

Editorial

Occupationally Exposed: It Is Time to Protect Ourselves!

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Interventional cardiologists and cardiac catheterization laboratory staff face significant occupational hazards related to ionizing radiation.¹ Radiation exposure causes both deterministic effects (direct tissue damage) and stochastic effects (risks related to DNA damage, namely cancer and fetal malformations). For example, owing to the deterministic effects of radiation exposure, interventional cardiologists have a 3-fold higher risk of developing cataracts than the general population.² Researching stochastic effects, one alarming study of brain tumors in interventional physicians found that 85% of these tumors were on the left side of the brain,³ corresponding to the side typically facing the x-ray source and raising concerns for radiation carcinogenesis. To mitigate radiation risks, interventionalists and staff typically wear heavy lead aprons, which themselves convey substantial risks of orthopedic injury. A survey of interventional cardiologists reported that approximately 50% have experienced at least 1 occupational orthopedic injury during their careers.⁴ Radiation and orthopedic risks are major sources of concern for interventionalists and may influence trainees contemplating careers in interventional cardiology.

The occupational hazards of a career in interventional cardiology have been known for many years; however, in the wake of the COVID-19 pandemic and associated physician burnout, physician wellness has become a major cultural focus. Within the cardiology community, the American College of Cardiology has launched several initiatives to promote clinicians' mental and physical well-being (<https://www.acc.org/clinicianwellbeing>). Beyond the medical community, the United States Congress has taken legislative action to promote physician wellness including the Dr Lorna Breen Health Care Provider Protection Act, which provides both financial and policy support for physician mental health, and the proposed Physician Wellness Program Act, which aims to improve physicians' access to mental health services. In the aftermath of the pandemic, one thing has become exceedingly clear: provider well-being is of the utmost importance.

In this issue of JSCAI, Rizik et al⁵ report results with a novel radiation shielding system, the Protego system (Image Diagnostics), which functions as a radioprotective wall between the x-ray source and the operator. With the Protego system in place, interventional operators need not wear lead-protective equipment. This single-center study

compared radiation exposure during cardiac catheterization procedures between 2 cohorts of operators—1 cohort using standard radiation protection techniques and 1 cohort using the Protego system. Radiation exposure was lower in the operators of the Protego cohort at both the thyroid level (0.36 ± 0.86 vs 58.5 ± 50.2 μ Sv; $P < .001$) and waist level (0.84 ± 2.99 vs 121.4 ± 171.2 μ Sv; $P < .001$). In addition, in 68% of the procedures (17/25), no radiation exposure was recorded in the cohort using the novel system.

The minuscule level of operator radiation exposure with the Protego system is lower than levels ever reported previously with any radiation protection strategy (Table 1). Furthermore, this radiation protection was achieved with no significant limitations to the performance of the procedures and without the extreme weight of lead-protective garments. Although the number of procedures in the experimental arm was small ($n = 25$), these results represent a major advance in the field of occupational safety in the cardiac catheterization laboratory. Future research is necessary to determine whether this system can yield similar radiation reduction without procedural limitations in structural heart and peripheral vascular interventions.

The revolutionary reduction in radiation exposure achieved with the Protego system has the potential to improve the health of interventional cardiologists and cardiac catheterization laboratory staff. Physical health may be improved not only by reducing the risks of deterministic and stochastic effects of radiation exposure but also by obviating the

Table 1. Novel radiation protection strategies and reported radiation reductions compared with traditional cardiac catheterization

Product	Radiation protection strategy	Reported radiation reduction, %
Protego	Radioprotective wall between x-ray source and operator	99
Rampart	Portable radiation shield with cutout for patient	60
RADPAD	Bismuth sulfate protective drape	44
DoseAware	Real-time dosimetry with alerts	81
ClarityIQ	Noise reduction fluoroscopy algorithm	73

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need for lead-protective garments, which can lead to orthopedic injuries. Moreover, mental health may be improved by allaying many of the fears of long-term radiation exposure. These improvements in health may make recruitment of physicians, nurses, and technologists easier. Health systems may balk at incorporating novel protection systems such as Protego owing to up-front costs of implementation; however, physicians and physician-led organizations such as the Society for Cardiovascular Angiography & Interventions should demand this level of protection for themselves and their staff. We are occupationally exposed: it is time to protect ourselves!

Declaration of competing interest

Paul N. Fiorilli has received consulting honoraria from Edwards Lifesciences and Medtronic. Andrew M. Goldsweig has received consulting honoraria from Inari Medical and speaking honoraria from Edwards Lifesciences and Philips.

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