Case reports

Transluminal angioplasty of a stenosis of an internal mammary artery graft

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SUMMARY Stricture of an internal mammary artery graft was successfully dilated by percutaneous angioplasty in a young man who had recurrent angina soon after bypass surgery.

The number of patients undergoing coronary artery bypass surgery in the United Kingdom increases each year.¹ In most cases this is a palliative because there is subsequent progressive narrowing of both the native arteries and the bypass grafts.² Thus many patients present with recurrent angina or myocardial infarction some years after the operation.^{2,3} To avoid repeat surgery, percutaneous dilatation of saphenous vein bypass grafts is performed in many centres.⁴ Internal mammary artery grafts are more difficult to dilate. Successful application of this technique, however, may avoid further surgery.

Case report

A 34 year old man was referred in November 1984 for further treatment of angina pectoris that had been present for one year. Despite medical treatment he remained severely limited by his symptoms. There was no family history of coronary artery disease, hypertension, or diabetes. The patient had smoked 20 cigarettes per day until the onset of his angina. The resting electrocardiogram and chest radiograph were normal as were all blood tests except for mild type IIb hyperlipidaemia. At cardiac catheterisation the intravascular pressures were normal. Angiography demonstrated a normal sized left ventricle with normal wall motion. There were important stenoses in the mid-portion of the left anterior descending coronary artery after the first septal branch, in the left circumflex artery after the first marginal branch, and in the proximal portion of the right coronary artery.

In April 1985 coronary artery bypass surgery was performed. Saphenous vein grafts were placed to the

distal right coronary artery and left circumflex artery and the left internal mammary artery was anastomosed to the mid-portion of the left anterior descending coronary artery. The patient made an uneventful recovery with no electrocardiographic signs of perioperative infarction. He was discharged 10 days after operation on aspirin only and at outpatient review six weeks later he was active and free of symptoms. Twelve weeks after his operation the patient noticed the return of typical exertional pain with a rapid deterioration in exercise tolerance and episodes of rest pain. The resting electrocardiogram remained normal but on exercise typical chest pain and severe ST segment depression developed in the anterolateral and inferior leads. Medical treatment with calcium antagonists, β blockers, and nitrates failed to improve his symptoms. Repeat angiography demonstrated normal left ventricular function, no change in the native left circumflex or right coronary artery, but total occlusion of the left anterior descending coronary artery over a long segment at the site of the previously severe stricture. The saphenous vein grafts to the right and left circumflex coronary artery were patent with good distal flow. Angiography of the left internal mammary graft demonstrated a tight stenotic lesion in the mammary artery just proximal to its insertion into the left anterior descending artery (fig 1).

In view of the recurrence of symptoms despite medical treatment and the known short duration of total occlusion in the left anterior descending coronary artery we decided to attempt angioplasty and restore antegrade flow in the native coronary artery. This was attempted with a 4 left guide catheter, 0.018 mm, high torque floppy wire, and 3 mm balloon (Advanced Cardiovascular Systems, San Francisco). Despite repeated attempts it was not possible to cross the occlusion in the native left anterior descending coronary artery.

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Fig 1 Angiogram after selective injection of a left internal mammary artery graft injection (anteroposterior view) demonstrating a tight stenosis (arrowed) at the distal end of the graft just proximal to its insertion into the left anterior descending artery. IMA, internal mammary artery; LAD, left anterior descending artery.

A number 1 left Amplatz guiding catheter was then advanced to the origin of the left internal mammary artery. The same guidewire and balloon as described above were then advanced down the internal mammary artery into the native left anterior descending coronary artery and three inflations at 7 atmospheres pressure of 40 seconds' duration were performed at the graft stenosis. During each

Fig 2 Repeat angiogram (anteroposterior view) after angioplasty, showing successful dilatation of the stenosis (arrow).

inflation the patient's electrocardiogram showed ST segment elevation in the same leads in which the exercise test had shown ST segment depression. Angiography after the angioplasty demonstrated a widely patent graft (fig 2). Four days later the patient exercised normally without chest pain or ST segment shift. The patient was treated with verapamil for three months. An exercise test off treatment four months after angioplasty induced no ST changes and thallium uptake at peak exercise was normal.

Discussion

Percutaneous transluminal arterial angioplasty was successfully used in this patient to dilate a symptomatic stenosis of an internal mammary graft. The patient returned to work and further surgery was avoided. Coronary bypass vein grafting is effective in treating anginal symptoms and reducing mortality in patients with specific subsets of coronary stenosis. Unfortunately, angina often recurs because vein bypass graft patency decreases with time. Early graft occlusion is associated with poor graft flow and late occlusion with the development of atherosclerosis in the graft. The latter is also frequently accompanied by the unrelenting progression of disease in the patient's native vessels.² Although internal mammary grafts have a higher patency rate, early and late stenoses develop with a similar aetiology to those in vein grafts.⁵ Coronary angioplasty can be used in patients with recurrent symptoms after bypass grafting to avoid repeat operation, with its attendant higher mortality and lower success rates.⁶ Angioplasty may be performed on new stenotic areas in the native coronary arteries and on stenoses in coronary bypass vein grafts.⁴ The technique of dilatation of internal mammary graft stenoses described in this paper is also likely to be useful in postponing the need for repeat bypass grafting. This is especially important in view of the recent increased use of internal mammary artery grafts.

Percutaneous dilatation of coronary arteries is a well accepted method of treating symptomatic coronary disease for which the rates of success, early complications, and late restenosis (approximately 30%) are known.⁷ Dilatation of coronary vein bypass graft stenoses has been successfully performed in many centres but with less primary and long term success.⁴ The application of this technique to the treatment of internal mammary artery graft stenoses is a new development and there is little information on long term follow up. Kereikes *et al* reported two cases successfully treated in this way with good initial results, no complications, and no evidence of restenoses at follow up five months later.⁸ Our patient also showed a good initial angio-

graphic result and although repeat angiography was not performed a negative exercise test and thallium scan were highly suggestive of no restenosis.⁹ Because their histology is similar it is likely that the same complications will be associated with internal mammary artery dilatation as with native coronary artery; however, further information from large series is needed to define these points.

Although dilatation with standard equipment was successful in this patient, our subsequent failure to reach a stenosis in a native left anterior descending artery via an internal mammary artery graft suggests that the success rate will be further improved by minor equipment modifications. In this case we were able to engage the left internal mammary artery using a catheter that had a preformed shape designed to fit an artery of a different anatomy; however, guide catheters specifically designed to engage the graft artery are likely to simplify the procedure. When fully advanced out of the guide catheter the balloon can reach and dilate a stenosis approximately 30 cm away. Stenosis in the long and tortuous internal mammary artery or in the native artery distal to the anastomosis may not lie within 30 cm of the guide catheter. Hence shorter guide catheters or longer balloon catheters may be needed.

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