

# Desirability of immediate surgical standby for coronary angioplasty

Richard D Levy, David H Bennett, Nicholas H Brooks

## Abstract

**Objective**—To assess the value of emergency surgical standby for percutaneous transluminal coronary angioplasty.

**Design**—Retrospective review of the major complications of coronary angioplasty in a regional cardiac centre.

**Setting**—All angioplasties were performed in the cardiac catheterisation laboratory of Wythenshawe Hospital with surgical standby in an adjoining operating theatre.

**Patients**—1262 vessels were dilated in 1032 patients (mean age 53 years) between 1984 and 1989.

**Main outcome measures**—In-hospital mortality from emergency surgical revascularisation after angioplasty; the rate of myocardial infarction and overall morbidity.

**Results**—Coronary angioplasty achieved primary success in 90% of cases. Thirty eight (3.7%) patients (five women (mean age 55.8) and 33 men (mean age 53.0)) were referred for urgent surgical revascularisation—36 direct to operation and two within 24 hours. All patients survived surgery. Five of the 38 had had a previous angioplasty to the same vessel and one had had previous coronary artery grafts. Four of the 38 had an angioplasty for unstable angina. Eighteen had single, 13 double, and seven triple vessel coronary artery disease. The target vessel was the left anterior descending in 25, right coronary artery in nine, circumflex in three, and the left anterior descending and circumflex coronary arteries in one. Five required external cardiac massage on the way to the operating theatre; two of them had a left main stem occlusion. Four internal mammary artery and 60 reversed saphenous vein grafts were implanted (1.6 per patient). Complete revascularisation was achieved in 36 (94.7%) patients. Q wave myocardial infarction occurred in six (15.8%). The final outcome was: none dead, three patients with angina, one late death, one cerebrovascular accident, one late operation for a new left anterior descending lesion, two patients on diuretics with or without an angiotensin converting enzyme inhibitor. One orthotopic transplant was performed in a patient in whom cardiogenic shock developed after the left

anterior descending coronary artery became occluded 72 hours after angioplasty.

**Conclusion**—There was no surgical mortality and low morbidity among patients for whom immediate surgical cover was requested.

The level of surgical cover required for coronary angioplasty is widely debated and ranges from a recommendation for full standby to the need only for facilities at a remote site. It is our practice to have a team on standby in an adjoining operating theatre.

Emergency coronary artery bypass surgery for failed angioplasty is required primarily for acute coronary closure in a patient who is a candidate for operation.<sup>1</sup> A report of the American College of Cardiology/American Heart Association Task Force stated that an experienced cardiovascular surgical team should be available within the institution for emergency surgery for all procedures.<sup>2</sup> This is also the view of the Society of Cardiothoracic Surgeons of Great Britain and Ireland and the International Society and Federation of Cardiology.<sup>3</sup> The results of a recent British study suggest that surgical standby at a different site may allow coronary angioplasty to be carried out on "selected" patients.<sup>4</sup>

## Patients and methods

All patients undergoing coronary angioplasty at Wythenshawe Hospital between 1984 and 1989 were included in this retrospective study. Angioplasty (1262 vessels in 1032 patients (mean age 53 years)) was performed in one of two cardiac catheterisation laboratories that are adjacent to three operating theatres. All patients were given 300 mg aspirin before the angioplasty, unless this was contraindicated, and 10 000 units of heparin at the start of the procedure followed by 2000 units per hour.<sup>5</sup> Surgical standby was requested for all patients except those who would not benefit from surgery if a major complication of angioplasty occurred such as those undergoing "salvage" angioplasty. "Salvage" angioplasty was performed in patients with severe angina in whom surgery was deemed inappropriate because of one, or more usually a combination, of the following factors: advanced left ventricular dysfunction, distal vessel disease rendering the patient inoperable, advanced age, coincidental medical illness, and previous coronary artery surgery.

Regional  
Cardiothoracic Unit,  
Wythenshawe  
Hospital, Manchester  
R D Levy  
D H Bennett  
N H Brooks

Correspondence to  
Dr Richard D Levy,  
Department of Cardiology,  
Wythenshawe Hospital,  
Southmoor Road,  
Manchester M23 9LT.

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To avoid delays in the cardiac surgical programme, the angioplasty was started as a patient in the operating theatre was coming off cardiopulmonary bypass. Patients were referred for emergency surgery when there was occlusion of a major coronary artery accompanied by myocardial ischaemia which could not be relieved by additional dilatation attempts. Perfusion catheters were used when deemed appropriate.<sup>6</sup> Routine operations were postponed only when a patient was referred for emergency coronary artery bypass surgery. In cases of extreme urgency, the surgical team is prepared to operate in the cardiac catheterisation laboratory. Thus these arrangements result in minimal disruption of the cardiac surgical programme.

### Results

The primary angioplasty success rate was 90% with a clinical restenosis rate of 21%. Thirty-eight (3.7%) patients (five women (mean age 55.8) and 33 men (mean age 53.0)) were referred for urgent surgical revascularisation after occlusion of a major coronary artery during coronary angioplasty. Thirty six were operated upon immediately and the remaining two within 24 hours. Five patients required external cardiac massage until the sternotomy was performed; two of them had a vessel occlusion extending to the left main stem. The haemodynamic consequences of myocardial ischaemia were such that three of the five patients requiring cardiac massage were revascularised in the cardiac catheterisation laboratory. All 38 patients survived operation.

Five of the patients who had emergency coronary artery bypass grafts had had a previous angioplasty to the same vessel and one had had previous coronary artery grafts. Four of the 38 had angioplasty for unstable angina. Eighteen had single, 13 double, and seven triple vessel coronary artery disease. The vessel damaged at angioplasty was the left anterior descending in 25 (17 dissections and eight occlusions), right coronary artery in nine (six

dissections and three occlusions), circumflex in three (two occlusions and one with hindsight was probably due to an air embolism), and left anterior descending and circumflex arteries in one. Four internal mammary artery grafts and 60 reversed saphenous vein grafts were implanted (1.6 per patient). Complete revascularisation was achieved in 36 (94.7%) patients. We do not know the precise interval to revascularisation, but because of the proximity and availability of the surgical team the operation started within 30 minutes of the decision having been made. The operation was performed on the fibrillating heart in nine patients and cardioplegia was used in 29. The mean aortic cross clamping time was 33 minutes. Nine (23.6%) needed inotropic support for weaning from cardiopulmonary bypass and no patient required an intra-aortic balloon. Q wave myocardial infarction with a rise in cardiac enzymes occurred in six (15.8%) patients. One orthotopic transplant was performed in a patient in whom cardiogenic shock with an occluded left anterior descending coronary artery developed 72 hours after angioplasty when the operating theatre was no longer available.

The final outcome was: no deaths; three patients with angina (grade 1–2), one late death, one cerebrovascular accident, one late operation for a new left anterior descending lesion, two patients on diuretics and an angiotensin converting enzyme inhibitor for heart failure (New York Heart Association classes II and III).

A further five patients died without referral for surgery (0.48%): two had undergone a salvage angioplasty for inoperable coronary artery disease, one had a cerebrovascular accident three hours after the angioplasty, and two died suddenly (six hours and 48 hours) after angioplasty because of occlusion (table 1).

### Discussion

In 1979, Gruentzig *et al* reported that of their first 50 patients undergoing coronary angio-

Table 1 Details of patients not referred for emergency surgery who died after coronary angioplasty

Age	Sex	Death	History	Angiographic details	Angioplasty and outcome
68	M	July 1986	Unstable angina one week after inferior myocardial infarction	Good left ventricular function; inferior hypokinesis, occluded right coronary artery, left anterior descending and circumflex arteries severely diseased proximally	Left anterior descending—good result; asystole 6 h later on cardiac care
68	F	Dec 1987	Unstable angina	Left ventricular ejection fraction 15%, inferior akinesis, left anterior descending and circumflex arteries heavily diseased, subtotal right coronary occlusion with collaterals from the left coronary artery	Left anterior descending and circumflex arteries; occlusion of left anterior descending artery, failure to resuscitate
44	M	Jan 1989	Unstable angina	Good left ventricular function, minor inferior hypokinesis, left coronary artery normal with collaterals to an occluded right coronary	Right coronary artery; some clot in artery, remained on heparin, died suddenly 48 hours later, occluded right coronary artery
71	M	Feb 1989	Unstable angina one week after inferior myocardial infarction	Left ventricular ejection fraction 25%, inferior akinesis, occluded right coronary artery with collaterals from a patent left anterior descending, subtotal circumflex occlusion	Circumflex artery; vessel occluded with considerable hypotension, resuscitation failed
65	M	Feb 1989	Stable angina	Good left ventricular function, occluded right coronary artery, subtotal circumflex disease, severe disease of proximal left anterior descending artery	Left anterior descending artery; occluded vessel cleared by intracoronary streptokinase, massive cerebrovascular bleed 3 h later

Table 2 In-hospital results of emergency coronary artery bypass graft (CABG) surgery after failed elective percutaneous transluminal coronary angioplasty (PTCA)

	Total number of PTCA's	Emergency CABG (%)	Q wave myocardial infarction	Deaths (%)
Current report	1032	38 (3.7)	6 (15.8)	0
Atkins and Block <sup>8</sup>	125	11 (8.8)	1 (9.1)	0
Cowley <i>et al</i> <sup>9</sup>	3079	202 (6.6)	52 (25.7)	13 (6.4)
Golding <i>et al</i> <sup>10</sup>	1831	81 (4.4)	37 (46)	2 (2.5)
Killen <i>et al</i> <sup>11</sup>	3000	115 (3.8)	50 (43.5)	13 (11.3)
Pelletier <i>et al</i> <sup>12</sup>	265	35 (13.2)	3 (8.6)	0
Reul <i>et al</i> <sup>13</sup>	518	70 (13.5)	8 (11.4)	4 (5.7)
Talley <i>et al</i> <sup>14</sup>	NA	202	54 (27)	5 (2.5)
Bredee <i>et al</i> <sup>15</sup>	4142	155 (3.7)	62 (40)	4 (2.6)

NA, not available.

plasty, seven (14%) required emergency surgical revascularisation.<sup>7</sup> Since then, several large series have emphasised the role of immediate surgery for major complications of angioplasty. Table 2 shows the in-hospital results of these studies.<sup>8-15</sup> The results of our study are comparable, with a 3.8% rate for emergency surgery and no surgical mortality; 15.8% of patients undergoing emergency surgery developed Q wave myocardial infarctions, but none required postoperative intra-aortic balloon pumping.<sup>16</sup> It has been suggested that modern techniques including perfusion catheters, atherectomy, lasers, stents, intra-aortic balloon pumping, femoro-femoro bypass, and other temporary bypass support may permit stabilisation of patients with acute ischaemia before elective transfer to the theatre.<sup>17</sup> While these techniques may be successful in some patients, experience is limited. Perfusion catheters are ineffective if there is cardiac arrest and the perfusion pressure is low. Intra-aortic balloon pumping can only be used to support the circulation and could not have improved myocardial perfusion in our patients with left main stem occlusion. We believe that insertion of a balloon pump serves only to delay the one measure likely to save the patient's life.

A smaller series from Belfast has been reported in which only off site surgical facilities were available to cover angioplasty complications.<sup>4</sup> Twelve of 444 patients required urgent surgical revascularisation and none of the patients died. The mean time to surgical revascularisation was 268 minutes. The principal cause for delay was the wait for an operating theatre to become available and not the transfer time between hospitals. The potential benefit for patients who were revascularised more than four hours after the coronary occlusion, and the incidence of myocardial infarction and morbidity were not discussed. Another recent series reported a 40% incidence of myocardial infarction in those undergoing emergency surgery after angioplasty with a minimum time to revascularisation on site of 73 minutes.<sup>15</sup> Our five patients who required external cardiac massage could not have survived had immediate surgery not been available. The events that required surgery were unpredictable such as a thrombus in the left main stem and dissection. The patients who required external cardiac massage were not identified at being at a higher risk before angioplasty. We believe that the immediate availability of surgery for most cases of coronary angioplasty was largely responsible

for the lack of surgical mortality and low morbidity in our series.

There is concern that disruption of the routine surgical programme by provision of cover for coronary angioplasty might result in more deaths on the surgical waiting list. Our arrangements, however, resulted in the postponement of 38 routine operations out of a total of 5200 operations performed between 1984-9.

It has been suggested that coronary angioplasty with off site surgical back up makes the best of the facilities we have,<sup>18</sup> whereas another view proposes that the cardiologist rather than the sick patient should travel to the surgical centre to perform coronary angioplasty.<sup>19</sup> The underprovision of cardiac surgical facilities in the United Kingdom gives rise to the claim that the risks of coronary angioplasty covered by a distant surgical team are outweighed by the benefits of a shorter time on the waiting list than would be possible if angioplasty could be undertaken only in a surgical centre.<sup>20</sup> While we acknowledge the force of this argument, we believe that expediency should not be confused with ideal practice.

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## PLANTS IN CARDIOLOGY



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*Ryania angustifolia* (Turcz.) Monach.

### Ryanodine

Ryanodine is a pseudo-alkaloid that is found in *Ryania angustifolia* (Flacourtiaceae) and other species of *Ryania*. It has proved valuable in the study of the calcium release channel of the sarcoplasmic reticulum which it blocks in a dose related manner. Such studies showed that the sarcoplasmic reticulum is a major intracellular calcium store and that it provides most of the energy for cell excitation.

The genus *Ryania* is named after John Ryan, an eighteenth century physician and Fellow of the Royal Society, and its species are small trees in tropical Central and South America. The roots are poisonous and are used to kill rats and alligators, to rid clothing and hair of lice, and even for euthanasia of the elderly by a nomadic Amazonian tribe. Ryanodine was first isolated from *Ryania speciosa* at the Merck Research Laboratories in 1948 during a survey of plant materials for new insecticides.

The family Flacourtiaceae contains a Burmese tree *Hydnocarpus kurzii* whose fruit yields Chaulmoogra oil which was the only effective treatment for leprosy before modern antibacterial drugs. The genus *Idesia* contains salicin, and other genera are used as arrow poisons.

A HOLLMAN