

Reducing Unnecessary Radiation Exposure for Interventional Radiology Procedures

- The emergence of new imaging technologies has spurred a reassessment of radiation safety and protection standards and practices.
- Fluoroscopically guided interventional procedures generally involve higher radiation doses than other imaging modalities.
- In a recently published paper, a team of researchers at Massachusetts General Hospital examined the efficacy of a pilot program designed to reduce unnecessary radiation exposure during fluoroscopically guided interventional procedures.
- The dose-monitoring and patient follow-up program, designed to raise awareness of radiation dose and the risks of unnecessary exposure, proved to be effective in reducing the number of high-dose procedures performed.

The discovery of the X-ray in 1895 led almost immediately to a recognition of its clinical potential. The subsequent application of X-rays for diagnostic purposes led relatively quickly to the realization that radiation could injure people. Within a decade, the medical community saw both the introduction of X-ray imaging and the birth of the field of radiation safety and protection.

By the beginning of the 1960s, scientists had developed a better understanding of X-ray-related injuries, and various organizations had come together to provide guidance in limiting radiation exposure. They introduced a range of standards and practices, opening the door to the modern era of radiation safety and protection. In more recent decades, the emergence of techniques such as fluoroscopically guided interventional procedures, involving potentially greater radiation exposure to patients, as well as to radiologists and clinical staff, has led to a reassessment of the standards and practices currently in use. Researchers have been exploring the effects of exposure resulting from a number of these techniques, fluoroscopy in particular.

Monitoring Radiation Dose in Fluoroscopically Guided Interventional Procedures

X-ray fluoroscopy is a valuable tool for minimally-invasive diagnostic studies and therapeutic interventions in nearly every patient organ system, under a wide range of medical conditions. Some examples are cardiac catheterization, percutaneous vertebroplasty and localization of foreign bodies. However, because of the nature of the technique, it relies on a continuous X-ray beam to produce video-like studies of the body and typically delivers higher radiation doses than any other imaging modality. As a result, fluoroscopy has been linked to cases of skin injury, hair loss and other reactions in patients. Physicians and clinical staff are also at greater risk of radiation exposure.

Studies documenting cases of fluoroscopy-related injury over the past two decades have led professional organizations, such as the Society of Interventional Radiology (SIR) and the American College of Radiology (ACR), to introduce guidelines for monitoring radiation dose in fluoroscopy. In 2018, the US Food and Drug Administration (FDA) included fluoroscopy in an initiative designed to reduce unnecessary radiation exposure during medical imaging. New regulations issued by the independent, not-for-profit Joint Commission require radiation dose management for all fluoroscopic procedures, effective January 1, 2019. Now, in a paper published in the March 2019 issue of *Radiology*, a team of researchers at Massachusetts General Hospital has reported a retrospective study of the clinical effect of continuous dose monitoring and patient follow-up for fluoroscopically guided procedures. The goal of the study was to determine the extent to which a program at Mass General helped address the issue of unnecessary radiation exposure for these patients.

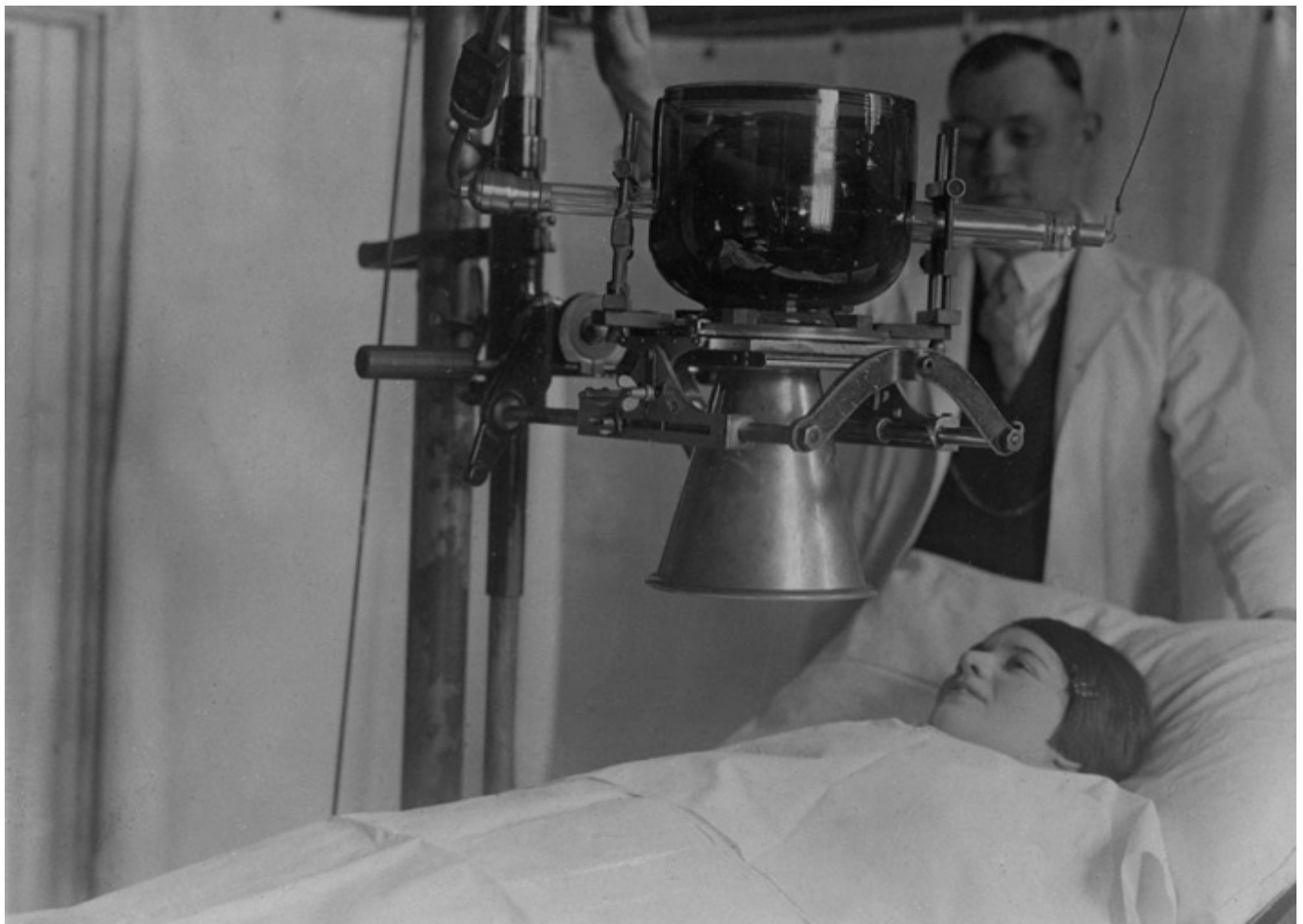


Figure 1. Massachusetts General Hospital continues to improve its radiation protection practices with X-ray imaging, which it has been using since the early days of the technique.

Minimizing Radiation Exposure Through Increased Awareness of Delivered Dose and Related Risks

The dose-monitoring and patient follow-up program at Mass General was designed to raise clinicians' awareness of both the amounts of radiation delivered to patients during fluoroscopically guided vascular interventional procedures and the risks of unnecessary exposure for these patients. The program collected radiation dose data for procedure planning, promoted strategies to help avoid unnecessary exposure (e.g., use of lower frame rates where appropriate, use of ultrasound for guidance instead of fluoroscopy where possible) and renewed focus on patient safety during interventional radiology procedures. With respect to the latter, radiologists were required to follow up with patients who had received air kerma at the reference point (an indicator of patient skin dose) of 5 Gy or greater to ensure that appropriate care is provided when injuries occur and to reinforce the need to know the extent to which patients are exposed to radiation. This component of the program was especially important because clinicians are not likely to see any signs of skin damage at the time of the procedure. Adverse effects of the exposure may not be evident until days or even weeks later.

These efforts and the resulting awareness of unnecessary radiation exposure and how to minimize it greatly impacted patient dose management, the researchers wrote in the Radiology paper. Over the course of the eight years included in the study, they saw a three- to eight-fold reduction in the number of high-dose procedures performed. The researchers concluded that similar programs could be incorporated into other institutions' practices, as well as into training curricula for medical residents and fellows to help establish standards of safe and responsible practice with fluoroscopically guided procedures.

Further Information

For more information about radiation dose in fluoroscopically guided interventional procedures, please contact [Bob Liu, PhD](#), Department of Radiology, Massachusetts General Hospital. We would like to thank Dr. Liu for his advice and assistance in preparing this article.

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