How can we take creative research a step further?

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In their manuscript, “Assessment of Left Ventricular Volumes and Ejection Fraction using Ultra-Low-Dose Thallium-201 SPECT on a CZT Camera: A Comparison with Magnetic Resonance Imaging” in the current issue of the Journal of Nuclear Cardiology, Sala et al. demonstrated a good correlation ($r = 0.86$) between LVEF's determined by these two methodologies.¹ The authors should be congratulated on their initiative in validating one of the essential components, LV function, of a significant technical and clinical advancement in myocardial perfusion SPECT. Quantification of left ventricular function, of course, compliments the information provided from the assessment of myocardial perfusion in risk stratification of patients.

The ultra-low dose thallium-201 myocardial perfusion SPECT technique that these authors report has several potential advantages over conventional SPECT with Tc-99m sestamibi or tetrofosmin. First, due to its considerably higher myocardial extraction, the difference in tracer uptake in normal myocardium versus that supplied by a stenotic coronary artery during exercise or pharmacologic stress is greater with Tl-201 than with the Tc-99m agents, potentially affording greater diagnostic sensitivity. Second, the Tl-201 stress/delayed protocol is less labor-intensive than that for the Tc-99m agents, which requires two separate injections. Third, delayed redistribution Tl-201 images are superior in the assessment of myocardial viability. And fourth, the

much higher count rate capabilities of solid-state detectors allow for lower injected radiopharmaceutical activity (only 0.5 MBq/kg, averaging 44.1 ± 8.3 MBq per patient in the current report) and a significantly lower patient radiation dose (only 4.85 mSv), compared to approximately 11 mSv for conventional Tc-99m SPECT and comparable to that reported for MPI SPECT performed with state-of-the-art CZT cameras. This dose is well below the ASNC recommendation of 9.0 mSv.²

The authors did, however, report some limitations of their method. Left ventricular end systolic volume was systematically underestimated using ultra-low-dose Tl-201 SPECT on a CZT camera compared to magnetic resonance imaging, high ejection fractions were underestimated, and myocardial mass was consistently overestimated. These discrepancies are all likely attributable to poorer spatial resolution of Tl-201 SPECT compared to MRI. These limitations by no means minimize the clinical applicability of gated Tl-201 SPECT functional parameters determined by the methodology the authors report. In contrast, these limitations should serve as a research incentive for these authors and others.

Scatter from the low-energy Tl-201 Hg X-ray degrades SPECT image quality and decreases spatial resolution. Although CZT solid state detectors provide energy resolution superior to that afforded with NaI scintillation cameras, it is clearly not adequate to allow for accurate delineation of the myocardial borders at end systole, resulting in overestimation of LVEF, underestimation of ESV in patients with high EFs, and inaccuracy in determination of myocardial mass. Scatter correction techniques, although presently imperfect, have been investigated and reported.³ Scatter correction could improve Tl-201 SPECT's spatial resolution and minimize the errors the authors encountered. SPECT acquisition using a higher resolution imaging matrix has been reported to improve SPECT spatial resolution for nuclear medicine static and dynamic images.⁴ Investigators have also validated improvement of spatial

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resolution of gated myocardial perfusion SPECT with conventional NaI cameras using “4D SPECT”, an innovative method whereby the resolution of perfusion tomograms is refined and improved by incorporating temporal information from the individual gated frames.⁵ It might be postulated that if these technical advancements were applied to the methodology currently reported by Sala et al., some of the shortcomings of their technique could be minimized.

So, where do we go with a promising new technique such as ultra-low-dose thallium-201 SPECT on a CZT camera? Do we rely on these authors to further refine their technique? Do we wait for other investigators using similar methodology to attempt to further develop the technique? Perhaps, but this is certainly not the most expedient way to advance such a promising methodology.

I believe ASNC and the Journal of Nuclear Cardiology have an important role in identifying further research and development needs and formulating a means to inform the Nuclear Cardiology community of such needs. It should be emphasized that the international Nuclear Cardiology community must be included in any such communication. Notably, the present article by Sala et al. emanated from the Czech Republic. Presently, 10 percent of ASNC members practice in 62 countries outside the USA.

The ASNC Technology Committee, composed of Nuclear Cardiology physicians and technologists, basic scientists, and representatives from industry, is charged with identifying advancements in instrumentation, image processing software, and radiopharmaceuticals that will benefit Nuclear Cardiology. Once these research needs have been identified, it is critical that they are effectively and expeditiously communicated to the Nuclear Cardiology community, particularly our industry colleagues. “Bulletins” could appear on the

ASNC website and in the Journal identifying such research and development needs. A forum discussing future directions in technical advancements could be held at the ASNC Annual Meeting or on the ASNC website. If we truly want Nuclear Cardiology technology to move forward to enhance and improve our diagnostic and prognostic capabilities and remain competitive with other technologies, i.e. echocardiography, CT, and MRI, we must be proactive in publicizing specific research needs and encouraging appropriate investigation.

Disclosure

E. Gordon DePuey has nothing to disclose.

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