

# Paediatric Open Heart Surgery in Trinidad and Tobago

## An Example of Collaborative Care

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### ABSTRACT

*Between September 1998 and February 2003, 204 children underwent cardiac surgery in Trinidad and Tobago to correct or palliate congenital heart disease. The defects included isolated ventricular or atrial septal defects as well as tetralogy of fallot and coarctation of the aorta. A few patients also had complex cyanotic congenital heart disease. The patients ranged in age from 2 days to 17 years. In some cases, palliative surgery was undertaken as a first step towards complete correction but the majority of patients underwent complete repair. The commonest postoperative complications were haemorrhage and small transient pericardial effusions. The overall mortality rate was < 1%. This paper describes the cardiac lesions, post-operative morbidity and mortality of these patients..*

# Cirugía Pediátrica a Corazón Abierto en Trinidad y Tobago

## Un Ejemplo de Cuidado Colaborativo

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### RESUMEN

*Entre septiembre de 1998 y febrero de 2003, 204 niños fueron sometidos a cirugía cardíaca en Trinidad y Tobago, a fin de corregir o paliar la enfermedad cardíaca congénita. Las cardiopatías incluían defectos septales atriales o ventriculares aislados, así como tetralogía de Fallot y coartación de la aorta. Algunos pacientes también presentaban cardiopatía congénita cianótica compleja. Los pacientes tenían edades que fluctuaban de dos días a 17 años. En algunos casos, la cirugía paliativa se emprendió como un primer paso hacia la corrección completa pero a la mayoría de los pacientes se les practicó la reparación completa. Las complicaciones más comunes del post-operatorio fueron hemorragias y pequeñas efusiones pericardiales transitorias. La tasa general de mortalidad fue <1%. Este trabajo describe las lesiones cardíacas, la morbilidad y mortalidad post-operatoria de estos pacientes.*

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### INTRODUCTION

Congenital heart disease constitutes a significant cause of paediatric morbidity in Trinidad and Tobago. At present, approximately 10 to 15 new patients are diagnosed each week in the paediatric cardiology clinic. Until 1998, all children requiring surgical repair were referred abroad as this service was not available on the island. This changed in September 1998. Initially a team of doctors, nurses and technicians from the United States of America performed these procedures, with a limited amount of assistance from

local staff (Table 1). In December 1999, a new agreement was made between Caribbean Heart Care (a private company) and the Eric Williams Medical Sciences Complex (operated by the Northwest Regional Health Authority, Ministry of Health, Trinidad and Tobago), to provide paediatric cardiac surgery for the children of Trinidad and Tobago. Surgical teams would continue to come to the island from cardiac centres in North America and Europe but the new arrangements included a marked difference in the make up of the team for these lists. Specifically, there was a much greater reliance on local expertise, particularly in the area of intensive care nursing and postoperative care for these patients (Table 1).

The initial group of patients done by the current team in December 1999 consisted of 10 carefully selected patients. These first children were all in reasonably good general health apart from their isolated cardiac defect, and were all

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Table 1: Team composition for initial and subsequent paediatric open heart lists at the Eric Williams Medical Sciences Complex

Date	Foreign staff	Local team
September 1998 to August 1999	2 cardiac surgeons	1 assistant cardiac surgeon
(20 patients)	2 anaesthetists	1 paediatric cardiologist
	3 intensivists	
	20 nurses	
	1 perfusionist	
	<b>Total : 28</b>	
December 1999 to the present	1 or 2 cardiac surgeons	3 anaesthetists
	1 anaesthetist	1 assistant surgeon
	1 perfusionist	1 perfusionist
	2 intensivists	1 paediatric cardiologist
	<b>Total : 6</b>	All ICU nurses

over one year of age. No child weighed less than 10 kg. The cases were mainly straightforward atrial septal defects and ventricular septal defects. As the expertise of the local team improved, subsequent lists included younger patients with more complex defects requiring repair or palliation (Fig. 1).

Up to February 2003, these teams performed open-heart surgery on 204 patients ranging in age from 48 hours to 17.7 years. This paper reviews the range of procedures performed during this time and assesses the success of this venture in terms of clinical outcome and scope of practice. We also discuss plans for the future and areas requiring improvement.

## METHODS

Clinical, operative and intensive care notes for all patients who had cardiac surgery were reviewed by the main author. These data were supplemented by audit data collected routinely on all procedures and outcomes. The main data analyzed were patient demographics, cardiac defects and other malformations, surgical procedure, morbidity and mortality.

## RESULTS

### Demographics

A total of 208 paediatric cardiac surgical procedures were performed on 204 patients during the period under consideration (September 1998 to February 2003). Of these, 182 were from Trinidad, 3 from Tobago and 23 from Guyana (sponsored by the government of Guyana). There were 101 girls and 103 boys. Patients ranged in age from 48 hours to 17.7 years and weighed between 3.2 kg and 50 kg. Figure 2 gives a breakdown of patients by age group.

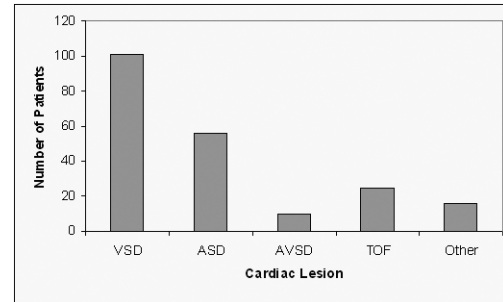


Fig. 1: Congenital heart defects addressed by the paediatric open-heart team at the Eric Williams Medical Sciences Complex.

VSD = Ventricular septal defect (49%), ASD = Atrial septal defect (27%), TOF = Tetralogy of fallot (12%), AVSD = Endocardial cushion defect (5%), 'Other' includes: tricuspid atresia (four patients); single ventricle (two patients); pulmonary atresia (one patient); coarctation (five patients); transposition of the great arteries (three patients).

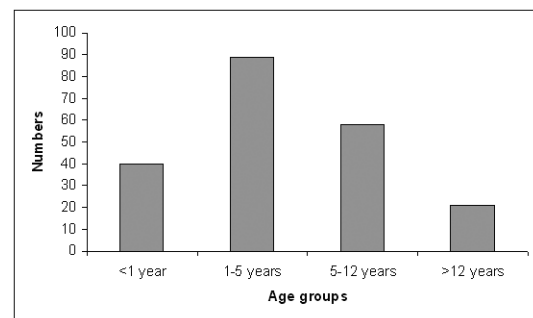


Fig. 2: Paediatric open-heart patients by age group.

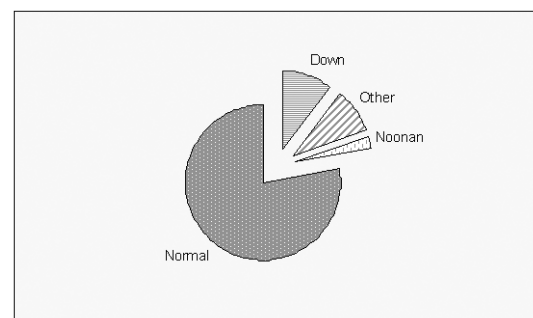


Fig. 3: Percentage of patients with identifiable syndromes receiving open-heart surgery at the Eric Williams Medical Sciences Complex.

Twenty-two children had Down syndrome. Five were identified as having Noonan syndrome. These assessments were based on physical examination and clinical features. There are no facilities in Trinidad and Tobago for clinical genetics and there were 19 children (9%) (Fig. 3) with multiple congenital anomalies who could not be confidently placed into specific known syndromes.

Table 2: Paediatric open-heart surgical procedures performed at the Eric Williams Medical Sciences Complex between September 1998 and February 2003.

Curative procedures	Number performed
Ventricular septal defect	100
Atrial septal defect	56
Endocardial cushion defect	10
Tetralogy of Fallot complete	25
Coarctation of the aorta	5

Table 3: Patients in whom paediatric open-heart surgery was cancelled or abandoned

Patient condition	Patient age	Reason for cancellation
VSD	7 months	could not be intubated
VSD	8 months	No thymus found on sternotomy
VSD	14 years	pulmonary hypertension
TOF	6 months	extremely small pulmonary arteries
VSD	15 years	infective endocarditis
VSD	7 months	trisomy 18 confirmed on genetics test abroad

### Defects

The cardiac conditions for which patients were referred are listed in Figure 1. All patients had congenital heart disease. The majority of patients requiring surgery presented with ventricular septal defects (VSD) (48%) and atrial septal defects (ASD) (27%). Other fairly common abnormalities were endocardial cushion defects (AVSD) and Tetralogy of Fallot (TOF) (12%). Additional lesions included tricuspid atresia (four patients), single ventricle (two patients), pulmonary atresia (one patient), coarctation of the aorta (five patients) and transposition of the great arteries (three patients). One patient was admitted with signs and symptoms of an atrial septal defect but was found at surgery to have significant right to left shunting via a large coronary artery fistula. All diagnoses were made using 2-D echocardiography. Cardiac catheterization was performed in selected cases only for clarification of anatomy or determination of pulmonary vascular resistance pre-operatively.

### Surgery

Table 2 shows the different surgical procedures performed. The majority of patients had repairs of ventricular (49%) or

atrial (27%) septal defects. These were done by either primary (suture) or secondary (patch) repair. One child, who was failing to thrive at six months with multiple muscular ventricular septal defects including several apical defects, underwent a pulmonary artery band procedure, with a view to complete repair later after growth and recovery had occurred.

Fifteen children, all under eight months of age, underwent modified Blalock-Taussig shunt placement. Of these, eight had TOF and three had already progressed to complete repair at our centre. The youngest patient of the group had a modified BT shunt placed at two days of age because of tricuspid atresia but six months later returned for successful bi-directional Glenn shunt placement. Six patients had their procedures cancelled or abandoned for medical reasons and are not included in this report. The reasons for cancellation are listed in Table 3. Two patients were postponed because of pneumonia and one for chicken pox but they later returned for surgery after recovery.

### Morbidity

The most commonly seen early postoperative complication was bleeding and six patients were returned to the operating theatre for exploration. A 22-month-old patient with Down syndrome and ventricular septal defect had a catastrophic bleed requiring resuscitation and urgent surgical exploration in the intensive care unit. She was later noted to have left hemiplegia and visual impairment. Neurological follow-up nine months after the event noted that she had completely recovered her sight and milestones were progressing normally but there was residual weakness. Superficial wound infections were successfully treated with intravenous drugs followed by oral antibiotics. There were no incidences of deep infection (mediastinitis).

Small pericardial effusions are fairly common in the weeks following repairs of septal defects in children and generally require medical rather than surgical treatment. However, one patient returned two weeks after repair of atrial septal defect with impending tamponade. Clear serous fluid was obtained on drainage and she recovered quickly with no recurrence.

Three patients had complete atrio-ventricular conduction block in the early postoperative period, requiring external temporary pacing. Of these, one was diagnosed with ventricular septal defect and two had endocardial cushion defects. One of these did not recover after two weeks and a permanent pacemaker was placed.

One patient sustained irreparable damage to his aortic valve during repair of a ventricular septal defect with aortic valve prolapse. A 17 mm St Jude prosthetic valve was placed.

### Mortality

Of the 204 patients undergoing open-heart surgery, there have been a total of seven deaths. Two of these were early

mortalities, each occurring within the first four days after surgery. The first was a six-year-old boy with TOF who succumbed to intractable right ventricular failure on the 3<sup>rd</sup> postoperative day. The second was a six-month-old girl with Down syndrome and endocardial cushion defect who died suddenly on the third postoperative day.

In addition to the above, there were three children who died more than 30 days after initial surgery. A three-year-old child with Down syndrome and complex congenital heart disease succumbed from congestive heart failure two months following a Bidirectional Glenn procedure. Two others died suddenly more than one year following modified BT shunt placement for tricuspid atresia and transposition of the great arteries, respectively. Both children had been lost to follow-up.

## DISCUSSION

This large percentage (22%) of multiple malformation syndromes is not uncommon among children with congenital heart disease (1, 2). The prevalence of congenital heart disease worldwide has been reported as 6.5–8 per 1000 live births (3–7). These levels are found in developed (3, 4) as well as developing (5) countries. Remarkably, these figures have also remained relatively constant over the years (6, 7). In Trinidad and Tobago, studies are still in progress regarding the epidemiology of congenital heart malformations.

Historically, in Trinidad and Tobago, patients requiring heart surgery have sought help from the major cardiac centres in North America and Europe. The drawbacks of this practice include the high cost to the patient and/or the referring government or charitable organizations, as well as the dwindling number of available centres. As a result of the above, there is always a growing list of waiting patients with inevitable mortalities among the more seriously ill patients.

Additionally, the absence of an on-site paediatric cardiac specialist surgeon makes anything more than the simplest palliative procedures impossible. At the same time, the cost of a continuous dedicated paediatric cardiac surgical unit would be prohibitive given the constraints on the health economy.

The collaborative effort described in this report appears to have adequately addressed the above problems for the most part. Scarce and expensive resources required for paediatric open-heart surgery are made available to the team when a paediatric cardiac surgery list is ongoing. This includes the use of operating theatre space, ICU beds, perfusion and monitoring equipment. During the rest of the year, this equipment continues to be used for other purposes, such as the general care of critically ill patients and in non-cardiac surgery.

The visiting team members continue to work in large centres in their respective countries, thus maintaining their skills between visits with volumes that would not be possible in Trinidad and Tobago. Conversely, various levels of staff

in Trinidad and Tobago have been able to gain experience and expertise in the management of paediatric cardiac surgical patients as they remain integrally involved in the care of these patients during the operative and immediate postoperative period. This has allowed a pool of local expertise to develop in Trinidad and Tobago and this helped to minimize the cost of these procedures. The area in which the greatest change has been seen is critical care nursing. The knowledge and experience gained by the staff has raised the level of care offered to all patients needing intensive care throughout the year.

The growing body of knowledge is also reflected in the gradual change in profile of the children benefiting from the service. In the last 12 months, the majority of children operated on have been less than three years old and the range of defects and procedures is expanding.

With two early postoperative deaths among 208 procedures, and the morbidity reported above, the programme figures compare favourably with those found in both developing and developed countries although it is difficult at this stage to draw any definitive statistical conclusions (8, 9).

There remain some outstanding areas of limitation and concern. Financial constraints have so far not allowed the teams to offer prosthetic and homograft valve replacement. As a result, older children with rheumatic heart disease, for example, are forced to await surgery abroad. Without a dedicated paediatric intensive care unit and full-time paediatric intensivists, procedures that may potentially entail a fairly long intensive care unit stay, such as Fontan procedures, are unlikely to be attempted soon. Additionally, in the absence of a locally-based surgeon, emergency procedures still cannot be offered.

In spite of the above limitations, the results of this study suggest that this system can provide a cost effective and sustainable service to patients in Trinidad and Tobago while maintaining an internationally acceptable standard of care.

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