke University), Julie Timins (chair, diagnostic radiologist, New Jersey), Don Miller (Food and Drug Administration), Pat Fleming (Saint Mary's College), Jerry Bushberg (University of California, Davis), Steve Sutlief (University of California, San Diego), and Ed Leidholdt (Veterans Affairs, Mare Island)

Photo courtesy of Don Miller