Follow up results of treatment of unstable angina by coronary angioplasty

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SUMMARY Eighty nine of 327 consecutive patients undergoing coronary angioplasty at a centre had unstable angina—defined as either a worsening of the frequency or the severity of chest pain or severe episodes of chest pain at rest with no evidence of acute myocardial infarction. Multivessel disease was present in 31 of these patients. Two or more vessels were dilated in the same procedure in one fifth of the patients. Primary success was obtained in 80 (90%) patients. Acute myocardial infarction was a complication in four (5%) patients, including two of four patients who needed emergency coronary bypass grafting. Follow up coronary angiography at a mean (SD) of 10 (6) months in 57 patients showed restenosis in 21 (37%); of these, 13 patients had repeat coronary angioplasty and three had elective coronary bypass grafting. All patients in whom angioplasty was initially successful were followed up for 10 (6) months after the last angioplasty procedure. There were no deaths. One patient had sustained a myocardial infarction unrelated to the dilated vessel. Clinically, 74 patients improved by at least one New York Heart Association class and 40 (50%) were symptom free and with no signs or symptoms of myocardial ischaemia on a stress test.

Coronary angioplasty offers long term symptomatic improvement at an acceptable risk in the majority of patients with unstable angina.

Patients with unstable angina are at increased risk of myocardial infarction and premature death.¹ In the past 10 years there has been much discussion on the best way to manage such patients.^{2,3} Although chest pain is often controlled by bed rest and intensive medical treatment, a substantial percentage of patients none the less have early unfavourable outcomes on medical treatment alone⁴; this result is partially related to persistent silent ischaemia.⁵ Percutaneous transluminal coronary angioplasty is increasingly accepted as a form of revascularisation in patients with unstable angina.⁶⁻¹² We report the results of a follow up of selected patients with unstable angina treated with coronary angioplasty.

Patients and methods

Between July 1983 and May 1985 a total of 327

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patients underwent coronary angioplasty at our centre. Eighty nine patients had unstable angina—defined as either a worsening in the frequency or severity of chest pain or severe episodes of prolonged pain at rest shortly before admission with no electrocardiographic or enzymatic evidence of acute myocardial infarction. We studied 76 (85%) men and 13 women (mean (SD) age 55 (9) years). In 54 patients there was a history of old myocardial infarction. There was two and three vessel disease

Baseline clinical and angiographic data in patients treated with angioplasty

Variable	Data
Patients	89
Age (years)	55 (9) (35-69)
Men	85%
Left ventricular ejection fraction (%)	62 (11) (41-80)
Old myocardial infarction	54 (61%)
One vessel disease	58 patients
Two vessel disease	22 patients
Three vessel disease	9 patients

Coronary angioplasty for unstable angina

causing stenosis of 70% of the luminal diameter in 22 and nine patients respectively. Four (5%) patients had had previous coronary angioplasty. The table summarises the baseline clinical and angiographic data. Patients were treated with nitrates, β blockers, calcium antagonists, and aspirin. The degree of coronary stenosis was visually estimated as a percentage of the luminal diameter by two angiographers in multiple projections and results were averaged.

Coronary angioplasty was performed as previously described,¹³ after intravenous heparin (10 000 IU) and intracoronary isosorbide dinitrate (0.2 mg) or nifedipine (0.1 mg) or both. The transfemoral approach was used in all cases. Prolonged anticoagulation with intravenous heparin infusion was not used routinely after a successful procedure, but the patients received oral nifedipine 40 to 60 mg/day and aspirin 100 mg/day unless contraindicated. Primary success was considered to have been achieved if the following conditions were met: angiographic improvement of the lesion with no significant residual stenosis, improvement in the transstenotic pressure gradient (whenever available), absence of electrocardiographic or enzymatic evidence of myocardial infarction or need for coronary artery bypass grafting within 48 hours of the procedure, and improvement of at least two New York Heart Association functional classes for angina. In multivessel angioplasty success was defined as dilatation of at least the ischaemia related lesion. Transient electrocardiographic changes in leads V1–V5 were regarded as indicating lesions of the left anterior descending coronary artery, while changes in leads V6, I, aVL or II, III, and aVF were said to reflect a lesion in either the circumflex or the right coronary artery respectively. When no electrocardiographic changes had been recorded, the vessel that showed the most severe stenosis and perfused a myocardial region with at least partially preserved contraction was identified as the ischaemia related vessel. Treatment with aspirin 100 mg/day was recommended to all patients after discharge and anti-anginal, hypotensive, or antiarrhythmic drugs were also given as clinically indicated.

The clinical follow up consisted of an interview, a physical examination, and a symptom limited stress test. The stress test was performed on a bicycle ergometer. The workload was increased by 25 W every three minutes, and the test was regarded as positive if the patient complained of typical chest pain or if ST segment depression of ≥ 1 mm appeared 0.08 s after the J point. A few patients lived a long way from the hospital and they were followed up by a questionnaire or a telephone interview.

We recommended that all patients should have

follow up coronary angiography. Recurrence of stenosis was defined as loss of $\geq 50\%$ of initial gain in luminal diameter at the site of angioplasty. When appropriate the χ^2 test was used for statistical analysis. A p value < 0.05 was regarded as significant.

Results

Coronary angioplasty was attempted in 89 patients and was successful in 80 (90%). In 18 (20%) patients we were able to attempt coronary angioplasty on the same day as diagnostic coronary angiography. In 18 (20%) patients two or more vessels were dilated during the same procedure (fig 1). Lesions of the left anterior descending coronary artery accounted for 54% of the 110 dilated vessels (fig 2). The mean (SD) diameter of stenosis was reduced from 84 (12)% to 25 (10)% and the mean transstenotic pressure gradient (available for 82 successfully

Fig 1 Distribution of single and multivessel coronary angioplasty procedures. PTCA, percutaneous transluminal coronary angioplasty.

Fig 2 Distribution of vessels attempted. LAD, left anterior descending; Cx, circumflex; RCA, right coronary artery.

Fig 3 Treatment of restenosis. PTCA, percutaneous transluminal coronary angioplasty; CABG, coronary artery bypass graft.

Fig 4 Clinical follow up of patients after the last successful angioplasty procedure. PTCA, percutaneous transluminal coronary angioplasty.

dilated vessels) from 54 (15) to 14 (10) mm Hg. Of 31 patients with multivessel disease, 15 had a successful complete revascularisation and in 13 angioplasty of the ischaemia associated lesions was successful. Acute myocardial infarction was a complication in four patients: two of them had emergency coronary bypass grafting. There were five additional failures caused by our inability to cross the coronary lesion, which was a total chronic occlusion in four patients. All four patients had sustained an infarction with minimal hypokinesia in the region perfused by the occluded vessel and had a severe stenosis on other vessels, with visible collaterals in two patients.

Follow up coronary angiography was performed at a mean (SD) interval of 10 (6) months (range 2–23 months) in 57 (71%) patients: it showed recurrence

of stenosis in 21 (37%). Recurrence was recorded in 17 (35%) of 48 patients who had angioplasty of a single vessel and in 4 (44%) of nine patients who had multivessel angioplasty (NS). Repeat angioplasty (fig 3) was performed in 13 patients and it was successful in 12; one patient needed emergency coronary surgery because acute coronary occlusion occurred as a complication of the procedure. Three patients underwent elective coronary bypass grafting for the treatment of restenosis.

A clinical follow up was available for all patients with initially successful angioplasty at a mean interval of 10 (6) months after the last successful dilatation procedure. There were no deaths. One patient had sustained an acute myocardial infarction unrelated to the dilated vessel. Seventy four (93%) patients had improved by at least one New York Heart Association class for angina and 41 (50%) were symptom free (fig 4). At follow up 10 (80%) of 13 patients with multivessel disease and successful angioplasty of only the ischaemia related lesions were symptom free or had only mild angina. A stress test was performed in 52 patients as a part of the follow up evaluation at a mean interval of 12 (5) months (range 4–20 months) from the last coronary angioplasty procedure. Forty patients (77%) had neither signs nor symptoms of myocardial ischaemia at a mean workload of 117 (39) W (range 25–200 W) and a mean (SD) double product (blood pressure $\times$ heart rate) of 28 000 (6300) mm Hg/min. Twelve patients (23%) had angina or signs of myocardial ischaemia or both at a mean workload of 104 (35) W (range 50–175 W) and a mean double product of 25 000 (5500) mm Hg/min.

Discussion

The primary success rate in most reports of coronary angioplasty for unstable angina ranges from 61% in earlier studies⁸ to 93% in more recent series when steerable systems were used.⁹ Acute complications were reported in seven to 12%.^{9–11} Our success rate (90%) and complication rate (5%) compare favourably with these reports and to some extent may reflect the inclusion in our series of patients with less severe coronary lesions. Coronary angiography was performed at follow up in 71% of our patients after a successful angioplasty. The patients in our series who declined follow up coronary angiography were usually symptom free. In 37% of our patients recurrence of stenosis was seen at angiography. This rate is higher than in other reports in which restenosis rates for patients with unstable angina ranged from 24%⁷ to 32%.¹¹

All our patients in whom angioplasty was successful had an immediate and considerable improvement

in anginal symptoms. One patient sustained a myocardial infarction on a non-dilated vessel during the follow up period. Others have reported a similarly low frequency of infarction after a successful angioplasty for unstable angina.⁹⁻¹¹ A definite symptomatic improvement was apparent 10 (6) months after the last successful dilatation procedure in about two thirds of our patients, and one half of them were symptom free and with no sign of myocardial ischaemia on a stress test. Long term clinical improvement also persisted in the subset of patients with incomplete myocardial revascularisation—80% of them were either symptom free or had only mild angina. This accords with other reports of incomplete myocardial revascularisation by coronary angioplasty in patients with unstable angina.¹⁰⁻¹² Our data support observations that coronary angioplasty can be performed at an acceptable risk in selected patients with unstable angina. Immediate symptomatic improvement was achieved after a successful angioplasty of the angina related lesions and also in patients in whom myocardial revascularisation was incomplete. Long term improvement of angina was achieved in most patients; in some this required repeated coronary angioplasty.

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