

# Trends in cardiac surgery at the University of Cape Town, 1971 - 1981

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## Summary

A review has been undertaken of the number and types of surgical procedures performed in the Department of Cardiac Surgery of the University of Cape Town during the 11-year period 1971-1981, together with data on associated mortality.

A yearly average of 560 operations was carried out, of which 75% were for acquired and 25% for congenital heart disease. The number of patients treated continues to rise, from 434 in 1971 to 690 in 1981. There has been a slight reduction in the overall average yearly mortality, from 6.1% between 1971 and 1975 to 5.0% between 1976 and 1981.

There was a significant increase in the number of valve replacements in 1975 and 1976 and a more recent, continuing increase in operations for ischaemic heart disease, which now form 19% of the total operations. In both these groups the average yearly mortality has fallen during the period of study. The number of operations each year for congenital heart disease has remained fairly constant, but, disappointingly, there has been no significant reduction in mortality.

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The Department of Cardiac Surgery of the University of Cape Town carries out open and closed cardiac surgical procedures on adults at Groote Schuur Hospital and on children at the Red Cross War Memorial Children's Hospital.

Cardiac surgery on a routine basis at the University of Cape Town Medical School began in Groote Schuur Hospital in 1951. The early work of the department, between the years 1951 and 1965, has been reported previously.<sup>1,2</sup>

We have reviewed the number and types of surgical procedures performed in our department during the 11-year period 1971 - 1981 inclusive, together with data on the associated mortality. This is not a detailed analysis of the indications for surgery or of the causes of postoperative death, but is intended as an overall view of the changes in workload in cardiac surgery in our institutions, and of the mortality associated with the major operative procedures. It gives an indication of the trends in cardiac surgery in South Africa with regard to the number and types of procedures being undertaken at present and the related mortality figures.

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## Clinical material

A total of 6 161 cardiac operations were performed during the 11-year period (mean 560 per annum), of which 4 618 (75%) were for acquired heart disease and 1 543 (25%) for congenital heart disease.

Our unit is the most active cardiac surgical centre in the Cape Province, although both open and closed cardiac surgical procedures are also performed at Tygerberg Hospital in Cape Town and closed procedures at other centres in the Province, such as East London and Port Elizabeth.

The majority of our patients therefore come from the Cape, but a significant percentage hail from elsewhere in the RSA and abroad. The number of patients from outside Africa is, however, slowly declining and will continue to do so, for it has become our policy not to accept patients for routine cardiac surgical procedures from countries where adequate surgical facilities are available. The countries of origin of adults and children operated on during 1975 (chosen for the accessibility of accurate records) and 1981 are shown in Table I and the ethnic groups in Table II. Whereas Coloured patients made up 36% of the total in 1975, by 1981 they constituted 44%; this increase was seen in both sexes and in all age groups. Black patients made up only 13% of the total in 1975, and still constituted only 17% by 1981, the major increase in numbers being in women and children. The percentage of White patients fell from 51% to 40% over this

TABLE I. COUNTRIES OF ORIGIN OF PATIENTS OPERATED ON IN 1975 AND 1981

	1975		1981	
	GHS	RXH	GSH	RXH
<b>RSA and SWA</b>	<b>250 (75%)</b>	<b>152 (79%)</b>	<b>476 (94%)</b>	<b>214 (90%)</b>
<b>Other African countries</b>				
Angola	10	2	—	—
Botswana	1	—	2	7
Kenya	—	—	—	1
Malawi	—	2	1	3
Mozambique	4	4	5	—
Zambia	—	—	1	—
Zimbabwe/ Rhodesia	9	3	11	2
<b>Other countries</b>				
Greece	5	4	2	—
Italy	6	11	2	—
Mauritius	23	5	—	6
Romania	24	6	1	4
Seychelles	—	3	3	1
Sri Lanka	—	—	1	—
Turkey	1	—	1	—
UK	1	—	—	—
USA	1	—	—	—
<b>Foreign countries total</b>	<b>85 (25%)</b>	<b>40 (21%)</b>	<b>30 (6%)</b>	<b>24 (10%)</b>

GSH = Groote Schuur Hospital, RXH = Red Cross War Memorial Children's Hospital.

TABLE II. ETHNIC GROUPING AND SEX OF PATIENTS OPERATED ON IN 1975 AND 1981

	1975						1981					
	GSH		RXH		Total		GSH		RXH		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<b>White</b>												
Male	89	27	40	20	129	25	154	32	31	14	185	27
Female	83	25	54	28	137	26	58	12	30	14	88	13
Total	172	51	94	49	266	51	212	45	61	29	273	40
<b>Coloured</b>												
Male	61	18	27	14	88	17	107	22	41	19	148	21
Female	61	18	42	22	103	20	95	20	58	27	153	22
Total	122	37	69	36	191	36	202	42	99	46	301	44
<b>Black</b>												
Male	21	6	16	8	37	7	25	5	30	14	55	8
Female	18	5	14	7	32	6	37	8	24	11	61	9
Total	39	12	30	16	69	13	62	13	54	25	116	17
<b>Total</b>	<b>333</b>	<b>100</b>	<b>193</b>	<b>100</b>	<b>526</b>	<b>100</b>	<b>476</b>	<b>100</b>	<b>214</b>	<b>100</b>	<b>690</b>	<b>100</b>

TABLE III. ETHNIC GROUPING AND SEX OF PATIENTS OPERATED ON FOR ISCHAEMIC HEART DISEASE, 1977 - 1981\*

	1977		1978		1979		1980		1981	
	No.	%	No.	%	No.	%	No.	%	No.	%
<b>White</b>										
Male	54	77	68	71	63	69	73	66	87	67
Female	2	3	5	8	7	8	8	7	14	11
<b>Coloured</b>										
Male	13	19	18	18	16	17	25	22	26	20
Female	1	1	3	3	5	6	5	5	2	2
<b>Total</b>	<b>70</b>	<b>100</b>	<b>94</b>	<b>100</b>	<b>91</b>	<b>100</b>	<b>111</b>	<b>100</b>	<b>129</b>	<b>100</b>

\*No Black patients underwent coronary artery bypass grafting.

6-year period, despite a considerable increase in the number of men undergoing operative treatment for ischaemic heart disease (Table III).

### Overall workload and mortality

The total number of patients (including both adults and children) operated on each year during the 11-year period under review varied from 434 in 1971 to a maximum of 690 in 1981 (Fig. 1). The significant rise in the number of operations performed in 1975 and 1976 was related to an increase both in valve replacement and operations for ischaemic heart disease. The fall in the overall number of operations performed during 1980 was entirely related to abnormal local factors, including a temporary closure of the operating theatres at Red Cross Hospital for renovation work over a period of 9 months; this necessitated a greatly reduced number of operations, all performed at Groote Schuur Hospital, on patients of all ages.

Operations for ischaemic heart disease continue to increase steadily, although there has been a slight decline in the number of valve replacements performed during the last 3 years. Operations for congenital heart disease have varied little in number throughout the 11-year period, with a minimum of 185 in 1972 and a maximum of 241 in 1978.

Although the number of operations for valve disease has risen over the 11 years, they have formed a fairly constant proportion of the totals — 45% in 1971 and 39% in 1981. Operations for ischaemic heart disease, on the other hand, provided only 4% of the total in 1971, but had increased to 19% in 1981. The percentage of operations for congenital heart disease showed a decline from 44% in 1971 to 30% in 1981, although the actual annual

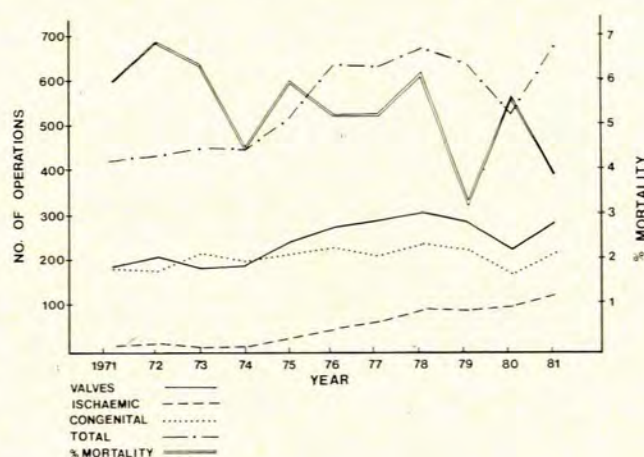


Fig. 1. Total number of cardiac operations performed, 1971-1981, and related hospital mortality. The numbers of operations for valvar, ischaemic and congenital heart disease are also shown.

number of procedures has changed little throughout the period; the fall in percentage can be explained by the increase in operations for ischaemic heart disease and valve disease rather than by any actual decline in the number of operations for congenital heart disease. Other procedures (e.g. aortic aneurysmectomy, pericardiectomy, and heart transplantation) make up only a relatively small number each year, and formed 6% of the total in 1971 and 6% in 1981, with a minimum of 4% (1972) and a maximum of 12% (1976). The number of heart transplants performed each year is shown in Fig. 2.

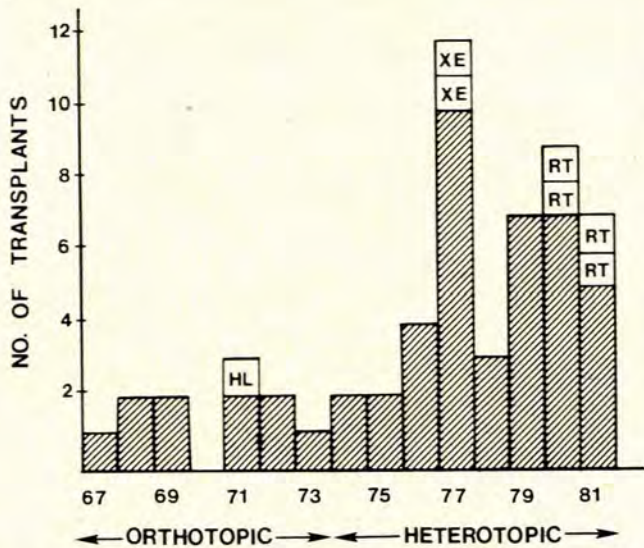


Fig. 2. Number of heart transplants performed 1969 - 1981 (HL = transplantation of heart and both lungs; XE = xenograft; RT = re-transplantation).

Overall hospital mortality has varied from a minimum of 3,4% in 1979 to a maximum of 6,5% in 1973. There has possibly been a trend towards a slight reduction in mortality over the course of the 11 years, the average yearly mortality being 6,1% between 1971 and 1975 and 5,0% between 1976 and 1981.

### Surgery for valve disease

A more detailed analysis of operations for valve disease in adults is shown in Fig. 3. The total number of open-heart procedures rose markedly during the years 1975 (189) to 1978 (284). (The fall during 1980 was due to the local factors already discussed.) This increase involved procedures on the mitral valve, the aortic valve, and two or more valves; the actual number of prosthetic valves inserted increased by a similar percentage.

Although it remains the policy of our unit to perform closed mitral valvotomy whenever this is deemed suitable on clinical grounds, there has been a fall in the number of these operations carried out in recent years. A maximum of 59 closed mitral



Fig. 3. Number and related hospital mortality of operations performed in adults for valve disease, 1971 - 1981 (AVR = aortic valve replacement; MVR + An = mitral valve replacement or mitral annuloplasty; valvotomies = closed mitral valvotomies).

valvotomies in 1972 fell to a minimum of 7 in 1978. This may reflect more stringent criteria for selection for closed valvotomy, or more confidence on the part of the surgeon in obtaining a better result by an open procedure. During the first 5 years of this study, the yearly average was 47 valvotomies, which represented 20,5% of the total number of valve operations; during the second 6-year period it had fallen to 24 (10,2%).

Rheumatic valve disease remains a major problem in the Cape Province, particularly in the lower socio-economic classes. The increased number of cases is due to a continuing referral of new patients together with a steady return of patients requiring replacement of previously implanted and now malfunctioning prostheses. Malfunction of bioprostheses (e.g. porcine heterografts) results largely from calcification, leading to stenosis or regurgitation; with mechanical prostheses, malfunction is usually related to thrombosis which may be accompanied by embolism.

There has been a substantial reduction in the hospital mortality associated with valve surgery, from a maximum of 8,3% in 1972 to 2,2% in 1980. During the period 1971-1975 the average yearly mortality was 7,6%; between 1976 and 1981 it had fallen to 4,7%. This reduction in mortality is probably related in part to improved methods of myocardial protection during valve insertion, namely the use of cardioplegia.

The mortality associated with closed mitral valvotomy remains low; there were only 4 deaths in 380 cases (1,1%) during the 11-year period, only 1 of these since 1973.

### Surgery for ischaemic heart disease

There has been a dramatic increase in operations for ischaemic heart disease, beginning in 1975 (Fig. 4). Before 1975 few procedures for ischaemic heart disease were performed, these consisting mainly of the Vineberg operation and left ventricular aneurysmectomy. Vineberg operations are no longer performed and the incidence of aneurysmectomy remains constant at between 1 and 6 per year. The great increase has been due entirely to the advent of coronary artery bypass grafting using the saphenous vein, and the increase continues. In the Cape ischaemic heart disease affects mainly the White male population, but is being seen increasingly in the White female and Coloured male groups (Table III).

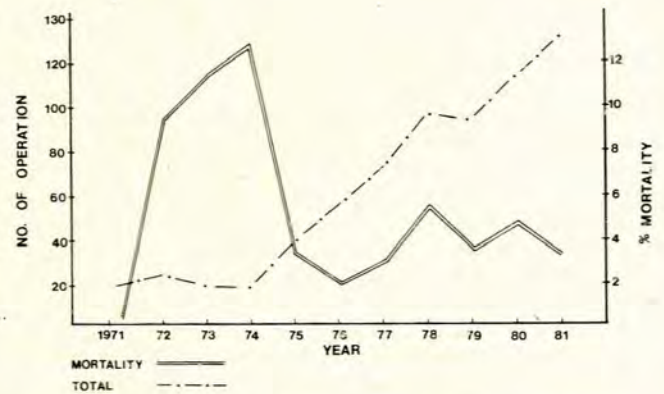


Fig. 4. Number and related hospital mortality of operations performed for ischaemic heart disease, 1971 - 1981.

The mortality associated with these procedures has shown a marked fall; coronary artery bypass grafting, in particular, is associated with a low mortality. The higher mortality in the first 5 years of this study (mean yearly mortality 7,3%) was partly associated with the type of operation performed, but was greatly influenced by the small number of such procedures; one death greatly increases the percentage mortality. The average yearly

mortality during 1976-1981 was 3,5%; this included patients undergoing myocardial revascularization with and without aneurysmectomy and patients with poor left ventricular function from previous myocardial infarction. Myocardial revascularization is undoubtedly the 'growth area' of cardiac surgery at the present time.

**Surgery for congenital heart disease**

The total number of operations (both open and closed) for congenital heart disease per year has remained relatively constant (Fig. 5), averaging 205 per year between 1971 and 1975 and 216 per year between 1976 and 1981. The numbers of operations on adults and infants (children under the age of 1 year) have remained basically constant, although there has been a slight increase in the number of operations performed on children under the age of 15 years.

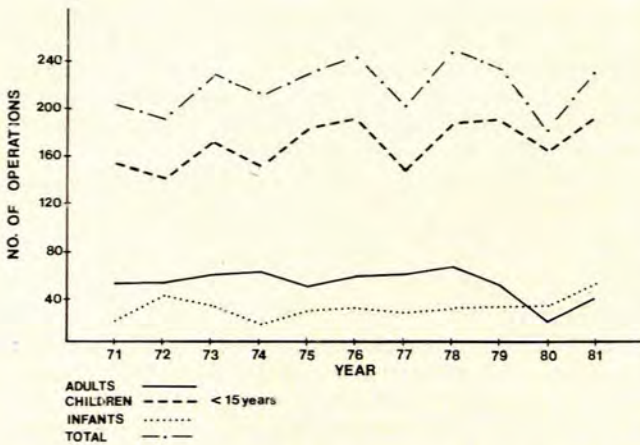


Fig. 5. Number of operations performed for congenital heart disease, 1971 - 1981. The numbers of operations on adults, on children under 15 years, and on infants are also shown.

Simple congenital lesions were the first cardiac disorders amenable to correction by surgery; the absence of a significant increase in the number of operations for congenital heart disease over the past 11-year period would suggest that presentation of such patients in the Cape is static. There is almost certainly a large pool of untreated patients in many African countries, but as yet these patients are not being referred to South Africa in large numbers.

The proportion of closed to open surgical procedures has remained fairly constant. The percentage of open procedures per year varied in adults from 69% to 91%, in children (under 15 years) from 61% to 90%, and in infants from 46% to 75%. No obvious trend towards performing more or fewer open procedures in each age group is noticeable. An increase in the number of open-heart procedures performed in infancy and a coincident fall in closed palliative procedures might have been expected, as there has been much debate in recent years among surgeons about performing corrective operations at an early age in certain specified conditions; no significant trend has been reflected in our figures.

Mortality in the various age groups has fluctuated widely (Fig. 6). The numbers of patients in the adult and particularly in the infant groups are relatively small, and therefore one death can affect the percentage mortality markedly. There would, however, appear to be a slight increase in mortality in the later part of the 11-year period in the under-15 age group; the reason for this remains obscure. This group includes infants, but mortality in the infant group would not appear to have changed significantly, the annual mortality rate of 25% being identical between 1971 and 1975 and 1976 and 1981.

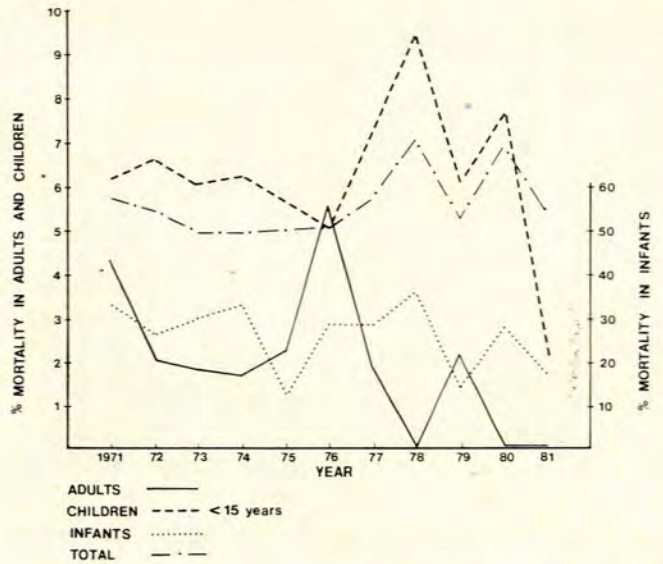


Fig. 6. Hospital mortality associated with operations performed for congenital heart disease, 1971 - 1981.

Cardiac surgery, whether palliative or corrective, is only performed in infancy in life-threatening conditions; both open and closed operations carry a high mortality. Closed operations were associated with an average yearly mortality of 26% in the first 5 years of this study and 20% during the next 6 years, although the number of operations involved was very small (average 10 per year). There was, however, a marked rise in the number of closed procedures in infants to 26 during 1981 with an associated mortality of 11%; the reasons for this significant increase in the number of closed operations in this age group remain uncertain, but would appear to be related to greater referral of Black infants from rural areas. Open operations carried a mortality of 26% during both the periods 1971 - 1975 and 1976 - 1981.

The lack of improvement in the mortality rate among patients of all ages undergoing surgery for congenital heart disease is disappointing, particularly as it does not reflect a more ambitious approach on the part of surgeons attempting correction of complex conditions previously deemed inoperable (Fig. 7); there has, in fact, been a slight fall in the number of complex forms of congenital heart disease operated on during the period of study.

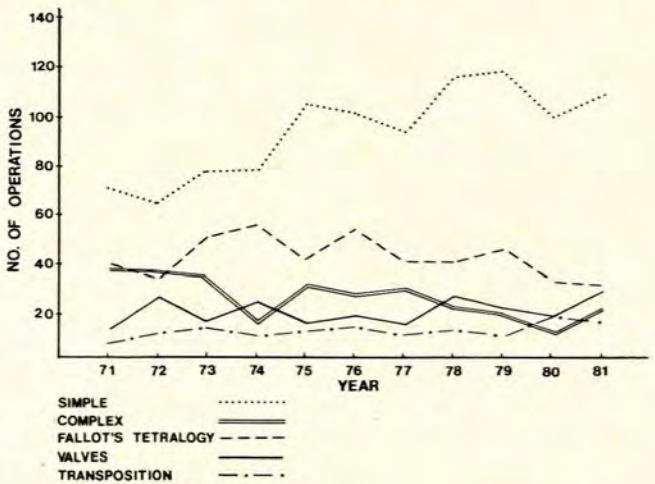


Fig. 7. Numbers of operations performed for various cardiac conditions in children, 1971 - 1981.

## Surgery in children

The majority of cardiac surgical procedures in children (under the age of 15 years) involved correction or palliation of congenital lesions, operations for valve disease forming only 7-15% of the yearly total (Fig. 7).

A small increase in the total number of operations performed on children, from an annual average of 173 between 1971 and 1975 to 194 between 1976 and 1981, was largely due to an increase in operations for 'simple' congenital conditions such as atrial and ventricular septal defects, patent ductus arteriosus, coarctation, and pulmonary and aortic valve stenosis. The number of operations for Fallot's tetralogy and transposition of the great arteries remained fairly constant, and procedures for the more 'complex' congenital lesions, such as total anomalous pulmonary venous drainage, complete atrioventricular canal, single ventricle, pulmonary atresia and tricuspid atresia have actually diminished (1971 - 1975: 29 a year; 1976 - 1981: 21 a year).

## Causes of hospital mortality

Causes of operative and postoperative deaths have not been analysed in detail. There would, however, appear to be no significant change in factors relating to mortality throughout the 11-year period.

Postoperative myocardial failure in patients with advanced valve disease and in children with complex and congenital lesions remains a major cause of death despite improved methods of preoperative myocardial protection and postoperative circula-

tory support. This problem is most commonly related to patients who have presented themselves very late for consideration of surgical treatment; myocardial function is frequently extremely poor as a result of long-standing, unrelieved valve disease. The general state of the patient at the time of operation is also an important factor in postoperative morbidity and mortality; emergency procedures on moribund patients obviously carry a very high risk.

Myocardial infarction in both valve and ischaemic heart disease patients, thrombo-embolism following valve replacement, and respiratory conditions such as adult respiratory distress syndrome and pulmonary infection remain significant causes of mortality. Complications of operative technique or judgement (e.g. failure to relieve pulmonary outflow tract obstruction in Fallot's tetralogy, thrombosis of pulmonary-systemic shunts in infants and children) have become relatively infrequent.

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## REFERENCES

1. Schrire V, Barnard CN. An analysis of cardiac surgery at Groote Schuur Hospital, Cape Town, for the 14 years April 1951 - April 1965: Part I. Acquired heart disease. *S Afr Med J* 1966; **40**: 279-284.
2. Schrire V, Beck W, Barnard CN. An analysis of cardiac surgery at Groote Schuur and Red Cross War Memorial Children's Hospitals, Cape Town, for the 14 years April 1951 - April 1965: Part II. Congenital heart disease. *S Afr Med J* 1966; **40**: 461-467.