Percutaneous Transluminal Coronary Angioplasty: A Review

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INTRODUCTION

On September 16, 1977, Andreas Gruentzig performed the first percutaneous transluminal coronary angioplasty (PTCA). Initially the procedure was reserved for proximal discrete lesions in a single vessel. With the development of steerable guidewires, low profile balloons, ancillary devices and increased operator experience, the indications of PTCA have been extended to several subsets of patients with multivessel disease. PTCA has become a major revascularisation procedure and in 1987, nearly 200,000 patients underwent angioplasty in the United States alone.

SELECTION OF PATIENTS

The patient selection for PTCA is guided by the following four criteria: that the procedure is likely to reduce the symptoms and avoid the complications of coronary artery disease (CAD); to be performed successfully without complications; to provide sustained benefit and to achieve the results equivalent to coronary artery bypass grafting (CABG) but with lower morbidity and cost.

INDICATIONS

PTCA is indicated in patients with not only single but also multivessel disease in whom the lesions are suitable for high degree of success without the likelihood of significant complications. As a result of improved equipment and operator experience, these include proximal, distal, eccentric, tandem and bifurcation lesions.

Mildly Symptomatic or Asymptomatic Patients

Mildly symptomatic or even asymptomatic patients with critical proximal disease of one vessel supplying a large area of myocardium and markedly positive stress test are likely to benefit from angioplasty. The revascularisation in these patients despite absence of symptoms is indicated to prevent the complications of effort induced ischaemia including the possibility of myocardial infarction.

Multivessel Disease

Multivessel disease can also be appropriately treated with PTCA, provided the lesions are suitable, LV function is adequate and no single dilatation jeopardizes massive amount of myocardium. Myler et al reported multivessel angioplasty in 494 consecutive patients. The dilatation was successful in 89 per cent of 1117 lesions with clinical improvements in 95 per cent of the patients. Long term clinical follow-up in 164 patients showed a significant improvement in the anginal class of majority of the patients. Angiographically, restenosis was noticed in at least one lesion amongst 56 per cent of the group and in all lesions in 20 per cent. Similar results have been obtained in a New Zealand study of 200 consecutive patients and an Emory University study of more than 1500 selected patients with multivessel disease. In all these studies the
complication rate was acceptably low. In the experience from Mayo Clinic, however, the restenosis rate in patients with multivessel disease does not seem to be higher and is comparable to that in single vessel disease.

Totally Occluded Vessels

Totally occluded vessels are being increasingly treated with PTCA with successful recanalisation in selected patients. Disciascio et al reported a success rate of 63 per cent in 46 patients. Duration of occlusion was the most important predictor of success. Melchior et al reported effective dilatation in 69 per cent of 45 patients with occlusion of less than a month's duration. In the experience from Emory University the success rate was 80 per cent in selected cases who had total occlusion for less than 20 weeks. The long standing total occlusions are therefore, generally considered inappropriate for angioplasty.

Prior Coronary Bypass Surgery

Angioplasty in saphenous vein grafts has shown significant promise. Cote et al reported results of PTCA for saphenous vein and internal mammary artery grafts in 82 patients with 85 per cent success rate. The complication rate was low and there was significant improvement in angina status at two years follow-up. Ernst et al reported successful angioplasty in 97 per cent of vein grafts and 86 per cent of native coronary arteries in their series of 83 patients. Follow-up angiography demonstrated a 31 per cent restenosis rate. Experience at Emory showed the high primary success rate of vein graft PTCA. The restenosis rate was higher for the proximal anastomosis and the body of graft than for the distal anastomosis. Grafts with extensive disease and total occlusion are usually avoided due to the potential complication of distal embolisation.

Unstable Angina

Interest in this field is growing. DeFeyter et al compared the results of single lesion angioplasty in 43 patients with multivessel disease and 111 patients of unstable angina with only single vessel disease. The primary success rate and complications were similar in both the groups. However, the recurrent angina at six months follow-up was more in patients with multivessel disease (29%) than in those with single vessel disease (16%; P < 0.05%). Wohlgelernter et al performed one vessel PTCA of the "culprit lesion" in 27 patients with refractory unstable angina and multivessel disease. At 18 months follow-up sustained symptomatic improvement was seen in all but 4 patients.

Acute Myocardial Infarction

Another area of interest is the role of PTCA in the management of acute infarction either alone or in combination with thrombolytic therapy. According to Hartzler et al, in the first 500 patients who underwent direct PTCA with no lytic therapy, the success rate was 94 per cent with total mortality of 8.5 per cent. Fung et al examined the outcome of 34 patients receiving intravenous streptokinase for acute infarction. Emergency PTCA was attempted in 29 patients in whom lytic therapy alone was unsuccessful. Angioplasty was successful in all the 16 patients with subtotal and in 12 out of 13 patients with total occlusion. However, recent controlled clinical trials of PTCA after lytic therapy point to the efficacy of delayed angioplasty following successful initial thrombolysis.

Miscellaneous Categories

Finally, certain patients, such as those with very poor left ventricular function or coexistent non-cardiac morbid conditions (pulmonary or metastatic diseases) in whom CABG would be extremely risky may also be candidates for PTCA.

CONTRAINDICATIONS

PTCA is contraindicated in patients with unprotected left main coronary disease. It is also better avoided in persons who have a large area of myocardial dysfunction due to previous infarction and the contralateral arteries have high grade lesions. If such an artery is acutely occluded, it could result in cardiogenic shock and death. Furthermore, patients with multivessel disease who have chronic total occlusions are more appropriately treated with CABG, as are those with very long and