Coronary angioplasty in Australia 1995

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Coronary angioplasty in Australia 1995

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Preface

This is the eleventh national report on coronary angioplasty and presents information on all procedures performed in 1995. It is the first in the series to be produced jointly by the National Heart Foundation and the Australian Institute of Health and Welfare. The National Heart Foundation has been compiling data and reporting on coronary angioplasty performed in Australia since 1980. For this and future reports, a standing advisory committee appointed by the Foundation will oversee the angioplasty register as in the past and the Institute will be responsible for collating, analysing and reporting the data through its National Centre for Monitoring Cardiovascular Disease. The project is financed by the Foundation and the Institute, through funds it receives for the National Centre from the Commonwealth Department of Health and Aged Care.

Under its Act, the *Australian Institute of Health and Welfare Act 1987*, the Institute is able to provide the legislative protection that is required to operate the coronary angioplasty register and protect the data confidentiality interests of the participating units and their patients. The Act protects provider interests by specifying that information may only be released under circumstances that are not contrary to the written terms and conditions under which it was supplied to the Institute. It protects the confidentiality of units and patients by a requirement that the release of any identifiable information is subject to the approval of the Institute's Health Ethics Committee.

This report is intended primarily for workers in the field so it uses technical terms widely. However, to make the contents more accessible to other interested readers, a brief explanatory introduction and a glossary have been included.

Reports covering procedures done in 1996 and 1997 are in preparation and will be issued as soon as the data are made available by all participating units.

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Acknowledgments

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Summary

This report was prepared within the National Centre for Monitoring Cardiovascular Disease at the Australian Institute of Health and Welfare. It aims to provide details of percutaneous transluminal coronary angioplasty (PTCA) as performed in Australia in 1995. The report covers patterns and trends in the use of the technique, as well as in its indications, complications and success rates.

The main findings of the report are:

- During 1995 there were 11,348 coronary angioplasty procedures performed in Australia, with an average of 291 procedures per unit.
- Coronary angioplasty procedures increased by 17% in 1995 compared with the previous year.
- The average national rate was 629 per million population. This varies widely across States, from 403 per million population in Queensland to 875 per million population in Western Australia.
- A total of 95 physicians were operating in 39 Interventional Cardiac Laboratories throughout the country.
- Twenty-one per cent of the procedures were repeats, and in 59% of such cases these repeats occurred within the same year. In 69% of those cases which involved intervention more than once in 1995, repeat procedures were to the same lesion.
- The main indications for PTCA were stable angina pectoris (46%) and unstable angina pectoris (43%). Acute myocardial infarction (8%) is emerging as another significant indication.
- Twelve per cent of procedures were done on patients with previous coronary artery bypass grafts.
- Thrombolytic therapy was used before angioplasty in 5% of procedures.
- Stents were inserted in 30% of PTCA procedures in 1995. This represents a 175% increase over their use in the previous year.
- Complication rates associated with coronary angioplasty were as follows: need for coronary artery bypass graft 2.5%, myocardial infarction 1.5%, arterial complications 1%, mortality 0.7%.
- Coronary angioplasty achieved an adequate reduction in the lesion in 89% of lesions attempted.
- Seventy-three per cent of patients treated were discharged from hospital with a successful reduction of all lesions and no angina or complications.

Introduction

Heart disease is a major cause of morbidity and mortality, responsible for 30% of all deaths in Australia in 1996. The most common form of heart disease affecting Australians is coronary heart disease. This involves blockages in the heart's own arteries, the coronary arteries, by deposits of abnormal tissue known as plaques. Cardiac services offer a range of interventions to treat coronary heart disease, one of which is percutaneous transluminal coronary angioplasty (PTCA). The use of this minimally invasive technique has grown dramatically over the past 15 years.

PTCA involves inserting a catheter with a balloon annealed near its tip into a major artery reached via the skin (percutaneously). The catheter is threaded through the circulation back towards the heart and into the coronary arteries to the area of the vessel obstruction and the balloon is inflated to disrupt the plaque and create a wider passage for blood flow.

PTCA avoids the major trauma of coronary artery bypass graft (CABG) surgery because it does not require opening the patient's chest. However, the technique can only be used to treat certain types of coronary vessel obstruction. Generally, it is used where lesions are suitable or in patients in whom CABG is contraindicated.

While initial PTCA success rates are high, there is a risk of early acute closure of the coronary artery and a high rate of recurrence of the obstruction (restenosis). This has led to the development of other catheter-based techniques, including atherectomy (cutting or grinding through obstructions with mechanical devices), stenting (expanding prosthetic devices within the artery to form a tubular supporting structure) and laser angioplasty (cutting through obstructions with a laser beam). The most successful of these newer techniques is stenting, which reduces acute closure and restenosis, and hence its use is increasing rapidly.

The aim of this report, prepared within the National Centre for Monitoring Cardiovascular Disease, is to provide details of PTCA as performed in Australia in 1995. The report covers patterns and trends in the use of the technique, indications, complications and success rates, as well as monitoring the uptake of stenting, atherectomy and laser angioplasty.

This report is also available on the Internet at the Institute's web site at http://www.aihw.gov.au

Methods

This report summarises data collected from units on coronary angioplasty performed in 1995 but includes aggregate figures from previous years. Participating units are listed in Appendix A. The list of units is reviewed each year and new units are invited to join the register and submit their data. It is thought the register has full coverage of coronary angioplasty procedures in Australia.

Data collection forms are sent to all units at the beginning of each year for procedures done in the previous calendar year. Units are asked to complete the forms with aggregate results, not individual patient details, and submit them within eight weeks. Reports are provided by each unit under the condition that results will be presented in aggregate form only, and that results from individual units will not be released unless the head of the unit concerned agrees in writing.

Data were collected for coronary angioplasty only, on a collection form presented here in Appendix B. This form is reviewed and updated by the Coronary Angioplasty Advisory Committee each year to reflect changes in practice. The form used from 1980 to 1985 was updated in 1986 to collect additional data of interest to angioplasty practitioners and the wider medical community. Since then few changes have been made to the collection form, so results remain comparable. In 1989 questions were added about the use of stents, lasers and atherectomy in angioplasty procedures, so that the register follows these newer techniques from their introduction in Australia. Questions on the use of thrombolytics were incorporated more recently. Details on the use of angioplasty to treat acute myocardial infarction were introduced in 1995.

Units' responses are reviewed, data are checked for consistency and any discrepancies are referred to the relevant unit. The data are then entered into a dedicated database at the Australian Institute of Health and Welfare. Results are analysed and the annual report compiled and subjected to scrutiny by members of the advisory committee prior to its publication.

In the treatment of acute myocardial infarction (AMI), a 'primary procedure' is when angioplasty is used for AMI as soon as possible with or without thrombolysis preprocedure. A 'rescue procedure' is when angioplasty is used for AMI for failed thrombolysis.

Angioplasty rates are calculated as the number per million people in the Australian population. The rates have been calculated to include the Australian Capital Territory population with New South Wales, and the Northern Territory population with South Australia, as those States are where the vast majority of ACT and NT residents are treated.

Complication rates are given as percentages of those having the procedure. Complications refer to those occurring during the same hospital admission.

A 'primary success' is defined as a procedure which achieves an absolute reduction of initial degree of luminal diameter stenosis of at least 20% at the time of the procedure, and a residual diameter stenosis of less than 50%.

An 'early clinical success' is defined as a patient who had an adequate reduction of all lesions (primary success), and no angina or complications prior to discharge.

Number of participating units and procedures

There were 11,348 angioplasty procedures performed in Australia in 1995, by 95 physicians in 39 cardiology units. This was a 17% increase in procedures over 1994, re-affirming the continuing growth of angioplasty among the range of cardiological interventions. The average number of angioplasty procedures was 291 per unit, compared with 256 per unit in 1994. To the end of 1995 a total of 60,923 angioplasty procedures had been performed in Australia (Table 1). A list of all Interventional Cardiology Laboratories is presented in Appendix A.

Table 1: Number of procedures and units, 1980–95

			Procedures/unit	
Year	No. procedures	No. units	Average no.	Range
1980	11	2	6	5–6
1981	45	6	8	3–18
1982	151	9	17	1–38
1983	348	10	35	4–80
1984	737	10	74	8–230
1985	1,244	13	96	13–396
1986	1,840	15	123	7–403
1987	2,383	16	149	17–491
1988	3,153	19	166	51–506
1989	4,219	20	211	46–654
1990	4,904	20	245	61–660
1991	5,726	20	286	11–656
1992	6,748	27	250	14–703
1993	8,334	30	278	10–1,004
1994	9,732	38	256	2–897
1995	11,348	39	291	12–1,016
1980–95	**60,923**	—	—	—

Repeat procedures

Four of the units could not provide details on repeat procedures. In the remaining units, 21% of the procedures were repeats; and of these, the patient had undergone previous angioplasty in 1995 in 59% of cases, and before 1995 in 41% of cases (Figure 1).

Six of the units could not provide information on repeat procedures to the same lesion. For the remaining units, 69% of repeat procedures where the previous PTCA was in 1995 were to the same lesion, while 56% of repeat procedures where the previous PTCA was before 1995 were to the same lesion.

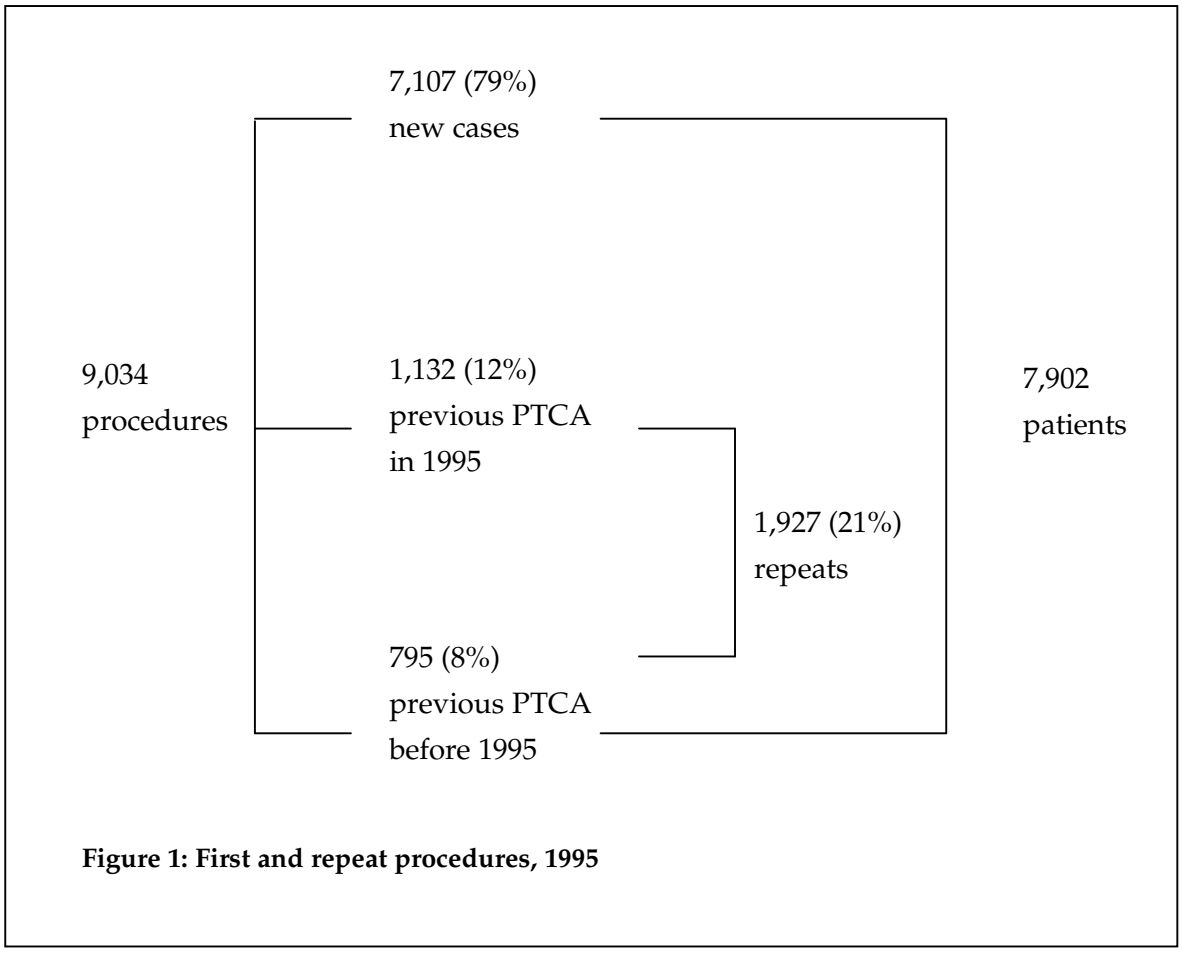


Figure 1: First and repeat procedures, 1995

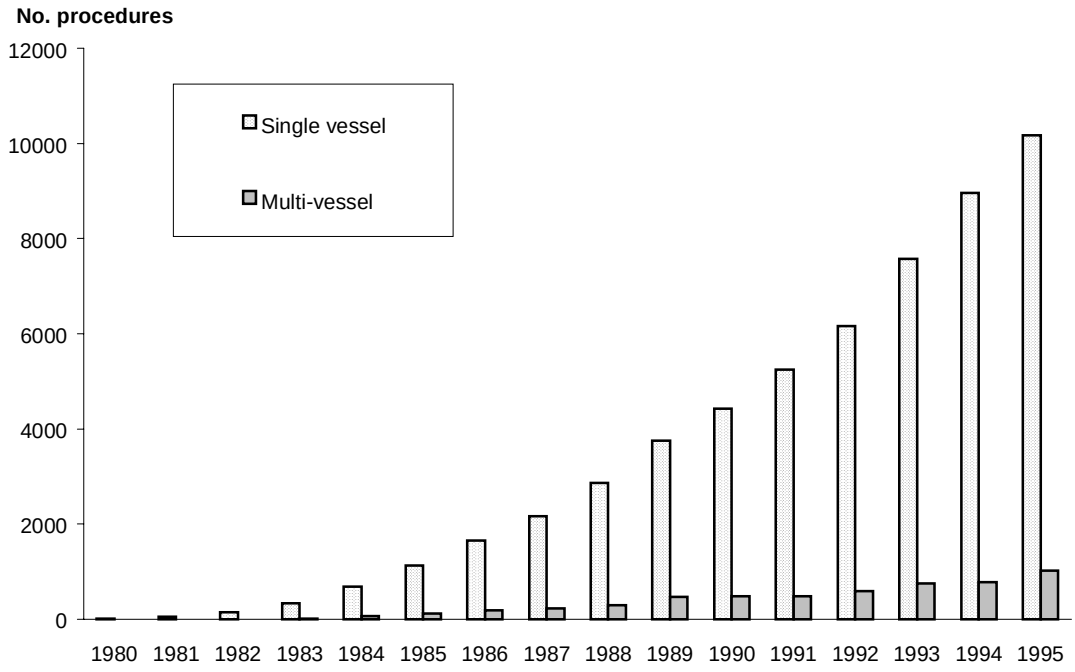
Trends in procedure type

The overwhelming majority of procedures have been on single coronary vessels only (Table 2). The proportion of double-vessel procedures increased between 1994 and 1995, from 7.5% to 8.3% of the total. Procedures on more than two vessels also increased. In 1995, single-vessel angioplasty comprised 91% of the 11,193 procedures where the details on the number of vessels were supplied. Figure 2 illustrates trends in the number of procedures since 1980.

Table 2: Trends in procedure type, 1980–95

Year	1 vessel	2 vessels	>2 vessels	Total
1980	10	1	0	11
1981	45	0	0	45
1982	148	3	0	151
1983	336	11	1	348
1984	678	47	12	737
1985	1,127	102	15	1,244
1986	1,651	183	6	1,840
1987	2,163	193	27	2,383
1988	2,865	271	17	3,153
1989	3,753	429	37	4,219
1990	4,420	454	30	4,904
1991	5,243	464	19	5,726
1992	6,162	527	59	6,748
1993	7,577	711	46	8,334
1994	8,961	732	39	9,732
1995[a]	10,179	928	86	11,193

[a] Details of vessels were unavailable for 155 procedures performed in 1995.

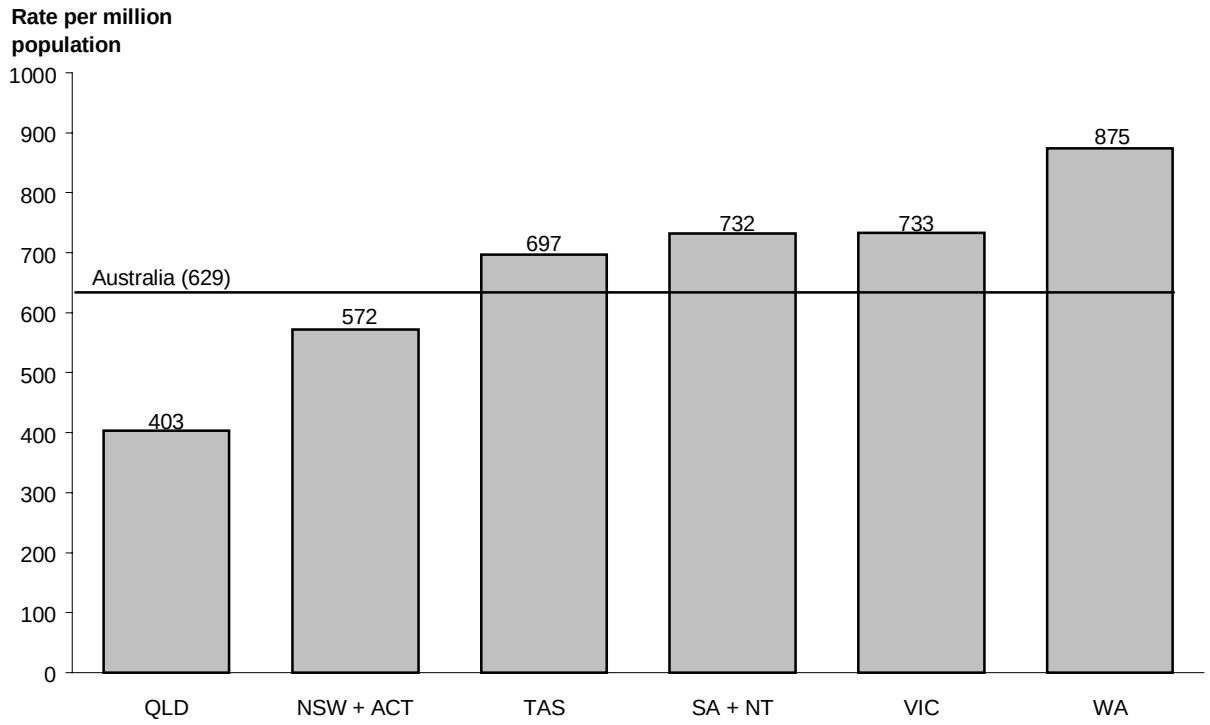


Note: Details of vessels were unavailable for 155 procedures performed in 1995.

Figure 2: Numbers of procedures, 1980–95

State comparison of PTCA rates

The national average rate for PTCA procedures is 629 per million population. There is a wide variation in rates across States ranging from 403 per million population in Queensland to 875 per million population in Western Australia (Figure 3).



Note: Rates have been calculated to include the ACT population with NSW and the NT population with SA since those are the States where the vast majority of ACT and NT residents are treated.

Figure 3: Coronary angioplasty rate by State, 1995

Indications for angioplasty

Not all units could supply this information, but of the 9,665 procedures for which data were available, the indication in 4,481 (46%) was stable angina pectoris (SAP) and in 4,134 (43%) unstable angina pectoris (UAP). Angioplasty was performed for prognostic reasons, or for acute myocardial infarction (AMI), in 10% of procedures (Table 3).

On the 1995 collection form, additional data were requested about the use of angioplasty as either a primary or rescue method for AMI. In this context, a primary procedure is when angioplasty is used for AMI as soon as possible with or without thrombolysis preprocedure. A rescue procedure is when angioplasty is used for AMI for failed thrombolysis.

Table 3: Indications for angioplasty

Indication	No. procedures	%
SAP	4,481	46.4
UAP	4,134	42.8
AMI primary	281	2.9
AMI rescue	252	2.6
AMI not specified	239	2.5
Subtotal AMI[a]	772	8.0
Prognostic	187	1.9
Other	91	0.9
Total	**9,665**	**100.0**

[a] Excludes units where details on AMI not available.

Previous coronary artery bypass grafts

All but five units could answer this question about the numbers of angioplasty patients with existing coronary artery bypass grafts. Of the 10,664 procedures performed by the remaining 34 units, 1,237 or 12% were on patients with CABGs.

Approach for procedure

In 1995, in nearly all the procedures (98%), the approach to the coronary arteries was made through the femoral artery, the remainder using the brachial approach. This was similar to the proportion in previous years.

Thrombolytic therapy pre angioplasty

The number of patients who receive thrombolytic therapy before angioplasty is of increasing interest as this therapy becomes more routine for acute myocardial infarction. Thirty-eight of the 39 units could supply this information. Of the 11,018 procedures carried out by these units, 564 (5.1%) involved the use of thrombolytic therapy before the angioplasty. This proportion was slightly lower than in 1994.

Use of stents, atherectomy and laser

In 1995 stents were used in 2,632 angioplasty procedures (30%) and 159 atherectomies were performed: 27 directional (0.3%) and 132 rotoblator (1.5%). There were no procedures in 1995 that involved the use of laser (Table 4).

Table 4: Stents, atherectomy and laser, 1993–95

	Method							
	Stents		Directional atherectomy[a]		Rotoblator atherectomy[a]		Laser	
Year	No.	%	No.	%	No.	%	No.	%
1993	255	3.1	78	0.9	117	1.4	0	0
1994	896	10.8	88	1.1	167	2.0	0	0
1995	2,632	29.8	27	0.3	132	1.5	0	0
Total	**3,783**	**14.6**	**193**	**0.8**	**416**	**1.7**	**0**	**0**

[a] Excludes units where details of procedures were unavailable.

Complications

Coronary artery bypass grafts

Table 5 and Figure 4 show the number of patients requiring coronary artery bypass grafts (CABG) after angioplasty during the same hospital admission, either as an emergency CABG for complications of angioplasty, or as CABG for a failed but uncomplicated procedure. This classification differs slightly from that used for 1980 to 1985 in which emergency CABG was defined as surgery within 24 hours, and CABG for a failed but uncomplicated procedure as surgery after 24 hours.

In 1995, 278 angioplasty patients required CABG during the same hospital admission, which is a rate of 2.5%. Of these, 222 (79.8%) were within 24 hours of angioplasty, and were emergency operations for complications of the procedure. The remaining 56 patients had CABG later during their admission. Between 1980 and 1995 a total of 1,496 angioplasty patients underwent CABG within the same hospital admission, equivalent to an overall rate of 2.5%. Since 1990 the rate of CABG post-angioplasty has fluctuated around 2%.

Table 5: Coronary artery bypass grafting for angioplasty failure or complications, 1980–95

Year	Total no. procedures	CABG within 24 hours		CABG after 24 hours		CABG Total	
		No.	%	No.	%	No.	%
1980	11	0	0	0	0	0	0
1981	45	3	6.7	2	4.4	5	11.1
1982	151	16	10.6	2	1.3	18	11.9
1983	348	16	4.6	7	2.0	23	6.6
1984	737	29	3.9	8	1.1	37	5.0
1985	1,244	45	3.6	10	0.8	55	4.4
1986	1,840	69	3.8	13	0.7	82	4.5
1987	2,383	52	2.2	18	0.8	70	2.9
1988	3,153	70	2.2	33	1.0	100	3.2
1989	4,219	86	2.0	35	0.8	121	2.9
1990	4,904	77	1.5	36	0.7	113	2.3
1991	5,726	92	1.6	35	0.6	127	2.2
1992	6,748	90	1.3	34	0.5	124	1.8
1993	8,334	118	1.6[a]	24	0.3[a]	158	1.9
1994	9,732	137	1.4	35	0.3	185	1.9
1995	11,348	222	1.9[a]	56	0.5[a]	278	2.5
1980–95	**60,923**	**1,109**	**1.8**	**345**	**0.6**	**1,496**	**2.5**

[a] As some of the units could not supply information about the time of CABG, this percentage was calculated on the procedures by the remaining units.

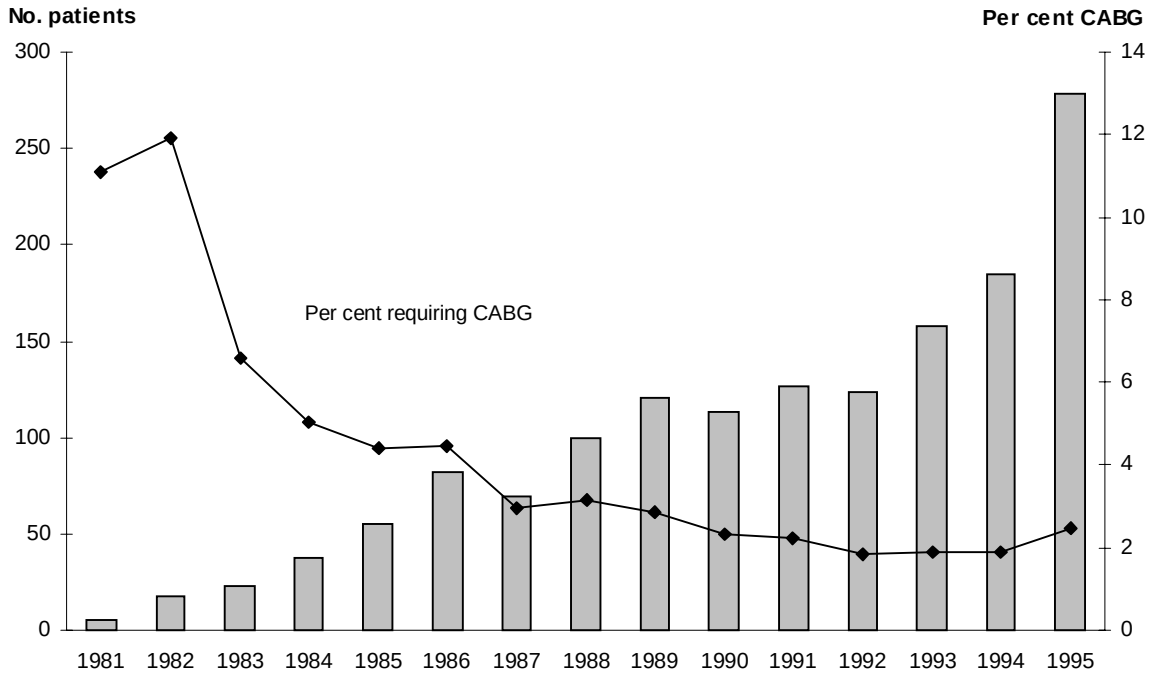


Figure 4: CABG for angioplasty failure or complications, 1981–95

Associated myocardial infarction

Three units could not supply the number of patients who suffered acute myocardial infarction after angioplasty but during the same hospital admission. In the remaining units, there were 155 such patients. This is equivalent to a rate of 1.5% for those units' 10,050 procedures over the year, and maintains the overall rate for 1980 to 1995 at 1.5%. The rate has been around 1–2% since 1984 (Table 6 and Figure 5).

Table 6: Angioplasty and associated myocardial infarction[a], 1980–95

Year	Procedures	AMI no.	AMI %
1980	11	0	0
1981	45	2	4.4
1982	151	13	8.6
1983	348	13	3.7
1984	737	15	2.0
1985	1,244	20	1.6
1986	1,840	32	1.7
1987	2,383	36	1.5
1988	3,153	62	2.0
1989	4,219	57	1.3
1990	4,089 [b]	85	2.1
1991	4,826 [b]	70	1.5
1992	5,603 [b]	74	1.3
1993	7,041 [b]	80	1.1
1994	8,231 [b]	112	1.4
1995	10,050 [b]	155	1.5
1980–95	**53,971**	**826**	**1.5**

[a] Acute myocardial infarction (AMI) is defined in this report as the appearance of new Q waves or T wave changes with enzymes twice the upper limit of normal.

[b] Excluding procedures performed by the units that could not supply information about this complication.

Arterial complications prolonging hospital stay

Eleven units could not supply information on the number of arterial complications prolonging hospital stay after angioplasty procedures. Of the remaining units, there were 80 such complications. This represents a rate of 1% in which arterial complications prolonged hospital stay for angioplasty procedures.

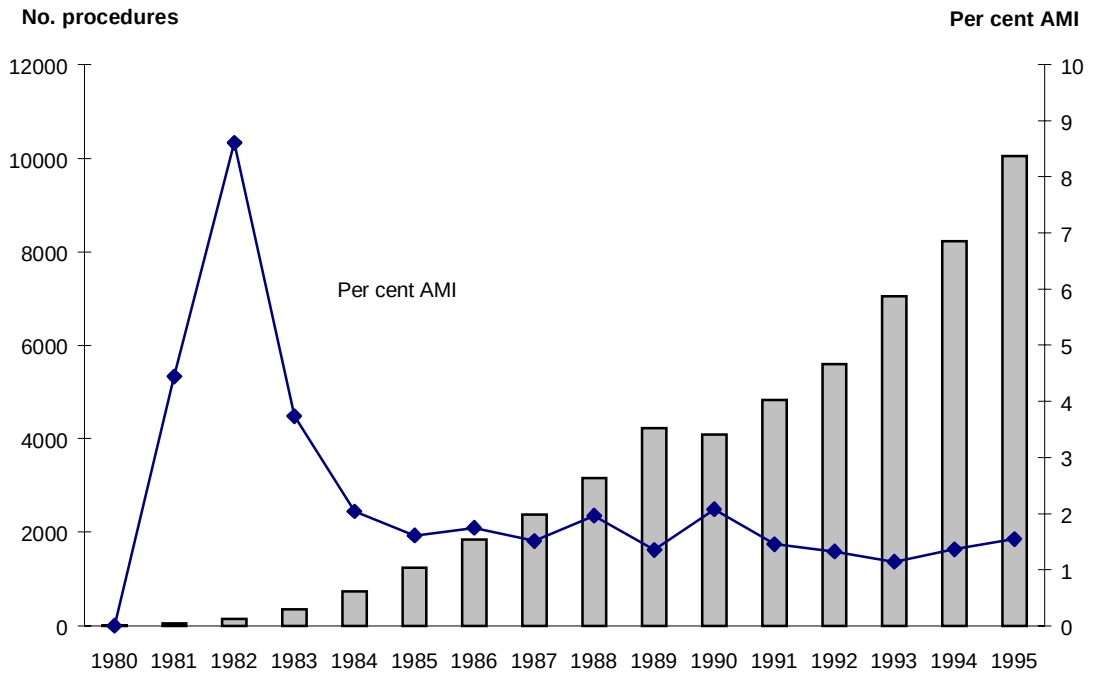


Figure 5: Acute myocardial infarction associated with angioplasty, 1980–95

Mortality

In 1995, 75 deaths occurred during the same admission in which angioplasty was performed. Details of the cause of death indicate that more than half the cases were extremely high risk with either cardiogenic shock, poor left ventricular function or life threatening ventricular arrhythmias pre procedure. The increasing use of angioplasty to try to rescue these patients will continue to have an adverse impact on mortality. At least 40 occurred within 24 hours of the procedure, 13 of which followed emergency CABG for complications of angioplasty. Three more deaths occurred after 24 hours but in the same hospital admission. This is a total rate of 0.7% for the year. Mortality rates have been increasing in the 1990s (Table 7 and Figure 6).

Table 7: Mortality associated with angioplasty, 1980–95

Year	Procedures (no.)	Deaths (no.)	Deaths (%)
1980	11	0	0
1981	45	0	0
1982	151	0	0
1983	348	4	1.1
1984	737	8	1.1
1985	1,244	10	0.8
1986	1,840	12	0.7
1987	2,383	9	0.4
1988	3,153	10	0.3
1989	4,219	8	0.2
1990	4,904	17	0.4
1991	5,726	18	0.3
1992	6,748	26	0.4
1993	8,334	33	0.4
1994	9,732	44	0.5
1995	11,348	75	0.7
1980–95	**60,923**	**274**	**0.5**

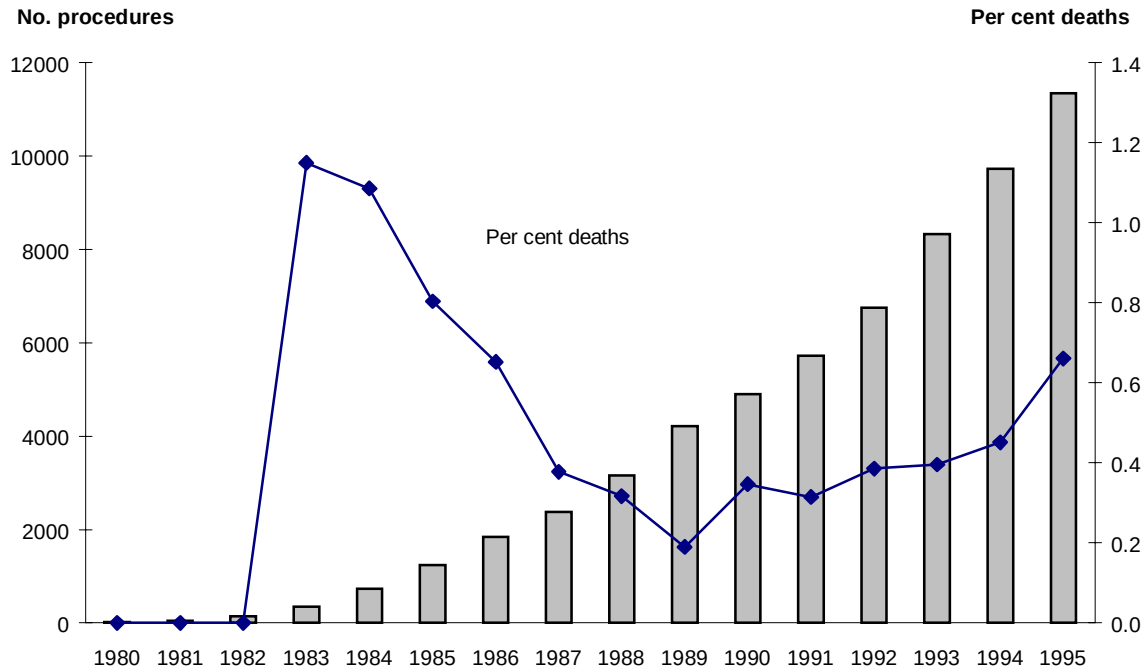


Figure 6: Mortality associated with angioplasty, 1980–95

The cause of death of most of the 75 patients who died in 1995 is listed below as supplied by each unit:

1. 65–69[1] year old male patient, CABG 12 years ago, with unstable angina and left ventricular failure. PTCA of SVG under general anaesthesia with balloon pump support. Successful PTCA but patient died 4 days later from terminal heart failure.
2. Patient with unstable post infarct angina. Occluded RCA and Cx OM, and non critical LAD lesion. LAD became obstructed doing Cx . No improvement in haemodynamics after PTCA of LAD and intra-aortic balloon pump. Emergency CABG but did not come off bypass.
3. Recurrent, intractable ventricular fibrillation despite maximum drug therapy.
4. Patient with AMI, put into GUSTO IIb PTCA substudy. Ventricular fibrillation arrest prior to and during PTCA. Intubated, ventilated, intra-aortic balloon pump, paced, CVVHD, pump failure, died.
5. Patient had elective PTCA, after procedure suffered large cerebral bleed.
6. Pump failure.
7. Patient with AMI: left main totally occluded. TPA at PTCA. Intra-aortic balloon pump, intubated, ventilated, died on table.
8. 60–64 year old male patient with acute AMI >24 hour PTCA. Poor left ventricular function, intra-aortic balloon pump inserted and transferred to ICU. Patient considered for heart transplant, died 3 days post PTCA from cardiac shock.
9. Patient in cardiogenic shock, died on catheter laboratory table.
10. Prolonged resuscitation with subsequent hypotension, hypoxia and myoclonic jerks. Patient died 2 days later with heart failure in CCU.
11. Patient in cardiogenic shock, died on catheter laboratory table.
12. Successful PTCA x 3 to RCA. Arrested in ward less than 24 hours after procedure and could not be resuscitated.
13. Patient with cardiogenic shock, severe triple vessel disease, failed PTCA, died in catheter laboratory.
14. Attempted rescue PTCA for left main dissection, cardiogenic shock during diagnostic study.
15. Acute infarct angioplasty, proximal LAD occlusion, reperfusion but cardiogenic shock.
16. 65–69 year old male patient in cardiogenic shock post-myocardial infarction, with multiple vessel occlusions. LAD reopened but no improvement in haemodynamics and died 2 hours later.
17. 75–79 year old male patient with cardiogenic shock. Occluded LAD reopened with clot aspiration and urokinase. Died 8 hours later—cardiac rupture.
18. 70–74 year old male patient with unstable angina. PTCA to RCA, extensive dissection, urgent CABG, died 48 hours post-op.
19. 50–54 year old male patient. Successful PTCA to LCx. Died 48 hours later due to massive pulmonary embolism.

[1] Patients' ages are shown in five-year age range for confidentiality reasons.

20. Patient came to catheter laboratory > 1 hour post infarct in cardiogenic shock and VT being massaged. LAD and RCA total occlusion. LAD not opened, RCA opened—no reflow, died on table.
21. Emergency PTCA after acute closure from PTCA 3 days earlier. Lesion unable to be reopened. Cerebral bleed sustained 2 days later. Neurosurgery performed. Patient died 2 days later.
22. 70–74 year old female patient with totally occluded LAD. Unsuccessful PTCA. Subsequent CABG, developed VSD after infarct to anterior wall.
23. 80–84 year old female patient with unstable angina. Uneventful PTCA but within minutes of procedure, the vessel reoccluded and could not be reopened. Patient went into cardiogenic shock and given the patient's age, CABG was not indicated. Patient died on catheter laboratory table.
24. 80–84 year old female patient with LAD disease and milder lesions in RCA and Cx. Acute closure following dilatation and a Palmaz-Schatz stent was deployed. Subacute closure occurred some days later and the vessel could not be reopened. Patient became hypotensive and at her age, CABG was not indicated. She died 4 hours later.
25. Patient died of pulmonary embolism 12 days post PTCA.
26. MI during PTCA due to thrombus flicking from blocked RCA into LAD, emergency PTCA, patient died.
27. 60–64 year old male patient with cardiogenic shock in emergency department. Occluded left main successfully crossed with wire and balloon but no flow.
28. 70–74 year old female patient with cardiogenic shock and large anterolateral MI. Successful PTCA to LAD and LCx. Initial improvement but later blood pressure drop and arrested.
29. 70–74 year old female patient. PTCA to severe LAD lesion, dissection, deployed stent, poor flow. Patient accepted surgery but did not come off pump.
30. 65–69 year old male patient. CABG on 2 previous occasions, severe LV dysfunction, acute MI, cardiogenic shock, failed primary PTCA to occluded graft to LAD, died within hours of cardiogenic shock.
31. 70–74 year old male patient, prior CABG, severe LV dysfunction, angina at rest, successful transluminal atherectomy to graft to RCA. Recurrent angina, died from ventricular tachycardia, refractory heart failure.
32. 65–69 year old female patient with acute myocardial infarction, pulmonary oedema, failed thrombolysis, successful rescue PTCA to LCx. Death on day 5 from respiratory failure.
33. Subacute thrombosis 8 days after insertion of a stent. Unsuccessful attempt at opening vessel, urgent CABG, patient died on operating table.
34. Patient with acute anterior MI, in cardiogenic shock and acute pulmonary oedema. Left main opened and urgent CABG. Condition deteriorated and patient died next day.
35. Stent inserted and patient discharged 4 days later. Acute chest pain and ventricular fibrillation arrest that night. Patient intubated and transferred to catheter laboratory. Cardiovascular deterioration despite patent vessel. Patient did not regain consciousness, asystolic arrest and died.
36. Cardiac catheterisation performed and patient referred for CABGs but had cardiac arrest 1 hour before operation requiring emergency PTCA. Despite resuscitation

throughout PTCA, patient remained in VT/VF. Unable to maintain cardiac output, patient died 2 hours after start of procedure.

37. 55–59 year old male patient in cardiogenic shock, no palpable pulses during procedure. Occluded left main. PTCA to proximal LAD and left main but virtually no cardiac output. Patient died in catheter laboratory.
38. 60–64 year old female patient with unstable angina. Cardiac catheter previous day revealed 80–90% LAD lesion. Patient hypotensive from time of groin puncture on day of PTCA despite atropine. LAD successfully dilated. Prolonged resuscitation several hours post procedure with a cardiac arrest. Eventual diagnosis of iliac artery laceration requiring two attempts at surgical repair. Prolonged ICU stay and death 10 days post angioplasty.
39. Patient with post MI angina and RCA occlusion. RCA attempted but could not be opened. Left main dissection from guide catheter while trying to cross balloon into LADDI.
40. Female patient presented with acute inferior and right ventricular infarction, complete heart block and cardiogenic shock. Primary angioplasty to RCA.
41. 70–74 year old patient with severe anterior wall MI, in cardiogenic shock following a total hip replacement operation done 24 hours prior to onset of symptoms. Primary PTCA to occluded LAD was successful. Patient required intra-aortic balloon pump support after the procedure, remained in cardiogenic shock and died due to progressive pump failure 2 days after the procedure.
42. 70–74 year old male patient with unstable angina due for elective catheterisation, developed massive MI complicated by severe cardiogenic shock. Diagnostic angiogram showed severe triple vessel disease. Occluded LAD was opened but patient died on table due to cardiogenic shock despite intensive CPR.
43. 70–74 year old male presented in emergency department with acute inferior wall MI. Rescue PTCA attempted. Diagnostic catheterisation showed dilated ascending aorta and near total occlusion of ostium of RCA. Patient underwent PTCA and stent implantation. Three days later cardiac arrest from which he could not be revived. Autopsy showed a large dissection of aorta which led to cardiac tamponade. The stent was patent.
44. 75–79 year old female patient presented in emergency department with acute inferior wall MI for 2 hours. Angiography showed triple vessel disease with blocked RCA at ostium. Successful PTCA to the RCA and stent insertion. Eight days later patient had recurrent AMI probably due to sudden stent thrombosis and died within 30 minutes. No autopsy done.
45. 70–74 year old male patient transferred to the unit in cardiogenic shock for 10 hours on intra-aortic balloon pump support. Angiography showed triple vessel disease. LAD opened successfully but patient remained in shock and died a few hours later.
46. 35–39 year old male patient transferred to the unit in cardiogenic shock due to large anterior MI. The patient had been given tPA a few hours before being transferred to unit. Angiography showed blocked LAD which was opened successfully. Patient died on table due to severe pump failure.
47. 80–84 year old female patient with severe unstable angina, had received intravenous heparin for 7 days prior to procedure. Successful PTCA of RCA stenosis. Soon after patient developed severe hypotension and falling haematocrit which did not respond to vigorous intravenous fluids and blood transfusion. Repeat angiography showed a

patent vessel. Patient thought to have intra-abdominal haemorrhage was subjected to exploratory surgery of abdomen. Patient had a large retroperitoneal bleed without rent in the aorta, died on operating table. Autopsy confirmed these findings.

48. Acute occlusion following PTCA. Patient was returned to laboratory but unable to be reopened.
49. PTCA for cardiogenic shock. Patient did well but never left the hospital, dying 2 months later due to pulmonary failure.
50. About 36 hours post PTCA patient developed bowel ischaemia, probably embolic from PTCA procedure.
51. 70–74 year old male with acute anterior MI, not suitable for thrombolysis. Emergency to cath lab, good LAD dilatation. Death. Possible LV rupture 26 hours after PTCA.
52. 75–79 year old female with PH angina. Anterior MI. Streptokinase treated. Recurrent pain. PTCA LAD successful day 3 but died day 5.
53. Acute MI and left bundle branch block complicated by pulmonary oedema. After day 3 recurrent chest pain, onset of cardiogenic shock. Died while attempting to open occluded proximal LAD.
54. 70–74 year old male with large anterior infarction, associated right bundle branch block and left anterior hemiblock (too late for thrombolysis). Successful PTCA to LAD 8 days later. Died 3 days later after going into cardiogenic shock.
55. 60–64 year old male with ID diabetes, hypertension and a permanent pacemaker. Large anterior and infero-lateral hypokinetic areas, 2 severe proximal LAD stenoses, distal LAD disease, totally occluded Cx and diffuse RCA disease, ongoing angina. Had angioplasty to both proximal LAD stenoses and stenting. Had VF cardiac arrest 8 hours after procedure, dying 24 hours after procedure with intractable ventricular arrhythmias with heart failure.
56. 80–84 year old male in cardiogenic shock with anterior MI. Intubated and intra-aortic balloon counterpulsation and successful PTCA to total LAD/Diagonal performed. Progressive cardiac failure and death 24 hours post procedure.
57. 70–74 year old male with acute inferior MI, history of AMI, CABG to LAD and RCA, PTCA to SVG to RCA. IV rTPA then developed hypotension, bradycardia and increased ST elevation. Attempted PTCA to totally occluded SVG on RCA, graft opened but no re-flow. Died in catheter laboratory.
58. 75–79 year old male with severe unstable angina, history of inferior AMI x2, CABG x2 and poor LV function. Developed pulmonary oedema during PTCA to totally obstructed LAD. Successful PTCA then progressive hypotension and bradycardia, dying 5 hours post procedure.
59. 75–79 year old male with anterior MI, history of CRF. Treated with IV rTPA, recovery complicated by LVF pulmonary oedema and AF. Reinfarction 6 days later, attempted PTCA to total LAD but progressive hypotension and death in catheter laboratory.
60. 65–69 year old female with infero-lateral MI. Total obstruction of the LAD, successful PTCA to RCA. IAB support but developed renal failure, pulmonary oedema and AF, dying 5 days post procedure.
61. 45–49 year old male with post anterior MI. Successful PTCA to LAD, suffered respiratory arrest one hour post procedure, echocardiography demonstrated tamponade consistent with acute rupture.

62. 65–69 year old male, new infarction, history of anterior MI, CABG and moderate LV dysfunction. Successful PTCA to SVG on RCA. Biventricular failure and pulmonary oedema post procedure. Respiratory arrest and death at 6 days.

Success rates in various vessel types

Definition of success

For the Angioplasty Register, a 'primary success' is defined as a procedure which achieves an absolute reduction of initial degree of luminal diameter stenosis of at least 20% at the time of the procedure, and a residual diameter stenosis of less than 50%.

Success rates

Altogether 12,983 lesions were attempted in 1995, corresponding to an average of 1.1 lesions attempted per procedure. Of the total attempts, 11,553 were primary successes, giving an overall success rate of 89%. Of the procedures, 86% were on partial occlusions, and 14% on total occlusions. Figures 7a, 7b and Table 8 show the number of lesions and success rates for individual vessel types. Attempts on partial occlusions are clearly much more successful than those on total occlusions.

Forty per cent of the lesions attempted were in the left anterior descending artery (LAD) or its diagonals. The right coronary artery (RCA) accounted for a further 33% of the lesions, and the left circumflex artery (LCx) including marginals and intermediate, 22%. This distribution is similar to that in 1994. Success rates were similar for all types of vessels, at around 90%.

Trends in success rates for partial and total occlusions are presented in Table 9. Overall success rates have remained consistent over the period 1993 to 1995.

There were 763 angioplasty procedures performed on bypass graft vessels, 690 on saphenous vein grafts (SVG, 610 successful), and 22 on internal mammary artery grafts (IMA, 20 successful). There were 51 procedures on left main arteries (LMA), 43 of which were successful.

The proportion of patients defined as early clinical successes was 73%; that is, they had a successful reduction of all lesions, and no angina or complications pre-discharge.

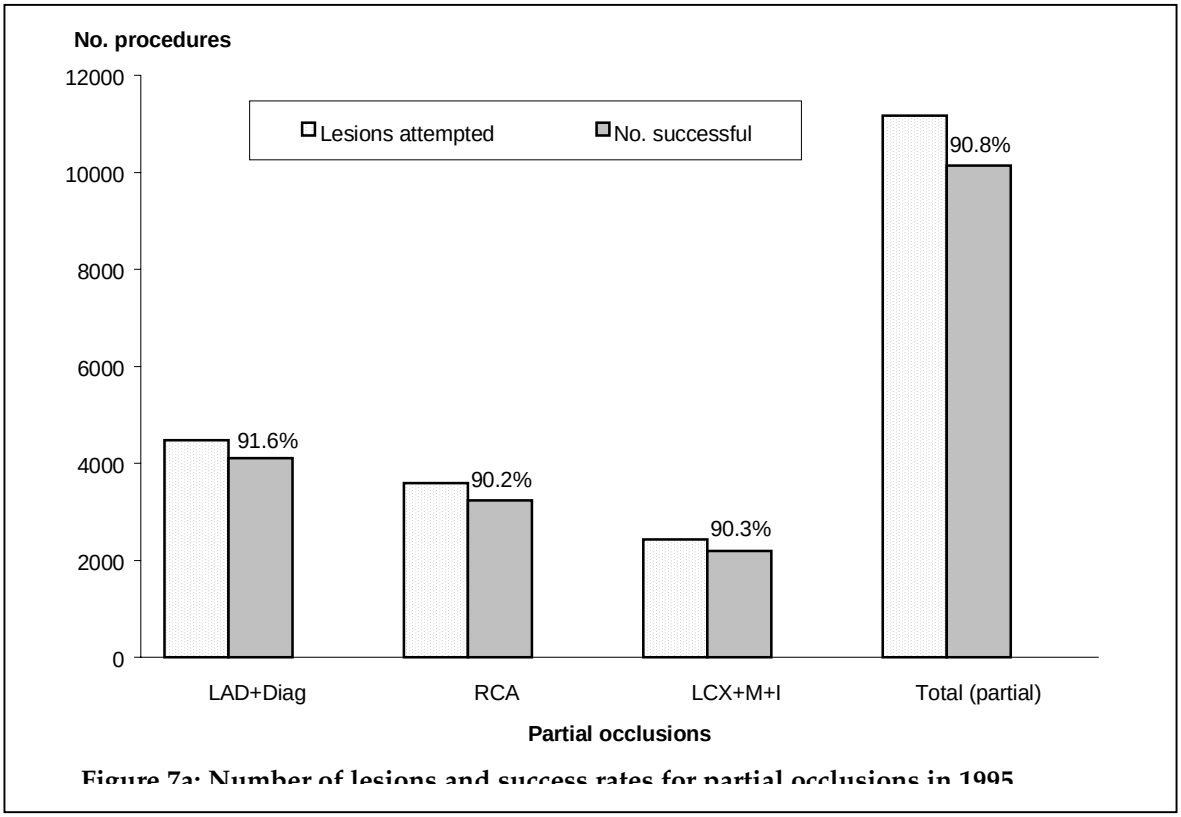


Figure 7a: Number of lesions and success rates for partial occlusions in 1995

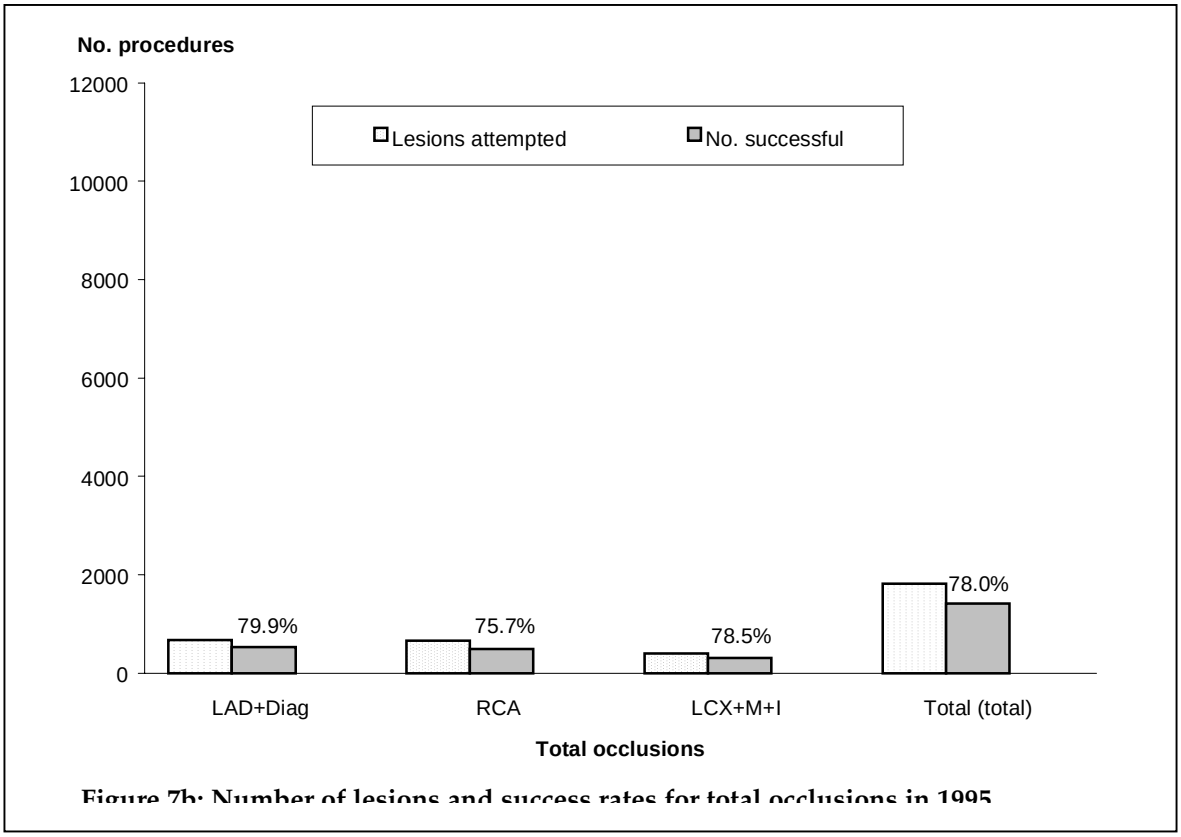


Figure 7b: Number of lesions and success rates for total occlusions in 1995

Table 8: Types of vessels and success rates, 1995

Lesions	Partial occlusion			Total occlusion			Overall		
	No. attempt	No. success	% success	No. attempt	No. success	% success	No. attempt	No. success	% success
LAD	4,063	3,735	91.9	629	508	80.8	4,692	4,243	90.4
Diagonals	415	368	88.7	37	24	64.9	452	392	86.7
RCA	3,594	3,243	90.2	655	496	75.7	4,249	3,739	88.0
LCX	1,703	1,504	88.3	273	219	80.2	1,976	1,723	87.2
Marginals & intermediate	728	691	94.9	122	91	74.6	850	782	92.0
Total	*10,503*	*9,541*	*90.8*	*1,716*	*1,338*	*78.0*	*12,219*	*10,879*	*89.0*
SVG	600	546	91.0	90	64	71.1	690	610	88.4
IMA	19	17	89.5	3	3	100.0	22	20	91.0
LM	45	39	86.7	6	4	66.7	51	43	84.3
Other	1	1	100.0	—	—	—	1	1	100.0
Overall total	**11,168**	**10,144**	**90.8**	**1,815**	**1,409**	**77.6**	**12,983**	**11,553**	**89.0**

Table 9: Success rates, 1993–95

Lesions	Success rates								
	Partial occlusion			Total occlusion			Overall		
	1993	1994	1995	1993	1994	1995	1993	1994	1995
LAD & diagonals	92.7	93.3	91.6	78.9	82.0	79.9	90.9	92.0	90.1
RCA	93.1	93.1	90.2	74.0	71.8	75.7	90.3	89.9	88.0
LCX & marginals & intermediate	91.5	91.5	90.3	74.3	74.5	78.5	91.0	89.4	88.6
Total	92.8	92.8	90.8	76.1	76.2	78.0	90.7	90.7	89.0
Total including SVG, IMA & LM	**93.0**	**92.7**	**90.8**	**76.2**	**75.8**	**77.6**	**90.7**	**90.6**	**89.0**

Glossary

Acute myocardial infarction (AMI): an acute episode of myocardial ischaemia (see below) of sufficient severity and duration to cause permanent damage to some heart muscle. The ischaemia is caused by occlusion of one or more coronary arteries.

Angina pectoris: a clinical syndrome marked by deep, unlocalised discomfort or pain in the chest or arm which is associated with physical exertion or emotional stress, and is relieved promptly by rest or sublingual nitroglycerine. Patients with unstable angina have episodes of discomfort which are more severe and prolonged, and which may occur at rest irrespective of exertion or stress. In most, but not all, angina, these symptoms reflect myocardial ischaemia resulting from significant underlying coronary artery disease.

Atherectomy: a dilatation technique, where mechanical devices attached to the insertion catheter cut or grind through obstructions in arteries.

Cardiogenic shock: a condition caused by inadequate cardiac output which fails to maintain blood supply to the tissues.

Coronary artery bypass grafting (CABG): vein or artery grafted surgically to permit blood to travel from the aorta to a branch of the coronary artery at a point past an obstruction.

Coronary stenosis: narrowing or constriction of a coronary artery.

Fibrillation: rapid, uncoordinated, chaotic activity of the muscle fibres of the heart.

Hypotension: decrease of systolic and diastolic blood pressure below normal.

Intra-aortic balloon pump (IABP): a balloon attached to a catheter inserted through the femoral artery into the descending thoracic aorta for producing alternating inflation and deflation during diastole and systole, respectively.

Intracoronary stenting: use of a prosthetic metal device to provide a supporting structure and maintain an enlarged coronary lumen at the site of an obstructive atherosclerotic plaque.

Laser angioplasty: use of a laser beam to cut through obstructions in the coronary arteries.

Left bundle branch block (LBBB): an ECG change marked by an intraventricular conduction delay affecting the left ventricular wall and septum. Acute occurrences most commonly result from myocardial ischaemia.

Left ventricular function: the function of the main pumping chamber of the heart that receives blood from the left atrium and pumps it out into the general circulation through the aortic valve.

Myocardial ischaemia: a condition in which oxygen and nutrient delivery to and waste removal from the heart muscle falls below normal levels, and oxygen demand exceeds supply. The metabolism of heart muscle cells is impaired, leading to various degrees of systolic and diastolic dysfunction.

Myocardium: the muscular wall of the heart located between the inner endocardial layer and the outer epicardial layer.

Percutaneous transluminal coronary angioplasty (PTCA): a method of treating localised coronary artery narrowing, using a special catheter with a balloon that can be inflated to dilate the narrowed vessel.

Revascularisation: to the greatest extent possible, restoration of normal blood flow to the myocardium by bypassing or removing obstructions in coronary arteries, as occurs when CABG or PTCA is performed.

Saphenous vein: a blood vessel from the leg, which is the most commonly used conduit for coronary artery bypass grafting.

Stenosis: narrowing or blockage.

Stent: see intracoronary stenting.

Thrombolytic therapy: pharmacologic treatment with a drug that can break up blood clots and restore blood flow to the myocardium.

Unstable angina: angina is termed unstable when chest pain occurs at rest, there is new onset of pain with exertion, or pain is more frequent, longer in duration or lower in threshold.

Appendix A: List of participating units

State	Unit
New South Wales	Charles Wentworth Private Hospital
	Eastern Heart Clinic
	John Hunter Hospital
	Lake Macquarie Hospital
	Royal North Shore Hospital
	Royal Prince Alfred Hospital
	St Vincent's Public Hospital
	Strathfield Private Hospital
	Sydney Adventist Hospital
	The Hills Hospital
	The St George Hospital
	Westmead Hospital
Queensland	John Flynn Hospital
	Mater Misericordiae Hospital
	St Andrews Hospital
	The Prince Charles Hospital
	The Wesley Hospital
	Townsville Hospital
South Australia	Ashford Community Hospital
	Flinders Medical Centre
	Royal Adelaide Hospital
	The Queen Elizabeth Hospital
	Wakefield Hospital
Tasmania	Calvary Hospital
	Royal Hobart Hospital
Victoria	Austin Hospital
	Box Hill Hospital
	Cabrini Medical Centre
	Epworth Hospital
	Monash Medical Centre
	St Vincent's Hospital
	St Vincent's Private Hospital
	The Alfred Hospital
	The Royal Melbourne Hospital
	Warringal Private Hospital
Western Australia	Fremantle Hospital
	Mount Hospital
	Royal Perth Hospital
	Sir Charles Gairdner Hospital

Appendix B: Data collection form

Calendar year in which information collected: 1995

Hospital/Unit _____

Date form completed _____

Form completed by _____

Names of doctors doing procedures (not Assistants) _____

_____

No. of Patients

1. No. of patients having first PTCA in 1995 _____

2. No. of patients having repeat PTCA in 1995 who had a previous PTCA in 1995 _____

   Interval between procedures:
   - less than 24 hours _____
   - 24 hours to less than 3 months _____
   - 3 to less than 6 months _____
   - 6 to less than 12 months _____

No. where repeat PTCA was to the same lesion _____

No. where repeat PTCA was for previous failure _____

3. No. of patients having repeat PTCA in 1995 whose previous PTCA was before 1995 _____

   Interval between procedures:
   - less than 24 hours _____
   - 24 hours to less than 3 months _____
   - 3 to less than 6 months _____
   - 6 to less than 12 months _____
   - 12 months or greater _____

No. where repeat PTCA was to the same lesion _____

No. where repeat PTCA was for previous failure _____

4. (a) Total number of patients having PTCA _____
(sum of 1 and 3(a) above)

(b) Total number of PTCA procedures in 1995 _____
(sum of 1, 2(a) and 3(a) above)

5. No. of single vessel PTCA procedures _____

6. No. of two vessel PTCA procedures _____

7. No. of three vessel PTCA procedures _____

8. No. of four or more vessel PTCA procedures _____

Note: A vessel is defined as a single arterial trunk
e.g. LAD + LADD = 1 vessel; LCX + marginal or intermediate = 1 vessel;
LM = 1 vessel; LAD + SVG or IMA = 2 vessels; SVG = 1 vessel; IMA = 1 vessel

No. of procedures

9. Approach during procedures:

Femoral _____
Brachial _____
Radial _____

10. No. of procedures for patients with previous CABG _____

11. Indication for PTCA:

Stable angina pectoris _____
Unstable angina pectoris _____
Prognostic (asymptomatic) _____
Acute myocardial infarction:

a) *primary*
time since AMI:
0-<2 hours .....
2-<4 hours .....
4-<6 hours .....
6-<8 hours .....

b) *rescue*
time since AMI:
0-<2 hours .....
2-<4 hours .....
4-<24 hours .....
after 24 hours .....

Other (specify details) _____

12. Total no. of procedures where thrombolytic therapy was given before PTCA:

<24 hours _____
24-48 hours _____
>48 hours but during same admission _____

13. Lesions

		No. of lesions	No. of primary Angiographic successes*
LAD	Partial occlusion		
	Total occlusion		
Diagonals	Partial occlusion		
	Total occlusion		
RCA including posterior descendens	Partial occlusion		
	Total occlusion		
LCX	Partial occlusion		
	Total occlusion		
Marginals including intermediate	Partial occlusion		
	Total occlusion		
Saphenous vein grafts	Partial occlusion		
	Total occlusion		
Internal mammary grafts	Partial occlusion		
	Total occlusion		
Left main	Partial occlusion		
	Total occlusion		
Other (please list)			

***Note:** **Primary angiographic success is success at time of procedure characterised by absolute reduction of initial degree of luminal diameter stenosis by at least 20% plus a residual diameter stenosis of less than 50%.**

14. Average no. of lesions attempted per procedure [total lesions/total procedures (from 4b)] _____

15. Number of patients defined as early clinical successes (successful reduction of all lesions, and no angina or complications pre-discharge) _____

16. No. of patients where procedure included insertion of a stent/s _____

17. No. of patients where procedure included use of laser _____

18. No. of patients where procedure included use of:

    (a) Directional atherectomy _____

    (b) Rotoblator atherectomy _____

    (c) Other viz _____

19. Subsequent procedures and complications:

(a) Subsequent CABG during same admission

CABG within 24 hours for failed PTCA or for complications of PTCA No. survived____No. died**____

CABG after 24 hours for failed PTCA or for complications of PTCA No. survived____No. died**____

(b) Acute myocardial infarction during same admission* **Number**

<24 hours after PTCA _____
>= 24 hours after PTCA _____

Total _____
Survived _____
Died** _____

(c) Other deaths (excluding (a) and (b))

~ within 24 hours of PTCA** _____

~ after 24 hours following PTCA, during same admission** _____

(d) Arterial complications prolonging hospital stay _____

***** **AMI = new Q waves or T wave changes with enzymes twice upper limit of normal**

****** **Please provide brief details including time interval after PTCA, indications, procedures and circumstances**

_____

_____

_____

_____

_____

_____

Related publications

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