LETTERS TO THE EDITOR

- The British Heart Journal welcomes letters commenting on papers that it has published within the past six months.
- All letters must be typed with double spacing and signed by all authors.
- No letter should be more than 600 words.
- In general, no letter should contain more than six references (also typed with double spacing).

Viable myocardium and reinjection of thallium

SIR,—Underwood and Pennell¹ gave a concise review of thallium scanning and the investigation of viable myocardium. Despite having listed in detail the many studies that have shown the value of the reinjection technique they conclude that for the detection and assessment of coronary artery disease conventional stress-redistribution imaging should continue unchanged. An additional reinjection study would be performed only if it was clinically important to establish the presence of viable myocardium.

The redistribution study will fail to demonstrate reversibility in a third of patients with ischaemia. There therefore seems little point in acquiring it when the detection of ischaemia is important. In recommending the continued use of the stress-redistribution technique Underwood and Pennell identified two practical problems associated with the reinjection technique—that is, the uncertainty over the amount of thallium required and the length of camera time which needs to be reserved for the study. These are indeed important problems. They can both be overcome, however, by omitting the redistribution study completely and routinely performing a reinjection study if the stress study is abnormal. Because a reinjection thallium dose of 35–40 MBq will be given, the initial stress dose can be reduced to 65–60 MBq, giving a total injected activity of 100 MBq. Though this is still 20 MBq greater than the maximum activity recommended in the United Kingdom by the Administration of Radioactive Substances Advisory Committee (ARSAC) for a thallium study, the clinical relevance of the information obtained would be increased. As a bonus, for those patients with a normal stress study the injected activity will be reduced by 20 MBq.

We suggest that to maximise the clinical value of thallium scanning there is good evidence for routinely replacing the redistribution study with a reinjection study and that the practical problems detailed by Underwood and Pennell can be overcome at the expense of a slightly increased radiation dose to the patient.

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1 Underwood SR, Pennell DJ. Viable myocardium and reinjection of thallium. *Br Heart J* 1992;68:537–9.

This letter was shown to the authors, who reply as follows:

SIR,—The variety of imaging options and radiopharmaceuticals is sufficient to confound the “expert” let alone the innocent bystander. At least seven different types of thallium image can be acquired: stress (immediately after stress injection), redistribution (three to four hours later), late redistribution (24 hours later), early and late reinjection (when supplementary thallium is given at rest after redistribution from stress), and early and late rest (when a full dose of thallium is given at rest without significant activity from a preceding stress study).

Because thallium is redistributed continuously after injection and because the rate of redistribution depends upon resting perfusion, interpretation is complex. Only three of the images give relatively “pure” information. The immediate stress and rest images show perfusion at the time of injection modulated by the amount of viable myocardium; the late rest image shows the distribution of viable myocardium irrespective of perfusion. In an ideal world each of these images would be acquired so that stress and rest perfusion can be related to the distribution of viable myocardium. This would also allow the identification of hibernation in areas of viable myocardium that are underperfused at rest (in other words with redistribution between the immediate and late resting images).

Note in passing the distinction between the terms “viable” and “hibernating”. Many commentators use these terms interchangeably but it is important to distinguish myocardium that is alive (“viable”) from that which has impaired resting perfusion and function with the potential to improve function after revascularisation (“hibernating”). Viable myocardium that is not hibernating may for example be present in a partial fixed defect after non-transmural infarction. The tissue is alive, the muscle volume is reduced with appropriately reduced perfusion, but resting ischaemia is not present and no improvement in contractile function would be expected with revascularisation.

So what of the suggestion to reduce routine thallium imaging to stress and reinjection images alone? This would be unwise, especially if the reinjection images were to be acquired shortly after reinjection. They would then show a combination of redistribution from the stress injection (which may be incomplete) and resting perfusion (from the resting injection). This strategy has been shown to mask redistribution that has taken place after the stress injection in up to 25% of segments,^{1–3} presumably in those with impaired resting perfusion (figure). Thus reversible defects would appear as fixed. It makes greater sense to consider early rein-

Short axis thallium tomograms in a patient with previous inferior infarction and significant disease of the left anterior descending and right coronary arteries. There is a fixed inferior defect with reversible septal ischaemia (arrows). The reversible ischaemia is apparent on redistribution (four hours after stress injection) but it is masked in the early reinjection image. The late reinjection image was acquired two hours after reinjection and redistribution is not yet complete.

jection after acquisition of the stress images with imaging several hours later, but this approach has also been found wanting for reasons that are unclear.⁴

Fortunately, it is our experience that the problem of absent redistribution at four hours in segments with reversible ischaemia is not as great as Kennedy and colleagues state. Though Yang and colleagues showed significant reversibility after reinjection but not after redistribution in 35% of patients and 18% of segments,⁵ they overestimated the problem by classifying partial redistribution as fixed. The true incidence will depend upon the population studied, but we believe that it is unusual and that clinical considerations will normally identify patients in whom apparent failure to redistribute can be misleading.

We cannot therefore accept the suggestion of Kennedy and colleagues. For detection of reversible ischaemia we recommend the routine use of redistribution imaging, supplemented by reinjection when necessary. In cases where the detection of hibernating myocardium is important a comparison of redistribution and late reinjection images may be helpful, but we prefer to inject thallium at rest and perform early and late imaging.

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- 1 Dilsizian V, Rocco TP, Freedman NM, Leon MB, Bonow RO. Enhanced detection of ischemic but viable myocardium by the reinjection of thallium after stress-redistribution imaging. *N Engl J Med* 1990;323:141–6.
- 2 Dilsizian V, Bonow RO. Differential uptake and apparent thallium-201 washout after thallium reinjection. Options regarding early redistribution imaging before reinjection or late redistribution imaging after reinjection. *Circulation* 1992;85:1032–8.
- 3 Dilsizian V, Bonow RO. Current diagnostic techniques of assessing myocardial viability in patients with hibernating and stunned myocardium. *Circulation* 1993;87:1–20.
- 4 Kiat H, Friedman JD, Wang FP, et al. Frequency of late reversibility in stress-redistribution thallium-201 SPECT using an early reinjection protocol. *Am Heart J* 1991;122:613–9.
- 5 Yang LD, Berman DS, Kiat H, et al. The frequency of late reversibility in SPECT thallium-201 stress-redistribution studies. *J Am Coll Cardiol* 1990;15:334–40.