# PROSTHETIC VALVE REPLACEMENT IN CHILDREN

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This report describes our experience with prosthetic valve replacement in children under the age of 16 years during the period 1968 to 1971. Prosthetic valves were replaced in 63 children and the period of follow-up ranged from 6 months to 4½ years.

Table I shows the indications for operation and the underlying valve pathology. Fig. 1 shows the age range of the patients: the youngest was 4 years old and half were 12 to 15 years old. Table II shows the racial incidence, most of the patients were African. Seven patients had undergone previous operations: mitral valvulotomy in 2, mitral annuloplasty in 3, mitral valve replacement in 1 and ligation of a persistent ductus arteriosus in another.

Fig. 2 shows the number of patients in whom a valve was replaced, the type of prosthesis used and the patients who died. A cloth-covered Starr-Edwards mitral valve prosthesis was placed in 32 patients, 7 died. Mounted inverted aortic homografts were placed in the mitral position in 15 children without mortality. A Beall valve was inserted in 2 and a Hammersmith mitral valve in one. A cloth-covered Starr-Edwards prosthesis was placed in the aortic position in 4 patients, a mounted inverted aortic homograft in one and the University of Cape Town aortic prosthesis in another. Two patients had aortic and mitral valve replacement with a Starr-Edwards valve. Three had an aortic and mitral valve replacement with a homograft and there was another small miscellaneous group.

Pre-operative disability was graded according to the criteria of the New York Heart Association and the pre- and post-operative status of the patients shown in Table III. The patients were severely disabled. They had important pulmonary arterial hypertension and more than half had a mean pulmonary arterial pressure of more than 50 mm.Hg. The degree of pre-operative pulmonary arterial hypertension was not related to operative mortality.

The children were rested in bed until cardiac failure had been controlled and were in an optimal clinical status at the time of operation. The range of bedrest ranged from 1 to 4 months.

An analysis of deaths is shown in Table IV. Eight deaths occurred in the immediate post-operative period. Two patients had active rheumatic fever and another had a myopathic process from sub-acute bacterial endocarditis. These 3 patients died in a low output state. One patient with congestive cardiomyopathy and severe mitral regurgitation was inappropriately selected for surgery, she died 4 days after operation. Two patients died of air embolism, 6 and 26 days after operation; one patient obstructed his endotracheal tube and another had a cardiac arrest in transit from the operating theatre to the intensive care ward. Neither could be resuscitated. There was one late death: in this patient a cloth-covered Starr-Edwards valve was placed in the mitral position and he died one year after operation from tissue ingrowth and a "stuck valve." Immediate and late deaths occurred in 14% of the patients submitted to valve replacement.

Residual post-operative disability is shown in Tables III and V. Active rheumatic carditis persisted or recurred in 5 patients at variable periods after operation. In one patient aortic incompetence progressed. Two patients developed post-operative atrial fibrillation but were converted to sinus rhythm. One patient has a persistent neurological defect. Two patients have mild peri-prosthetic valvar insufficiency, confirmed at post-operative cardiac catheterisation. This is mild and we have elected not to replace their valves. Three patients had a post-operative myopathy with poor left ventricular function and a low ejection fraction. The underlying cause is uncertain.

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Fig. 3 shows the typical radiological appearance before, and 19 months, after homograft mitral valve replacement. Before operation the heart was greatly enlarged with distension of the upper zone pulmonary veins and enlargement of the main pulmonary artery. After operation, the size of the heart and the pulmonary vascular changes returned to normal. Fig. 4 analyses the change in heart volume before and after replacement of the mitral valve with a homograft or a

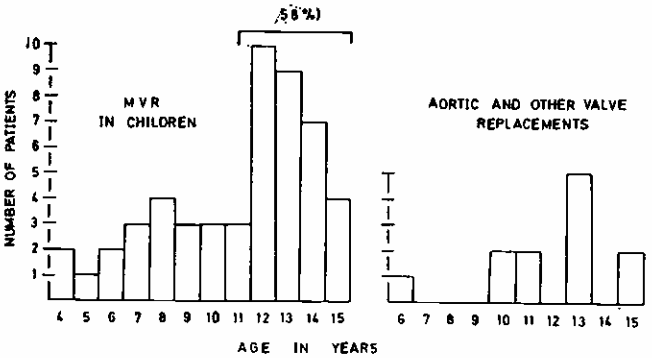


Fig. 1. The age range of the children who had prosthetic cardiac valve replacement.

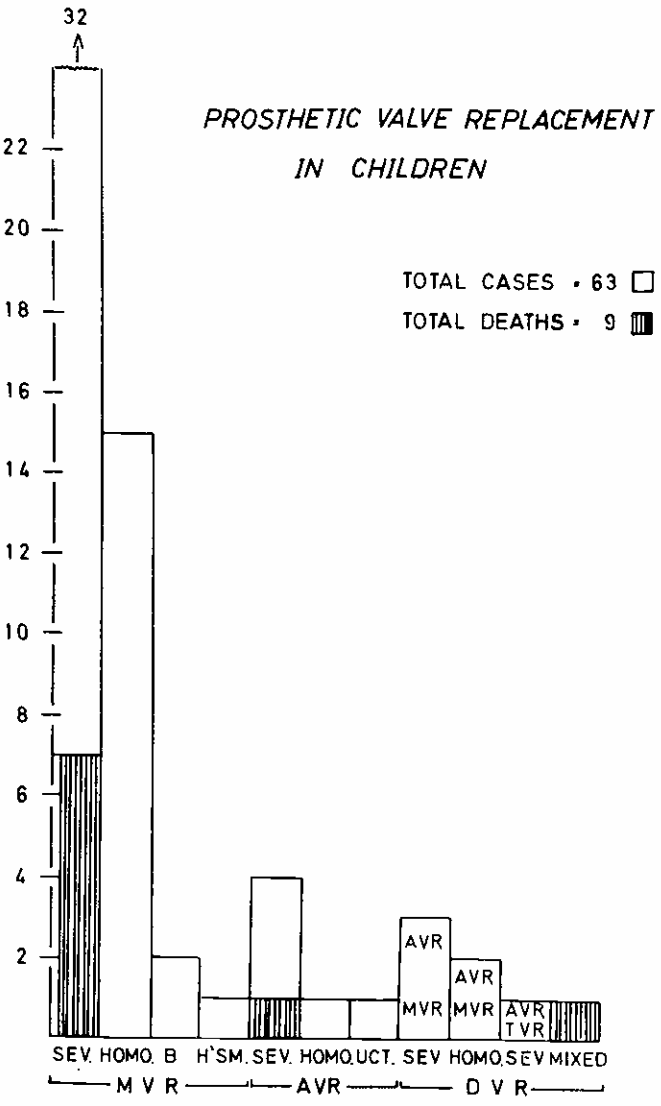


Fig. 2. The number of children in whom a valve was replaced, the type of prosthesis used and the patients who died.

TABLE I

INDICATIONS FOR OPERATION AND VALVE PATHOLOGY

| | | |
|---|---|---|
| **MITRAL VALVE REPLACEMENT** | | |
| Mitral incompetence | 39 | |
| Mixed mitral valve disease | 8 | |
| Calcific mitral stenosis | 4 | 51 |
| **AORTIC VALVE REPLACEMENT** | | |
| Aortic incompetence | 4 | |
| Aortic stenosis and incompetence (RHD) | 1 | |
| Aortic stenosis and incompetence (congenital) | 1 | 6 |
| **DOUBLE VALVE REPLACEMENT** | | |
| Mitral and aortic incompetence | 6 | |
| Mitral and tricuspid incompetence | 1 | 7 |
| TOTAL | | 64 |

TABLE II

RACIAL INCIDENCE

| | African | Indian | White |
|---|---|---|---|
| MVR | 39 | 10 | 2 |
| AVR | 2 | 3 | 1 |
| DVR | 6 | — | — |
| | 47 | 13 | 3 |

TABLE III

PRE AND POST-OPERATIVE DISABILITY

| | Pre-Operative Disability | | | | | Post-Operative Disability | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2a | 2b | 3 | 4 | 1 | 2a | 2b | 3 | 4 |
| Mitral valve replacement | — | — | — | 21 | 30 | 37 | 6 | 2 | — | — |
| Aortic valve replacement | — | — | 1 | 2 | 3 | 5 | — | — | — | — |
| Double valve replacement | — | — | — | 3 | 4 | 4 | — | 2 | — | — |

TABLE IV

VALVE REPLACEMENT IN CHILDREN
DEATHS IN 63 PATIENTS

| | | |
|---|---|---|
| 1. Myocardial failure | | 4 |
| Active carditis | 2 | |
| Post SBE | 1 | |
| Cardiomyopathy | 1 | |
| 2. Fault in post-operative management | | 2 |
| 3. Air embolism | | 2 |
| 4. Blocked prosthesis | | 1 |

TABLE V

RESIDUAL POST-OPERATIVE DISABILITY

| | |
|---|---|
| 1. Active rheumatic carditis | 5 |
| 2. Progression of rheumatic valvulitis | 1 |
| 3. Post-operative atrial fibrillation | 2 |
| 4. Neurologic deficit | 1 |
| 5. Peri-prosthetic valvar insufficiency | 3 |
| 6. Post-operative myopathy | 3 |

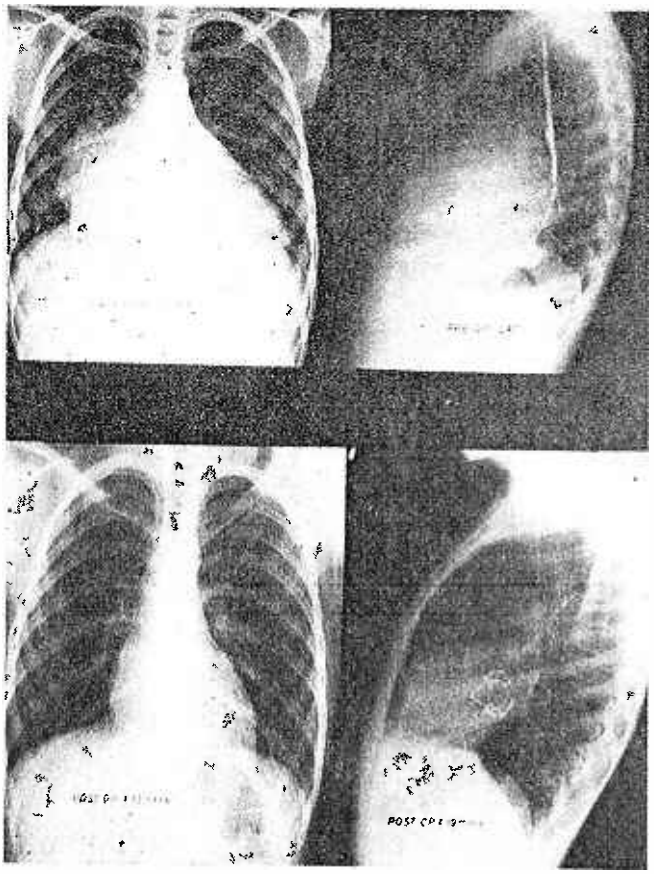

Fig. 3. A typical pre-and post-operative X-Ray of the chest before and after homograft valve replacement.

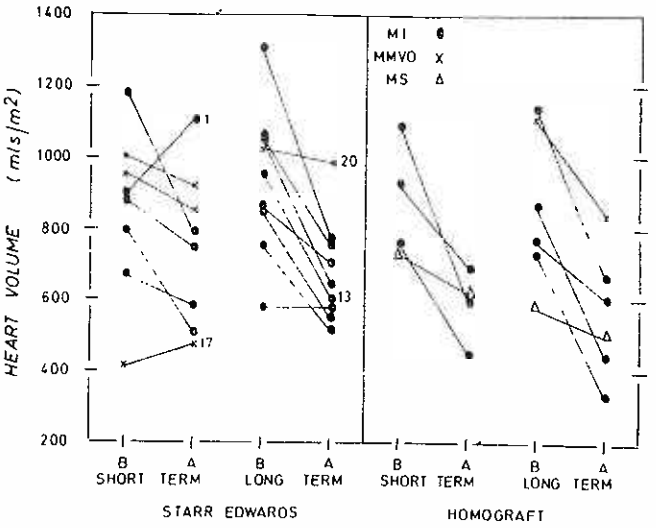


Fig. 4. The changes in heart volume before and after prosthetic valve replacement in the short and long term.

Starr-Edwards prosthesis. The patients were classified according to their pre-operative mitral valve pathology. They were also divided into two groups according to their period of post-operative surveillance: in the short term group surveillance was less than 3 months and in the long term group it ranged from 3 months to 3½ years. The normal heart volume for children is 450 mls/m$^2$ and all the patients had enlarged hearts. In the short term, there was an immediate reduction in heart volume in patients who had a homograft valve replacement. There was less improvement after a Starr-Edwards replacement. In the long term study, improvement occurred in both groups. Patients who are numbered had associated underlying pathology and are described in Table V.

The haemodynamic aberrations improved after surgery, mean pulmonary artery pressure decreased and was in the range of normal. Patients in whom a Starr-Edwards valve prosthesis had been inserted were left with an important gradient of 5-10 mm. across the valve.

There is a reluctance to undertake prosthetic valve replacement in childhood. Patients with important valvar disease require valve replacement if they have significant symptoms, severe valvar incompetence or severe pulmonary hypertension. In our hands, there is a low operative mortality and a low morbidity. The clinical status of the patients improved dramatically after operation. In contrast to adults, rheumatic fever still occurs and other valve lesions may progress. Our observations indicate that during the short period of follow-up, homograft valve replacement appears to be superior to replacement of the valve with a lateral orifice prosthesis.

# PREVALENCE STUDIES OF RHEUMATIC FEVER AND RHEUMATIC HEART DISEASE IN AN ISOLATED COMMUNITY IN THAILAND

By Punlope Podhipleux, Preecha Vichitbandha and Sombodhi Bukkavesa

The epidemiology of rheumatic fever was studied at Si-Chang, a relatively isolated island in the Gulf of Siam which populated 2,330 persons. Forty per cent of the population are aged between 5 to 15 years. The investigation was done for 5 months from August to December 1970. The socioeconomic and environmental factors were studied in correlation with the incidence of streptococcal infection, rheumatic fever and chronic rheumatic heart disease. The main occupation of the people is fishery. The living condition on the island is open fresh air and not crowded. The income and nutrition are average. The temperature, humidity and amount of rain fall were also studied. There was high incidence of streptococcal infection at the beginning and at the end of rainy season. 902 persons were examined at random. One case of active rheumatic fever with carditis and eleven cases of chronic rheumatic heart disease were found, none at the age between 5 to 15 years which is the most common age group for rheumatic fever in other places in Thailand. It is suggested that the incidence of rheumatic fever and rheumatic heart disease was high in older age group in this community. This may be due to crowded living condition of the adults, who stay in fishing boats most of the time.

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