The management of patients with stable angina and multivessel disease

PTCA or coronary bypass surgery?

B. J. Gersh

Division of Cardiology, Georgetown University Medical Center, Washington DC, U.S.A.

Introduction

In the 1970s and early 1980s, randomized trials comparing coronary bypass surgery with medical therapy emphasized the indications for coronary revascularization. In these trials and database studies, the major benefit of surgery over medical therapy upon survival was among 'sicker' patients, characterized by the severity of ischaemia, the extent of coronary disease and the presence of left ventricular dysfunction. In the late 1980s and 1990s, the focus shifted towards the preferred method of revascularization; coronary bypass surgery (CABG) or percutaneous transluminal coronary angioplasty (PTCA).

Difficulties in using the published literature for comparison

There are considerable problems involved in using the published literature to derive a comparison between the outcomes of treatment between the two groups. Firstly, (i) the distribution of multivessel coronary artery disease in the two populations is different. Among patients with multivessel disease undergoing PTCA, the majority have double vessel disease, whereas approximately 65–70% of surgically treated patients with multivessel disease have triple vessel disease. (ii) Moreover, the duration of follow-up after angioplasty is relatively short in most series compared with the experience following CABG. (iii) It is also difficult to draw comparisons against a background of changes in the 'state of the art'. From a technical stand point, CABG is on the plateau of the 'learning curve' following the widespread introduction of the internal thoracic artery and the use of platelet inhibitor agents during the last decade. Transcather interventional techniques are on a rapidly ascending limb of the learning curve with a corresponding improvement in primary success rates and a widening of the patient pool amenable to these techniques. (iv) Finally, most published studies use relatively 'soft' or subjective end points such as relief of symptoms for comparison.

Results of PTCA

Restenosis remains the Achilles heel of percutaneous transluminal coronary angioplasty, and it exerts a significant impact upon the late outcome after initially successful angioplasty. Table 1 documents the one-year outcome in hospital survivors after primary successful PTCA in the 1985–1986 cohort of the National Heart, Lung, and Blood Institute Registry, in which the majority of patients had single vessel disease. These data illustrate that the definition of a successful outcome is heavily dependent upon the perceptions of the observer. Ninety-seven percent of patients will be alive after hospital discharge and if the primary objective of the procedure is to ensure that patients are alive, free of myocardial infarction, and to avoid coronary bypass surgery at one year, then this outcome will have been achieved by PTCA in 81% of patients. On the other hand, if recurrent symptons or repeat PTCA is perceived by the patient or the physician as a negative outcome, only approximately 50% would have experienced a benefit. This is not an unreasonable objective given that the majority of patients have single vessel disease.

In the Randomized Intervention Treatment of Angina (RITA) trial which compared bypass surgery with PTCA, mortality and recurrent myocardial infarction during 2.5 years of follow-up was similar between the two groups (Fig. 2). Moreover, the rates of death, myocardial infarction and bypass surgery in the angioplasty group were relatively low in that 75% of such patients were free of these events at 2.5 years. On the other hand, the price of achieving this outcome was a substantial incidence of repeat PTCA and recurrent angina. In the interpretation of the results of the RITA trial, one has to remember that approximately a third of the patients had single vessel disease and, to be included in the trial, the extent of revascularization in the two groups had to be equivalent. This is probably not the case in the general population with multivessel disease undergoing PTCA.

Nonetheless, this and other trials are extremely useful if the results are interpreted in the context of the patients entering the study. PTCA is a reasonable

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Angioplasty vs bypass surgery

Two-vessel disease
n = 160

Three-vessel disease
n = 62

Lesions at restenosis risk, no.
296 (19/patient)
186 (30/patient)

Figure 1 Summary of angiography results after a mean follow-up period of 27 months after multivessel angioplasty. Multilesion restenosis was significantly greater in patients with three-vessel disease (P<0.01). (Reprinted with the permission of the American College of Cardiology, from Deligonul et al J Am Coll Cardiol 1988; 11. 1173-9. Adapted from[9] and reproduced with permission'.)

Table I One-year outcome in hospital survivors after primary successful percutaneous transluminal coronary angioplasty in the 1985-86 cohort of the National Heart, Lung, and Blood Institute registry

<table>
<thead>
<tr>
<th>Composite events</th>
<th>Freedom from events (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>97</td>
</tr>
<tr>
<td>Death/M1</td>
<td>90</td>
</tr>
<tr>
<td>Death/M1/CABG</td>
<td>81</td>
</tr>
<tr>
<td>Death/M1/CABG+angina less severe or asymptomatic</td>
<td>75</td>
</tr>
<tr>
<td>Death/M1/CABG/repeat PTCA+angina less severe or asymptomatic</td>
<td>62</td>
</tr>
<tr>
<td>Death/M1/CABG/repeat PTCA+asymptomatic</td>
<td>51</td>
</tr>
</tbody>
</table>

Based on 1108 patients. CABG=coronary artery bypass grafting; M1=myocardial infarction; PTCA=percutaneous transluminal coronary angioplasty.

alternative to bypass surgery providing the patient understands that the likelihood of a repeat revascularization procedure is quite high and recurrent symptoms are frequent. However, the similar rate of death and myocardial infarction in the two groups is reassuring and offers the patient the alternative of accepting PTCA without putting themselves at increased risk of death or myocardial infarction.

Results in patients with left ventricular dysfunction

In a multicenter study of patients with left ventricular dysfunction (ejection fraction <40%), the results of multivessel PTCA were very disappointing in that the 25–30% of patients were dead at 2 years[19]. This appears to be substantially higher than would be expected after bypass surgery. Several other studies of PTCA in patients with left ventricular dysfunction have been published, and although the results are not consistent, the impression is that the outcome in most patients is relatively poor[4,16,17]. An important issue in this regard is the completeness of revascularization, and among patients with multivessel disease, complete revascularization is achieved in only approximately 45% of patients with PTCA and among patients with triple vessel disease, repeat revascularization is achieved in only approximately 25% with PTCA[11]. This may relate to the difficulties in dilatation of chronic complete occlusions and although new technologies and devices will probably increase the success rate for complete chronic occlusions, for the present it is unlikely that most people with multivessel disease will be completely revascularized. In this regard, a study of patients in the Coronary Artery Surgery Study (CASS) registry with triple vessel disease and left ventricular dysfunction documented that amongst those with severe angina, there was a significant improvement in outcome in patients who had three or more vessels bypassed compared to those with two vessels bypassed[18]. Consequently, although it may not be necessary to completely revascularize all patients, patients with left ventricular dysfunction, multivessel disease and severe ischaemia should be completely revascularized. This will not be achieved by PTCA in the majority using current technologies. One explanation for the relatively poor results of PTCA in patients with left ventricular dysfunction and multivessel disease is that such patients comprise a subgroup in whom complete revascularization is indicated, and in most cases this was not done.

Randomized trials

The randomized trials of coronary bypass surgery and PTCA in patients with chronic stable angina have been late in coming, but the preliminary results to date are very helpful in determining the best therapeutic
strategy for the individual patient. In several trials carried out in North and South America and Europe, the results are very consistent in documenting no difference in mortality or late myocardial infarction between bypass surgery and PTCA, but at a price of relatively high rate of repeat revascularizations in the PTCA group. Approximately half of these repeat procedures were bypass surgery. In one study in North America, The Emory Angioplasty vs Surgery Trial (EAST), the preliminary results suggest that although in-hospitalization costs were significantly less after PTCA, after 3 years the cost was similar in the two groups, reflecting a higher rate of readmission in the patients initially receiving PTCA.

A crucial factor for the individual patient, however, is to understand the selection criteria for the patients included in these trials and to ask the question whether they are really representative of the general population? Preliminary data from the EAST trial documented that, of patients screened for entry into the study, approximately two thirds were excluded for angiographic reasons; they were considered suitable for PTCA; 14% of patients were excluded clinically and only 16% were finally included in the trial. The data from other studies are similar, so it would appear that the trials are confined to approximately one third of the patients who are clinically eligible and considered suitable candidates for revascularization for either procedure. Consequently, these trials do not address the issue of the preferred procedure in the remaining two-thirds of patients with angiographic exclusions. Moreover, it would appear that from the published data, patients with left ventricular dysfunction were not well represented in these trials. The mean ejection fraction in published studies is approximately 60% and in the RITA trial ejection fraction data were not presented. In patients with multivessel disease who were treated with PTCA, the majority have well preserved left ventricular function and it is likely that the subgroup of patients with left ventricular dysfunction and multivessel disease who need complete revascularization, were not included in these trials to any large extent.

**Therapeutic considerations**

(i) Among patients with multivessel disease who are at lower risk, as defined by the presence of mild ischaemia and normal left ventricular dysfunction, survival differences between treatment groups are likely to be small. In this situation, the major determinants of the therapeutic choice is the severity of symptoms and the patient's own preference. In this setting, many patients will opt for a trial of angioplasty, but there needs to be a clear understanding that there is an approximately 40% chance of requiring a repeat revascularization procedure over the next 1–2 years, although mortality and myocardial infarction rates are no different from those undergoing bypass surgery initially. (ii) In patients at higher risk as determined by left ventricular dysfunction and severe ischaemia, the major determinant of therapy is survival. In many of these patients complete revascularization is necessary, and since this will not be achieved by PTCA, bypass surgery is preferable.

In general, (a) patients with abnormal left ventricular function and multivessel disease should be completely revascularized. Moreover, the consequences of acute failure of PTCA in the subgroup with left ventricular dysfunction are severe and most patients in this category will undergo coronary bypass surgery. (b) On the other hand, among patients with mild ischaemia, particularly if there is normal left ventricular dysfunction, complete revascularization is not essential in order to achieve a good symptomatic outcome and for many of these patients PTCA will be the procedure of first choice.

**Conclusion**

Among patients with multivessel disease, coronary bypass surgery will remain the treatment of choice for...
those with triple vessel disease, left ventricular dysfunction, left main coronary artery disease and for those with diffuse coronary disease. This could change in the event that a solution to restenosis is found or with the development of new technologies which widen the pool of patients suitable for angioplasty. At the present time, however, the major role of PTCA in patients with multivessel disease will be in those with double vessel disease, preserved left ventricular function and suitable anatomy in those without diffuse disease. Among people of advanced age, PTCA is preferable when technically feasible, and 'salvage' PTCA has an established place in patients who are not candidates for surgery. The lessons of the 1970s, in regard to the indications for coronary revascularization, should not be forgotten in the 1990s. The indications for treatment are to relieve symptoms or surgery or medical therapy.

References


