Striking a balance in the discussion of the benefits of imaging tests and risks of radiation exposure

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Diagnostic testing from ionizing radiation is an integral part of the practice of medicine. The therapeutic advances and substantial improvement in the care of patients with cardiovascular diseases would not be possible without the concomitant advances in cardiovascular imaging that have occurred. Indeed, the testing that we perform can be lifesaving, although indirectly. This point is sometimes forgotten in the consideration of risks and benefits. In the case of heart disease, there has been a dramatic improvement in patient outcome.[1] It is hard to imagine that this would have occurred without accurate diagnostic testing.

Recently, a comprehensive review of the subject of the optimal use of ionizing radiation in cardiovascular imaging was published in the *Journal of the American College of Cardiology*.[2] There is superb content in this paper and the authors should be applauded for bringing together so much information on this complicated subject. The review serves as an effective educational tool for radiation terminology, the principals of best practice, and the various potential dangers of ionizing radiation. The American Society of Nuclear Cardiology (ASNC) was invited to be a signatory to this publication. However, the ASNC Executive Council, Board of Directors, and Quality Committee voted to refrain from endorsing the document, for 3 reasons.

1. As is the case with any topic related to patient care, one needs to strike a balance between the potential risk of radiation and the potential benefits of testing. It is harder to quantify the benefits of diagnostic testing, but an accurate diagnosis leading to effective treatment is clearly very valuable. It would be a disservice to physicians and patients to focus disproportionately on risk if it ends up frightening patients out of having useful studies. An accurately informed patient is a critical part of the medical decision making process and none of us want to contribute to an illogical radiophobia that would be harmful to patients. ASNC did not feel that this document, which covered both high and low radiation-dose cardiac procedures, struck the right balance. For example, in several places the word choice seemed more frightening than informative, and a striking image of skin necrosis from an electrophysiologic procedure was very prominent. Also, as Angelidis and colleagues point out in this edition of the *Journal*, and many others have pointed out previously, there is substantial controversy about the risk from low-dose ionizing radiation from medical diagnostic tests.[3–6] The risk may be much smaller than suggested by estimations derived by extrapolating from individuals exposed to much higher radiation doses using the linear no-threshold (LNT) hypothesis. While the linear no-threshold approach is endorsed by international regulatory documents such as the 2005 National Academy of Sciences Biologic Effects of Ionizing Radiation (BEIR) VII report as a reasonable approach for public policy purposes, its validity continues to be hotly debated.[6–8] The uncertainties related to the LNT theory are an important part of the discussion of this issue and were not included in the JACC review.
2. The ASNC Executive Council, Board, and Quality Committee members were also concerned that the document lacked the most up-to-date information. The data in many tables were obsolete and did not include contemporary nuclear cardiology practices for radiation reduction such as low-dose protocols

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and solid-state camera technology. In particular, the dose of radiotracer used with contemporary nuclear cardiology testing is lower than several years ago. None of the recent publications showing the potential for dramatic reduction in dose using high sensitivity cadmium zinc telluride (CZT) camera systems or myocardial perfusion PET imaging were included in that review. Ultra low-dose SPECT imaging (≈ 1 mSv, about 1/10th the dose of a standard rest/stress Tc99m SPECT study) is now commonly utilized.[9–11] Also, the dose from PET MPI (≈ 2-3 mSv) is considered a major advantage for this modality and contemporary PET equipment allows for a lower dose for ^{82}Rb than is presented in the ACC review (20-35 mCi rather than 50 mCi). A balanced review certainly should include the most up-to-date information on dose.

3. There has been significant progress in the scientific understanding of the biologic effects of radiation. Genomic and proteomic studies have elucidated the cellular repair mechanism for DNA damage and have reported substantial patient variability in radiation susceptibility. These studies also demonstrate that dose–rate of ionizing radiation is highly relevant and should be considered in addition to dose alone. For example, the radiation induction of some genes is dose-rate dependent, and another set of genes is dose-rate independent.[12,13] These findings suggest that the response to damage may vary at different doses and at different delivery rates.[12,14] The radiation associated with nuclear medicine tracers is delivered more slowly than radiation from x-ray machines and distributed in a large blood volume. Thus, the biologic effect may be different between the 2 sources and these data should be included in a comprehensive review of the topic.

ASNC is the only organization worldwide that is solely committed to the advancement of nuclear cardiology. We fully support the dissemination of up-to-date and balanced information on radiation science. Education is one of our most important missions. We also fully support and encourage the adoption of the ALARA (As Low As Reasonably Achievable) by all practitioners of nuclear cardiology. We look forward to continuing our collaboration with the ACC on these important endeavors.

Disclosures

Both authors report no conflicts of interest.

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