

EDITORIAL COMMENT

# Orthopedic Afflictions in the Interventional Laboratory

## Tales From the Working Wounded\*

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The breadth and pace of interventional innovations have been astonishing, yielding gratifying benefits to our patients and society. Ironically, while taming diseases once intractable, the medical professionals working in the interventional fluoroscopic laboratory are subjected to distinct occupational hazards that put their own health at risk (1-4). Case-based radiation is obligatory in this environment. Accumulated occupational radiation exposure (RE) has been well established to induce premature cataracts (4), and concerns regarding cancer risk are mounting (3). Above and beyond its direct adverse effects, RE is implicated indirectly in occupational “collateral damage.” That is, the considerable daily physical stresses inherent in procedural performance are associated with a predilection to orthopedic injuries, inextricably linked to the cumulative adverse effects of bearing the weight of personal protective lead aprons mandatory to reduce radiation risk (1,2).

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The study by Orme et al. (5), in this issue of the *Journal*, reports alarming and sobering data, detailing the career risks of orthopedic injuries in physicians and allied health personnel working in the interventional laboratory. Orme et al. report results of a large, multicenter case control study designed to determine the prevalence of work-related musculoskeletal pain, cancer, and other medical conditions utilizing an

electronic survey of 1,543 employees (physicians and allied personnel), of whom two-thirds (n = 1,042) are directly involved with procedures employing radiation; the remaining one-third serve as “controls.” The overall survey response rate was 57%—quite laudatory for such methodology. The key results of the study demonstrate that work-related musculoskeletal pain was significantly more common among health care workers participating in interventional procedures compared with those who did not (55% vs. 45%). Not surprisingly, these ailments were present in nearly one-half of physicians (44%); interestingly, the prevalence was even higher in nurses and technicians (60% to 62%). Of note, staff with radiation exposure suffered a higher incidence of breast cancer (19% vs. 9%), although it did not reach statistical significance. Considerations and limitations pertinent to the study’s methods are articulated in the paper itself, which notes the limitations of survey self-reported occupational exposure. The complicated field of cancer epidemiology is also emphasized, especially cautions in drawing conclusions regarding RE and cancer causation, particularly in a study neither designed nor powered to do so.

The authors, experts in the field, should be congratulated for an important study. The compelling results are consistent with, and extend observations from, prior studies over the past decade confirming that working in an interventional fluoroscopic environment poses significant risk for orthopedic injury. The present findings advance the field because the survey includes a very large number of respondents, employed age-matched controls, and assessed not only physicians but also nonphysician allied healthcare personnel (who interestingly had the highest prevalence of musculoskeletal complaints).

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## THE PARADOX OF DOING WELL WHILE SUFFERING HARM—RADIATION EXPOSURE: A NECESSARY EVIL IMPOSING A HEAVY TAX

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Interventionalists work in an environment that, unlike nearly any other in medicine, engenders daily occupational health risk. Radiation exposure is a “cost of doing business” in the interventional laboratory, and its health risks to both patients and operators are well known (1-4). Recent Food and Drug Administration attention and industry innovations have appropriately focused on “imaging wisely” to limit patient RE. While not inconsequential, exposure to patients is episodic and typically quite limited. In contrast, healthcare professionals working in the interventional laboratory are daily placed in “harm’s way.” Over a career, accruing chronic occupational RE is convincingly associated with substantial risk of posterior cataracts (4). More alarming are the serious and growing concerns for cancer induction. Recent reports of a cluster of predominantly left-sided brain cancers in interventionalists are disturbing and distressing (3); the present findings of increased breast cancers in exposed workers, though not statistically significant, is another disquieting “signal.” Taken together, these observations add to the increasing anxiety (though not yet proof of causation) regarding RE-related oncogenesis. It also should be emphasized that RE is of major concern to women in the field, in whom exposure during child-bearing years may influence career path choices (6).

## THE EPIDEMIC OF ORTHOPEDIC INJURIES

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The present data, together with prior reports, now strongly indicate that working in the interventional laboratory over time is associated with a high prevalence of orthopedic problems, particularly those related to the spine (an affliction having ignominiously gained the moniker “interventionalists disc disease”). This epidemic of orthopedic injuries is believed to be related to and aggravated by wearing personal radiation protective apparel (“lead” aprons). Of note, such mandatory leaded aprons are only partly protective, leaving operator’s arms, legs, and head exposed without direct protection (an issue highlighted in the aforementioned reports of predominantly left-sided brain cancers) (3). As procedures grow in volume and become increasingly complex and prolonged, it should not be surprising that interventional progress has been attended by an escalating epidemic of occupational-induced orthopedic afflictions. These occupational-related injuries not uncommonly result in missed days

of work, surgery, and, in some cases, curtailed careers.

## HONOR, DUTY, DENIAL, AND DISABILITY

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Those devoted to healing patients through interventional practice often enter this specialty with the bravado of the young and invincible. In training, we are taught the hazards of RE and methods for its mitigation (but not elimination). In the interventional lab, it is perhaps only both human and pragmatic to “scrub in” and care for our patients without further thought of the risks of longer term occupational injury. Akin to National Football League (NFL) players, we strap on our pads and helmets and enter the “field of play.” Optimism and hope are marvelous human attributes, but as the NFL has painfully learned, denial is not an effective strategy (7). Recognition of the worrisome prevalence of occupational orthopedic injuries in interventional practice and its parallels to the now embarrassing (and litigious problems) of the NFL’s epidemic of concussions (and other orthopedic afflictions) deserves attention, and preventive measures to avoid the quandary that “We play today, but we pay tomorrow.”

There are workforce issues also to be considered. Our burgeoning aging population will demand more interventions. Though some operators will “tough it out” as part of a growing cadre of “working wounded,” depletion of the ranks due to these problems seems inevitable. Some have already prematurely ceased working in the interventional laboratory due to these afflictions, joining the ranks of *recovering interventionalists*. Solutions must be found so we can practice our art and heal our patients with long, healthy, and robust careers.

## IMPERATIVE TO SHIFT THE PARADIGM FOR OPERATOR RISK

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What can be done to enhance operator safety? With respect to RE, recent industry innovations in radiation equipment now facilitate quality imaging with less dose and provide online exposure monitoring. From an operator perspective, meticulous application of established prudent radiation techniques is obvious and essential. Yet, despite these measures, we still labor under the orthopedic burden of only partially protective leaded apparel. Fortunately, there is now a growing technology portfolio that provides optimism for a healthier work environment. Technologies now available include ceiling-

suspended individual lead aprons, shielded gloves, shielded scrub caps for cranial protection, and vascular robotic technology. We can only hope the pipeline will yield a cornucopia of ever-better solutions. Our patients, society, and our spines will be the beneficiaries.

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