

Clinical outcome following coronary balloon angioplasty in 100 consecutive patients with multivessel coronary artery disease

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ABSTRACT – Prompted by current uncertainties regarding the precise role of percutaneous transluminal coronary balloon angioplasty (PTCA) in patients with multivessel disease, we reviewed the records of 100 such patients undergoing their first PTCA at our centre between 1 March 1987 and 23 March 1989. Thirty had three-vessel coronary disease (stenoses $\geq 70\%$ in all three major coronary artery territories), 51 had a previous myocardial infarction and 25 had undergone previous coronary bypass surgery. The mean number of lesions of $\geq 70\%$ per patient was 2.7 (0.8) [mean (SD)]. Successful angioplasty was achieved in 88 of these 100 patients. One year following successful angioplasty, the overall event-free rate [freedom from death, myocardial infarction, need for further revascularisation by either aortocoronary bypass graft surgery or repeat angioplasty, and recurrence of severe (class III/IV) angina] was 73%. These data suggest that, in patients with multivessel disease, angioplasty may be an effective technique for short-term symptomatic management. Definitive guidelines regarding the role of PTCA in such patients must await the results of ongoing large-scale clinical trials.

The technique of percutaneous transluminal coronary balloon angioplasty (PTCA) was first introduced in 1977 [1]. During its early years (1977–81) this procedure was confined to patients with angina refractory to medical therapy who had single-vessel disease with lesions that were proximal, discrete, noncalcified and subtotal, and who were good surgical candidates (in case of complications) [2, 3]. However, with increased operator experience, continuing technical improvements in angioplasty 'hardware' (guiding and dilation catheters and guide wires) and imaging equipment,

PTCA has been applied to an ever widening spectrum of patients with symptomatic coronary artery disease [2, 3]. Now, as PTCA enters its second decade of use, the technique is being applied routinely to patients with more complex anatomic situations, including distal disease, total occlusions, bifurcation lesions and diseased saphenous vein or internal mammary artery bypass grafts [2, 3]. A particularly important extension of PTCA over the past 5 or 6 years has been its increasing application to patients with multivessel coronary artery disease [4–6]. Indeed, in experienced centres more than 50% of patients undergoing PTCA have multivessel coronary artery disease [7]. Despite the popularity of PTCA in the treatment of such patients, its precise role in this important population is still uncertain [4–6]. To address this issue, a number of large-scale, controlled clinical trials both in Europe and in the US are now in progress [8]. We felt it important meanwhile to review our experience of PTCA in the treatment of patients with multivessel coronary artery disease.

Patients and methods

In this study the following clinical and angiographic criteria were used:

Multivessel disease: stenoses $\geq 70\%$ in two or more major epicardial coronary artery territories (right, left anterior descending, circumflex). A vessel was not considered stenotic if the area of narrowing was bypassed by a patent aortocoronary bypass graft.

Successful dilation: $\geq 30\%$ reduction in luminal diameter stenosis and a residual narrowing of $< 50\%$ in all attempted lesions without the occurrence of death, myocardial infarction or bypass surgery during hospitalisation.

Using these criteria, the records of 100 consecutive patients with symptomatic multivessel disease undergo-

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ing their first angioplasty at our centre between 1 March 1987 and 23 March 1989 were reviewed.

Dilation strategy

The dilation strategy was based on clinical decisions after review of the angiogram, correlation with the patient's symptoms, and electrocardiographic and left ventriculographic findings. In general, the lesion thought to be responsible for the patient's clinical symptoms was dilated first. If this was successful, dilation of other lesions may have been attempted, depending on the clinical judgement of the angiographer.

Data acquisition

Baseline data were collected at the time of dilation. Follow-up information was obtained by biannual clinical re-examinations and/or by postal or telephone questionnaire. The occurrence of major cardiac 'events' [death, myocardial infarction, need for further revascularisation by either repeat angioplasty or aortocoronary bypass surgery, and recurrence of severe (class III/IV) angina] were documented. Event-free survival was calculated at 12 months.

Results

The baseline clinical characteristics of the 100 patients undergoing angioplasty are detailed in Table 1. Thirty patients had three-vessel disease; 70 had two-vessel disease. When tandem lesions and major side-branch lesions were included, the mean number of lesions per patient was 2.7 (standard deviation 0.8).

Table 1. Baseline clinical characteristics of 100 consecutive patients with multivessel coronary artery disease undergoing angioplasty

Age	58 (9) [40-78] ^a
Male	90 ^b
Cigarette smoking	65
Previous	49
Current	16
Hypertension	29
Hyperlipidaemia	29
FH of CAD	51
Previous CABG	25
Previous MI	51
Angina status ^c	
Stable class I/II	17
Stable class III/IV	67
Unstable	16

^aMean (standard deviation) [range]

^bNumber of patients

^cCanadian Cardiovascular Society classification: FH of CAD, family history of coronary artery disease; CABG, aortocoronary bypass graft surgery; MI, myocardial infarction.

Acute outcome

Success at angioplasty was achieved in 88 of the 100 patients. Of these 88 patients, single-vessel angioplasty was performed in 77 and multivessel angioplasty in 11. Adverse events at angioplasty included one death, need for emergency bypass operation in 4 patients and non-fatal myocardial infarction in 4 patients (three Q-wave and one non-Q-wave infarctions).

Follow-up

After successful angioplasty, all 88 patients were reviewed for at least 1 year. In these patients, the following events occurred within a year of their angioplasty.

A second angioplasty was performed in 15 patients. In twelve, repeat angioplasty was required because of restenosis. In the other three, lesions not dilated at first angioplasty were dilated at the second. Three of the 12 patients eventually underwent coronary bypass surgery (two because of the development of a second restenosis, one following unsuccessful angioplasty).

Coronary bypass surgery. Five patients who developed restenosis of their initially successfully dilated lesions proceeded directly to surgery without any attempt at a second angioplasty. In addition, 3 patients, previously mentioned, were treated by bypass surgery following repeat angioplasty.

Myocardial infarction or death. One patient had an acute myocardial infarction 5 months after successful PTCA. This patient subsequently underwent repeat PTCA. There were no cardiac deaths at 1 year follow-up.

Severe (class III/IV) angina recurred in 24 patients. Fifteen patients were initially treated with repeat angioplasty, five with coronary bypass surgery. One of the other four patients was shown at angiography not to have developed restenosis of the initially dilated lesion. His angina resulted from a high grade complex lesion that had not been dilated at first angioplasty and no attempt was made to dilate this lesion following repeat angiography. His symptoms improved considerably after optimising his medication. The other three have not had a follow-up angiography and have been treated medically.

At 1 year the overall clinical restenosis rate (recurrence of angina and angiographic documentation of loss of $\geq 50\%$ of the luminal diameter gain at the time of initial angioplasty) was 19%.

The overall event-free-rate (freedom from death, myocardial infarction, need for further revascularisation by either coronary bypass surgery or repeat angioplasty, and recurrence of severe angina) was 73%.

Discussion

The results of the 1 year follow-up concerning the fate of 100 consecutive patients with multivessel coronary artery disease undergoing their first coronary balloon

angioplasty at our centre are encouraging. In these patients, PTCA was associated with a high immediate success rate and a favourable outcome at 1 year. Primary success at angioplasty was achieved in 88% of patients. Of these 88 patients, the majority (73%) remained free of cardiac events and were either angina-free or only mildly symptomatic after 1 year. The beneficial effects of angioplasty observed in this study are highlighted when one considers the clinical and angiographic features of the study group. Of these patients, 83 had either severe (class III/IV) stable or unstable angina, 30 had stenoses $\geq 70\%$ in all three major coronary artery territories, 51 had a previous myocardial infarction and 25 had undergone prior coronary bypass surgery.

Our experience with regard to the clinical efficacy of PTCA in patients with multivessel disease is similar to that of other centres [4, 7, 9]. Deligonul *et al.* [9] reported an 85% primary success rate in 470 patients with multivessel disease undergoing PTCA; one year later, 79% of patients were alive and free of non-fatal myocardial infarction or the need for coronary bypass surgery, and 82% of patients had symptomatic improvement by at least one anginal functional class. Holmes *et al.* [4] reported a 62% event-free rate at 24 months follow-up in a group of patients with multivessel disease and successful initial angioplasty.

Specifically as regards the occurrence of acute complications at PTCA in patients with multivessel disease, one of the most comprehensive reports is that provided by the results of the 1985–86 National Heart, Lung and Blood Institute Registry [7]. This report analysed the acute outcome of 1,802 consecutive patients (53% with multivessel disease) undergoing angioplasty at 15 centres, all of which had been performing angioplasty since before 1980, so it is not unreasonable to suggest that the results reflect the best of angioplasty technology. In the Registry report [7], in patients with multivessel disease, the mortality rate at angioplasty was 1.7% (1% in our series), the non-fatal myocardial infarction rate 5% (4% in our series) and the emergency bypass rate 4% (also 4% in our series).

A particularly important feature of our study patients is that 25% of them had undergone prior coronary artery bypass surgery (CABG). An increasing body of evidence suggests that, if patients who have had previous bypass surgery are judged to require further mechanical revascularisation, one should first consider the feasibility of performing PTCA rather than repeat surgery [10]. Repeat bypass surgery has at least a three-fold greater risk of mortality than the initial operation [11]. In contrast, repeat PTCA has a higher success rate and a lower risk (infarction, mortality) than the first angioplasty [2, 12]. At present there is no greater mortality risk in performing angioplasty in patients with prior CABG than in those who have never had bypass surgery [2, 12]. However, in patients with prior CABG, coronary angioplasty is twelve times less likely to cause death and two to three times less likely to cause infarction than repeat surgery [2].

The long-term efficacy of PTCA in patients with multivessel disease is still unclear. Similarly, the relative efficacy of angioplasty and bypass surgery in these patients is unknown. A number of large-scale clinical trials now running on both sides of the Atlantic should provide useful information. We are participating in one of these trials — the CABRI (Coronary Angioplasty versus Bypass Revascularisation Investigation) trial — in which eligible patients with multivessel disease are randomised to either angioplasty or bypass surgery. All patients have follow-up angiography at 1 year and, in the interim, exercise testing to detect residual cardiac ischaemia. This trial aims to recruit 2,000 patients from 25 participating European centres (3 in the UK). The major equivalent trial in the US is the BARI (Bypass/Angioplasty Revascularisation Investigation) trial, which aims to recruit about 2,500 patients who will be followed up for 5 years. It will, of course, be several years before the results of these trials begin to emerge. Whilst awaiting these results, our interim results encourage us to continue to consider angioplasty favourably in the treatment of selected patients with multivessel disease.

References

1. Gruentzig, A. (1978) Transluminal dilation of coronary artery stenoses *Lancet*, **i**, 263.
2. Myler, R. K., Stertz, S. H., Cumberland, D. C. *et al.* (1989) Coronary angioplasty: indications, contraindications and limitations: historical perspectives and technological determinants. *Journal of Interventional Cardiology*, **3**, 179–85.
3. Baim, D. S. (1988) Interventional catheterization techniques. In *Heart disease*, 3rd edn (ed. E. Braunwald) pp 1379–94. Philadelphia: W. B. Saunders.
4. Holmes, D. R., Reeder, G. S. and Vliestra, R. E. (1988) Role of percutaneous transluminal coronary angioplasty in multivessel disease. *American Journal of Cardiology*, **61**, 9G–14G.
5. Stertz, S. H., Shaw, R. E., Myler, R. K. *et al.* (1989) Coronary angioplasty in the setting of multivessel disease: current status and future directions. *Cardiology Clinics*, **7**, 1–12.
6. Whitlow, P. L. (1988) Percutaneous transluminal coronary angioplasty in two and three vessel coronary disease: information and speculation. *Journal of the American College of Cardiology*, **11**, 1180–2.
7. Detre, K., Holubkov, R., Kelsey, S. *et al.* (1988) Percutaneous transluminal coronary angioplasty in 1985–1986 and 1977–1981. *New England Journal of Medicine*, **318** 265–70.
8. Treasure, T. (1990) Angioplasty: where is the proof? *British Journal of Hospital Medicine*, **43**, 95–6.
9. Deligonul, U., Vandormael, M. G., Kern, M. J. *et al.* (1988) Coronary angioplasty: a therapeutic option for symptomatic patients with two or three vessel coronary disease. *Journal of the American College of Cardiology*, **11**, 1173–9.
10. Pinkerton, C. A., Slack, J. D., Orr, C. M. *et al.* (1988) Percutaneous transluminal angioplasty in patients with prior myocardial revascularization surgery. *American Journal of Cardiology*, **61**, 15G–22G.
11. Little, B. W., Loop, F. D., Cosgrove, D. M. *et al.* (1987) Fifteen hundred coronary reoperations. *Journal of Thoracic and Cardiovascular Surgery*, **93**, 847–59.
12. Myler, R. K., Topol, E. J., Shaw, R. E. *et al.* (1987) Multivessel coronary angioplasty: classification, results and patterns of restenosis in 494 consecutive patients. *Catheter Cardiovascular Diagnosis*, **13**, 1–15.