Experience with cardiac valve operations in Cape York Peninsula and the Torres Strait Islands, Australia

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ABSTRACT

Objective: To describe the outcome of valve surgery, for rheumatic heart disease (RHD) and non-RHD, in residents of Cape York Peninsula and the Torres Strait Islands referred to the Cairns Base Hospital specialist outreach service.

Design and participants: Retrospective review of medical records on all patients residing in the outreach area who had surgery for valvular heart disease between 1 January 1992 and 31 December 2004.

Main outcome measures: Operation type and perioperative characteristics; 5- and 10-year survival rates; reoperation rates; complications.

Results: Forty-seven patients met the selection criteria; the median age was 40 years (range, 4–76 years); and 39 patients were Indigenous. RHD was the predominant cause of valve dysfunction (30/47 patients). Thirty-seven patients had valve replacements, six had valve repair and four had balloon valvotomy as the initial procedure. There were three bleeding complications, two episodes of operated valve endocarditis, and six embolic complications. There were nine valve-related deaths (six in the first 5 years). At 5 years, all seven patients who had had valve repair or balloon valvotomy were alive. Seven of the 47 patients required reoperation. Survival analysis showed freedom from valve-related deaths to be 83% (95% CI, 66%–92%) at 5 years and 61% (95% CI, 33%–80%) at 10 years. Freedom from reoperation at 5 years was 88% (95% CI, 71%–95%). Among the 30 patients with RHD, freedom from valve-related death was 80% (95% CI, 60%–92%) at 5 years and 52% (95% CI, 21%–75%) at 10 years. In patients with RHD, freedom from reoperation at 5 years was 87% (95% CI, 65%–96%).

Conclusion: Valvular heart disease results in substantial morbidity and mortality, despite intervention. Efforts need to focus on prevention of rheumatic fever and closer follow-up.

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Cape York Peninsula and the Torres Strait Islands are home to about 20 000 people, up to 75% of whom are Indigenous Aboriginals and Torres Strait Islanders.[1] Although acute rheumatic fever is considered a rare disease in other developed countries, it has an unusually high incidence in this population and places a significant health burden on these communities.[2-4] The annual incidence of acute rheumatic fever in children aged 5–14 years has been estimated at 107/100 000 in Cape York Peninsula and 136/100 000 in the Torres Strait Islands.[5] This is less than in the Top End of the Northern Territory, where incidence is reported to be between 202/100 000[5] and 245/100 000.[6] Many of these patients eventually require surgery for rheumatic valvular disease.[6]

We describe here the outcome of valve surgery, for both rheumatic and non-rheumatic heart disease, in patients from Cape York Peninsula and the Torres Strait Islands over a 13-year period.

This region is serviced by specialist physicians and paediatricians from Cairns Base Hospital's outreach service, in conjunction with local medical officers, the Royal Flying Doctor Service, remote area nurses and Indigenous health workers. For the cases we reviewed, cardiac surgery was performed at either Townsville General Hospital or Prince Charles Hospital in Brisbane. The outreach service provided portable echocardiography locally in these communities throughout the study period.

METHODS

Inclusion criteria and data collection

To be included in the analysis, patients needed to be permanent residents of the catchment area and to have valvular heart disease of any cause that required surgery. Patients were identified from the specialist service records and the operation records of the relevant surgical centres. Clinical, echocardiographic and cardiac catheterisation data were obtained from the specialist clinical summaries and correspondence; medical records of Cairns Base Hospital and regional hospitals; and the relevant surgical centres. Mortality data were obtained from death certificates, medical records and autopsy reports.

Patients who had their first procedure between 1 January 1992 and 31 December 2004 were included, with the date of the valve procedure being taken as the entry point for each patient. Complete operative lists were available from January 1992, and we used this as the earliest entry date for survival analysis. End points included death and major complications. Complications included reoperation, bleeding (requiring hospitalisation), thromboembolism, and endocarditis of the operated valve. In the absence of death, patients were censored at 31 December 2004.

No patients were lost to follow-up. Two patients who had been reviewed in the outreach clinics were excluded, as they were not permanent residents of the region. Patients with reoperations during the study period who had initial surgery before 1992 were not included. Follow-up was by regular outpatient clinics in the community, or hospital admissions as required.

Definitions

Mortality data were expressed in accordance with published guidelines for reporting survival analyses.[7] Deaths were classified as either valve-related or non-valve-related. Major complications were reported according to the American College of Cardiology/American Heart Association guidelines for reporting complications of prosthetic heart valves.[8]

Preoperative pulmonary artery pressure (PAP) was classified as normal (< 35 mmHg), mildly elevated (36–45 mmHg), moderately elevated (46–65 mmHg) or severely elevated (> 65mmHg). Preoperative left ventricular (LV) function was reported as normal (LV fractional shortening [FS] > 30% and LV systolic diameter < 45 mm on echocardiography; or if function reported as normal at cardiac catheterisation); or impaired

1 Patient characteristics ($n = 47$)

Ethnicity	Number (%)
Aboriginal	25 (53%)
Torres Strait Islander	14 (30%)
Non-Indigenous	8 (17%)
Age at surgery, in years	**Median (range)**
Overall	40 (4–76)
Aboriginal	38 (9–62)
Torres Strait Islander	53 (4–47)
Non-Indigenous	63.5 (51–76)
Aetiology	**Number (%)**
Rheumatic	30 (64%)
Valve degeneration	6 (13%)
Bacterial endocarditis	4 (9%)
Congenital	3 (6%)
Syphilis	1 (2%)
Cystic medial necrosis	1 (2%)
Uncertain	2 (4%)

(FS < 30% or LV systolic diameter > 45 mm on echocardiography; or if function reported as impaired at cardiac catheterisation).

Valve dysfunction was attributed to rheumatic heart disease (RHD) at the discretion of experienced echocardiographers using accepted morphological criteria.[9] Portable Doppler echocardiography was only available from 2000.

Statistical analysis

Kaplan–Meier life tables were generated with Stata/SE software version 8 (StataCorp, College Station, Tex, USA) for overall patient survival and survival free of reoperation. Other results are reported as simple proportions.

Ethical approval

Ethical approval was obtained from the Cairns Base Hospital Ethics Committee.

RESULTS

Forty-seven patients were included in our analysis (Box 1). Of 30 patients who had echocardiographic evidence of RHD, 20 gave a history of past rheumatic fever.

Valve procedures

Thirty-seven patients had valve replacements, 29 with mechanical valves and eight with bioprosthetic valves (Box 2). The mechanical valves used were produced by CarboMedics Inc (Austin, Tex, USA) (18 patients), St Jude Medical (St Paul, Minn, USA) (eight patients) and ATS Medical Inc (Minneapolis, Minn, USA) (three patients). The eight bioprosthetic valves were all singleton replacements.

Six patients had isolated open mitral repair and four had mitral balloon valvotomy. The balloon valvotomy patients were included because some of them then went on to have open surgery for the same disease. Six patients had combined valve replacement and valve repair.

Perioperative status

Preoperative LV function was normal in 32/47 patients, impaired in 14/47 and unknown in 1/47. PAP was normal in 16/47, mildly elevated in 5/47, moderately elevated in 11/47, severely elevated in 6/47 and unknown in 9/47.

Only 3/47 patients were asymptomatic, and symptom status was unknown in 5/47. The remaining 39 had symptoms of RHD, endocarditis or coexisting ischaemic heart disease. The severity of symptoms was not recorded. Ischaemic heart disease was documented in 11/47 patients, absent in 31/47 and of unknown status in 5/47.

Thirty-four patients received anticoagulant.

Follow-up

Patients were followed after operation for a total of 280 person-years. The mean length of follow-up was 71 months (median, 78.5 months; range, 3–154 months). The median review interval was once every 20 months (range, 1–110 months).

Complications

There were major bleeding complications in three of the 34 anticoagulated patients, all of whom had mechanical valves. In one case, the bleeding was fatal. The other two patients experienced gastrointestinal bleeds with no residual complications.

There were two episodes of operated valve endocarditis, one of which required a second valve replacement. Both involved mechanical valves.

Six postoperative embolic complications occurred among five patients: three transient ischaemic attacks, two major strokes (one of which was fatal), and one pulmonary embolism. Four of the five patients had received anticoagulation treatment. Three had mechanical valves.

Valve-related mortality

There were 13 deaths, of which nine were established to be valve-related. Six of the valve-related deaths occurred in the first 5 years. No deaths were recorded in the first month after a procedure. Causes of valve-related death were sudden death, valve dysfunction, stroke and intracranial bleeding. The four non-valve-related deaths were attributed to renal failure, pneumonia, scleroderma lung disease and ischaemic heart disease.

2 Original procedures, number of reoperations and number of valve-related deaths for 47 patients undergoing cardiac valve procedures, 1992–2004

Original procedure	Type of valve inserted	Heart valve replaced	Reoperation (time*)	Valve-related deaths (time*)
Valve replacement ($n = 37$)	Mechanical ($n = 29$)	Dual mitral and aortic ($n = 7$)		3 (50,54,19)
		Mitral (two with tricuspid repair) ($n = 12$)		1 (30)
		Aortic (three with mitral repair) ($n = 10$)	1 (19)	2 (36,29)
	Bioprosthetic ($n = 8$)	Aortic heterograft (one with mitral repair) ($n = 3$)	1 (21)	
		Mitral heterograft ($n = 2$)		
		Aortic homograft ($n = 3$)	2 (29,130)	
Open mitral repair ($n = 6$)			1 (107)	1 (108)
Mitral balloon valvotomy ($n = 4$)			2 (58,49)	2 (80,115)

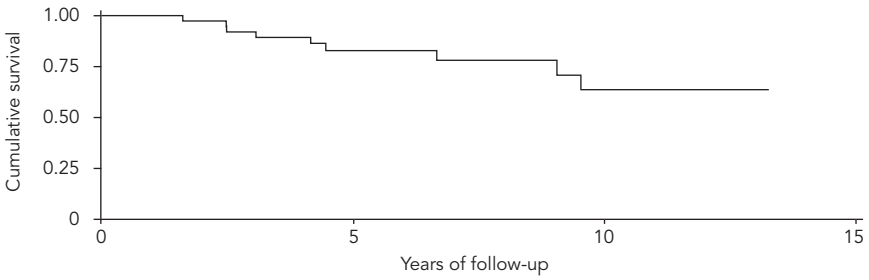
* Time (in months) after original procedure. ◆

3 Mitral valve procedures for rheumatic mitral valves in 30 patients, 1992–2004*

Initial procedure	Number	Valve-related deaths	Median age at surgery (years)
Mitral repair	4	1†	16
Mitral balloon valvotomy	4	2‡	36
Mitral mechanical replacement ± tricuspid repair§	9	1	30
Mitral bioprosthesis	1	0	51
Dual mechanical valve replacements	7	3	28
Mitral repair + mechanical aortic replacement	3	1	26
Mitral repair + bioprosthetic aortic replacement	1	0	9

* Mean follow-up period, 71 months. † Death occurred after reoperation. ‡ Two deaths occurred after valve deterioration, one in a patient who had had dual replacement, and one in a patient who declined surgery. § Two patients had both procedures. ◆

4 Freedom from valve-related deaths among 47 patients undergoing cardiac valve operations, 1992–2004



Seven of the nine valve-related deaths occurred in patients with moderately or severely raised PAP (PAP status was unknown in the other two patients). No valve-related deaths were recorded in the 21 patients with normal or mildly elevated PAP.

Four of the nine valve-related deaths occurred among the 32 patients with normal LV function. Among 14 patients with impaired LV function and one with unknown LV function, five valve-related deaths occurred.

Of patients with RHD, 29/30 had mitral valve procedures (Box 3). One patient with RHD had a homograft aortic valve and was still alive at 94 months' follow-up. At 5 years' follow-up, all seven patients who had undergone valve repair or valvotomy alone were still alive.

Reoperations

Seven patients had valve dysfunction requiring a second operation. Reoperations were performed at a median interval of 49 months (range, 19–130 months).

One of the seven was a non-Indigenous man with degenerative valvular disease. His mechanical aortic valve required reoperation because of staphylococcal endocarditis. He was the only one of 29 patients with a mechanical valve who required reoperation. No cases of structural valvular deterioration requiring surgery were seen in this group.

The six other patients were Indigenous people, of whom five had RHD. One patient had a homograft aortic valve replaced. Histological examination of the explanted valve showed non-Hodgkins lymphoma. In total, three of the eight bioprosthetic valves, one of the six open mitral repairs and two of four mitral balloon valvotomies required subsequent replacement as a result of valve dysfunction (Box 2).

There were two deaths in patients who underwent reoperation, the first at 1 month and the other at 57 months after operation. Both occurred in patients with rheumatic mitral valvular disease who had initial conservative procedures and then had dual mitral and aortic valve replacements, one patient with mechanical valves and the other with bioprosthetic valves.

Survival analysis

In the whole cohort, freedom from valve-related deaths was 83% (95% CI, 66%–92%) at 5 years and 61% (95% CI, 33%–80%) at 10 years (Box 4). Freedom from reoperation was 88% (95% CI, 71%–95%) at 5 years (not shown).

Among the 30 patients with RHD, freedom from valve-related deaths was 80% (95% CI, 60%–92%) at 5 years and 52% (95% CI, 21%–75%) at 10 years. Freedom from reoperation was 87% (95% CI, 65%–96%) at 5 years.

DISCUSSION

Ours is the first study to document outcomes of cardiac surgery in Cape York Peninsula and the Torres Strait Islands. The 5-year survival rate of 83% in our study is similar to or better than survival figures published for valve surgery in older, non-Indigenous patients who are more likely to have degenerative valvular disease, in whom the 5-year survival rate is 70%–80%.[10-15] Younger patients with rheumatic mitral valve repair or replacement alone typically have a 5-year survival rate of over 90%.[16-20] These figures vary greatly depending on the type of surgery, the number of valves involved and the population studied. The question is whether outcomes in the population we studied could be improved, given that the median age of our cohort was only 40 years.

The only other comparable study of Indigenous patients undergoing cardiac valve replacement for RHD was done in the Northern Territory.[21] The 5-year survival rate of 79% in the NT study was similar to the rate of 83% in our cohort. The 10-year survival rate was also similar (68% in the NT study compared with 61% in our study). Ninety-three per cent of the NT patients had mechanical valve replacements. As follow-up and data collection were noted to be very difficult in the NT cohort, it is possible that complication rates were under-reported.

The main limitation of our study was that it was too small to perform meaningful regression analysis to identify high-risk groups. For example, it would have been useful to know whether those who received anticoagulant had significantly higher rates of complications. We did observe that no valve-related deaths occurred in patients with normal or mildly elevated PAP. High PAP may be a surrogate marker for proceeding to "last resort" surgery in some patients. LV dysfunction has previously been shown to predict poorer outcomes,[21] but 71% of our patients had normal preoperative LV function. Despite this, a large number of patients were symptomatic by the time of

surgery. Another limitation of our study was the wide variation in review intervals: some patients would come for frequent assessment for a short time, then the review interval would be extended. The median follow-up interval of 20 months is still longer than ideal. The availability of close follow-up and ambulatory echocardiography is important for monitoring valve dimensions, LV function, PAP, symptoms, and the need for intervention.

A number of studies, including a recent meta-analysis,[22] suggest that repair of rheumatic mitral valves is superior to replacement.[20,22-27] The number of patients in our cohort was not high enough for our results to contribute directly to this comparison. However, it is worth noting that, of the seven patients who had dual mechanical valves placed, three have died and one is in a vegetative state after multiple embolic strokes. A further patient had dual mechanical valves placed at reoperation, then had a valvular thrombosis and died shortly afterwards. Thus, five of eight patients with dual mechanical prostheses had a poor outcome, the four deaths occurring within 5 years. In contrast, all seven patients with valve repairs or valvotomies and no valve replacement were alive at 5 years. The proportion of procedures that were repairs in our study is lower than that reported in some centres,[20] and it may be that conservative surgery should be more readily available. Repair of rheumatic valves can be difficult, and perhaps procedures should be performed in a small number of centres by surgeons with expertise and extensive experience in this field.

Careful selection of patients is important, particularly if multiple valves require replacement. The many complications of anticoagulation therapy can be a problem in remote areas. Some patients manage anticoagulation reliably and should not be denied best treatment. Others find compliance very difficult. Even hospital anticoagulation clinics in the United Kingdom have historically achieved poor results with anticoagulation therapy, with less than 50% of patients achieving therapeutic international normalised ratios (INRs).[28] Using "finger prick" INR testing is being trialled in some communities to provide timely feedback on anticoagulation.

Valvular heart disease in north-eastern Australia results in significant morbidity and mortality. Outcomes may be improved by closer preoperative and postoperative observation. As experience grows, more repairs, rather than mitral valve replacements, may be beneficial. Our main focus should be on primary and secondary prevention of RHD, as this will be the most effective treatment in the long run.

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COMPETING INTERESTS

None identified.

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