

LETTERS TO THE EDITOR

Thallium-201 Myocardial Perfusion Scintigrams in the Evaluation of Aortocoronary Saphenous Bypass Surgery

In a recent article, Verani et al. (1) reported the effect of aortocoronary bypass grafting (ACBG) on regional myocardial perfusion, using thallium-201 imaging after exercise.

At the present time there is considerable controversy about ACBG and the way in which angina is relieved by this operation. Improved myocardial perfusion through patent grafts would obviously lead to pain relief, but it has been suggested that in some cases perioperative infarction of ischemic myocardium may be the mechanism whereby angina is relieved.

Against this background, any study of myocardial perfusion after ACBG must be evaluated most critically. Verani et al. performed only exercise scintigrams both before and after ACBG, even though they commented that resting scintigrams would have helped them to distinguish between ischemic and infarcted myocardium.

In a review article, Pitt (2) commented on the anomalous finding of a perfusion defect seen in resting scintigrams but not under exercise. He attributed this finding to the presence of subendocardial myocardial infarction (SEMI).

We have studied four patients with SEMI, proven by typical clinical history, cardiac enzymes and serial ECGs. All four patients showed perfusion defects in resting scintigrams but not under exercise. The mechanism by which this apparent anomaly arises is not clear, but one suggestion is that there may be a greater development of coronary collateral circulation after SEMI and that the flow through this circulation is relatively greater during exercise than at rest.

Verani et al. were able to classify their patients preoperatively into those with, and others without, a previous myocardial infarction on the basis of criteria other than thallium scintigrams (presumably history, cardiac enzymes, and ECG).

These criteria, however, are not reliable for the diagnosis of perioperative myocardial infarction, especially when this is subendocardial. Thus, significant SEMIs occurring in the perioperative period would be difficult to establish with conventional methods, whereas their presence might be suspected if both exercise and resting scintigrams were performed postoperatively.

Verani et al. also noted that two patients who were improved clinically by ACBG showed deterioration in their postoperative scintigrams. One possible explanation is that an area of preoperative SEMI may have been converted into a transmural lesion that would become visible postoperatively on the exercise scintigram.

Therefore, despite the convenience of performing only exercise scintigrams, additional information is provided by resting scintigrams, and these can be of great value when one is assessing the benefits of ACBG.

H. SINGH
D. A. CAUSER
Walsgrave Hospital
Coventry, England

REFERENCES

1. VERANI MS, MARCUS ML, SPOTO G, et al: Thallium-201 myocardial perfusion scintigrams in the evaluation of aortocoronary saphenous bypass surgery. *J Nucl Med* 19: 765-772, 1978

2. STRAUSS HW, PITT B: Thallium-201 as a myocardial imaging agent. *Seminars in Nuclear Medicine* 7: 49-58, 1977

Reply

The letter of Singh and Causer addresses two major points: a) the value of rest and exercise thallium-201 scintigrams compared with an exercise scintigram alone, and b) the mechanism responsible for symptomatic improvement in patients following aortocoronary bypass grafts. We will address these issues.

When Tl-201 scintigrams were introduced into clinical medicine, several studies (1-2) suggested that perfusion defects that could be detected by injection of Tl-201 at rest identified areas of infarction, whereas additional perfusion defects that could be demonstrated only by injecting Tl-201 during exercise represented ischemic areas of myocardium. Subsequently, Pohost et al. (3) demonstrated that similar but not identical inferences could be made by obtaining scintigrams early and late after injecting Tl-201 during exercise. Several recent studies cast doubt on these early interpretations. They are: perfusion deficits demonstrated after injecting Tl-201 during rest a) frequently disappear if the patient is imaged a second time several hours later (4); b) do not always correlate with ECG or ventriculographic evidence of infarction (4); and c) frequently disappear following aortocoronary bypass grafts (4). Furthermore, the likelihood of obtaining a positive resting perfusion scintigram in a patient with clearly documented infarction is dependent on a) the time interval between the onset of the clinical event and the scintigram [earlier > later (5)], and b) the type and probably the size of the infarcted area [small subendocardial infarction < large transmural infarction (6)]. In addition, the sensitivity of nontomographic Tl-201 images is limited (7,8) and is markedly impaired in the absence of some stimulus that will increase coronary flow to normally perfused areas of myocardium. Furthermore, the distribution of Tl-201 in the heart is determined by a variety of factors, including coronary blood flow (8), extraction ratio (9), myocardial ATPase activity, and complex redistribution (4,10). In view of the above, there is uncertainty regarding the value of resting Tl-201 perfusion scintigrams, performed with conventional imaging techniques and a conventional protocol (one set of images following Tl-201 injection) in patients who are not acutely ill. Although such information may have been of value in our study, the information obtained may not warrant the additional cost and radiation exposure to the patient, particularly if early and late images following Tl-201 injection during exercise are obtained (11). Singh and Causer imply in their letter that the dominant mechanisms responsible for clinical improvement in patients following aortocoronary bypass grafts may not be improved myocardial perfusion. Although a patient's clinical improvement following this operation may be occasionally attributed to perioperative myocardial infarction, to cardiac denervation, or to a placebo effect, there is impressive evidence, obtained by many approaches, suggesting that improved perfusion is the dominant mechanism responsible for the clinical benefits of the procedure. Evidence to support this view includes the following:

1. Clinical improvement closely parallels the "completeness of the revascularization procedure" as assessed by postoperative arteriography (12).
2. Improved myocardial perfusion following aortocoronary