Repair of Transposition of the Great Arteries in 123 Pediatric Patients
Early and Long-Term Results

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SUMMARY
From May 1963 to July 1972, 123 patients ranging in age from 20 days to 15 years, with D-transposition of the great arteries, underwent an intraatrial baffle operation using a pericardial baffle. They previously had had a total of 121 various palliative procedures.

Twenty-six children (21%) died in the early postoperative period. The operative mortality was 13% in transposition of the great arteries with intact ventricular septum, 45% in transposition of the great arteries plus ventricular septal defect, and 33% in transposition of the great arteries plus ventricular septal defect and left ventricular outflow tract obstruction. By contrast the overall mortality has decreased to 15% in the 72 patients operated upon over the last 2 years.

There were 12 late deaths, 10 of which occurred within the first year postoperatively. Unexplained heart failure accounted for four deaths. Two sudden deaths were attributed to arrhythmias. Three patients died of proven pulmonary venous obstruction, one of them at reoperation. Pulmonary hypertension, reoperation for detachment of the baffle, and hypoglycemia were each the cause of one late death. There were no proven cases of tricuspid incompetence.

Eighty children have been repeatedly reexamined for up to 8 years and 6 months. The actuarial 6-year survival was 74.8% for survivors of operation.

Seventy-three children were leading a normal life at the time of the report.

Additional Indexing Words:
Cardiac surgery in infancy
Left ventricular outflow tract obstruction

Pulmonary artery banding

THE FIRST intraatrial baffle operation at The Hospital for Sick Children for correction of transposition of the great arteries (TGA) was performed in May 1963. The patient was 18 months old and had had an atrial septal defect (ASD) created under inflow occlusion at the age of 2 weeks.1 Nine years later this patient leads a normal life. A further 122 children have had an intraatrial baffle inserted since. All those discharged from the hospital who survived operation were reexamined for various lengths of time.

A physiologic rather than anatomic correction, the intraatrial baffle operation redirects both circulations at the atrial level. The early results of the procedure are satisfactory, particularly in patients with intact ventricular septum.2-5 However, there are little available data on the long-term results, and concern exists about the fate of the pericardial baffle and about the function of both right ventricle and tricuspid valve at systemic pressures.

The purpose of this report is to present our surgical experience with this procedure and analyze the results obtained over the past 9 years.

Clinical Material
From May 1963 to July 1972, 123 consecutive children with TGA, 91 males (74%) and 32 females (26%), ranging in age from 20 days to 15 years (mean 30 months) underwent the intraatrial baffle operation (table 1). The patients were assigned to four different groups according to the findings at the most recent preoperative heart catheterization, at operation, and in eight cases at postmortem examination.

Group I: 87 patients (71%) with D-transposition of the great arteries (D-TGA) and intact ventricular septum or a small ventricular septal defect (VSD) and normal left ventricular pressure.
Group II: 22 patients (18%) with VSD, no left ventricular outflow tract obstruction, and left ventricular pressure near or at systemic levels.

Group III: nine patients (7%) with VSD and left ventricular outflow tract obstruction (LVOTO). The site of obstruction was valvular, subvalvular, or combined. The pressure difference was 40 mm Hg or more at rest (table 2).

Group IV: five patients with intact ventricular septum and LVOTO as defined in group III.

Patients with double-outlet right or left ventricles, single ventricles, and pulmonary or tricuspid atresia were excluded from the study. A total of 121 palliative procedures had been performed on 92 of the children prior to the intraatrial baffle operation (table 3).

Procedures

All patients were operated upon under cardiopulmonary bypass, and moderate (30°C) hypothermia was employed as an adjunct in 64 (52%). The superior vena cava was directly cannulated, and the inferior vena cava cannulated at the cavoatrial junction using right-angled metal cannulae. Four of our patients weighing from 6.5 to 10 kg were operated upon under deep hypothermia and circulatory arrest, allowing the procedure to be carried out with striking ease. Prior to the insertion of the baffle, the remaining atrial septum was totally excised and the intraatrial groove oversewn. Pericardium was used for the baffle except in two cases in which a Dacron patch was used.

The coronary venous return along with the systemic venous circulation was diverted behind the baffle, either by cutting back the coronary sinus orifice or, as in 40% of the cases, by creating a window into the left atrium and closing the former opening with superficial sutures. A small flap of atrial septum was preserved for suturing the baffle in the region of the tricuspid valve ring. The left atrium was enlarged with a pericardial patch in 38% of the children. When a Baffles procedure had previously been performed, only superior vena cava flow was redirected behind the baffle through the mitral valve; similarly, after a Glenn procedure, only inferior vena cava flow was redirected. VSDs were closed through the right atrium and the tricuspid valve in all but two children; one defect was approached through the right ventricle and one through a fish-mouth incision in the left ventricle.

Twelve children had previously undergone a pulmonary artery (PA) banding. By using Silastic*-on-Teflon bands later removal was facilitated. The PA under the band was dilated with sounds or enlarged by a Dacron or a pericardial patch. In four children, the PA was simply cut through on each side of the band, the strictured area removed, and an end-to-end anastomosis performed providing a satisfactory increase in diameter.

Left ventricular outflow tract obstruction, as encountered in group III and IV, was usually approached through the pulmonary artery. In three children, from group III, a right ventriculotomy was also carried out.

Patients were not kept intubated nor artificially ventilated routinely when sent to the recovery room. Postoperative monitoring included electrocardiogram (ECG), arterial blood pressure, inferior and superior caval pressures, and more recently left atrial pressure which was kept between 10 and 15 mm Hg. Thirty-nine patients who were clinically well had radiographic evidence which was suggestive of pulmonary edema, developing within the first 2 days after surgery and persisting to a maximum of 30 days. This particular sign could not be correlated with the age of the children, the clinical status, the duration of cardiopulmonary bypass, the elevation of left atrial pressure, or the use of a right atrial patch.

*Silicon Medical Adhesive (Silastic), Dow Corning, Midland, Michigan.
Table 4

Mortality after 123 Intraatrial Baffle Operations

<table>
<thead>
<tr>
<th>Group</th>
<th>Diagnosis</th>
<th>Cases (no.)</th>
<th>Early mortality</th>
<th>Late mortality</th>
<th>Total mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>I</td>
<td>TGA + intact septum</td>
<td>87</td>
<td>11 13</td>
<td>8 9</td>
<td>19 22</td>
</tr>
<tr>
<td>II</td>
<td>TGA + VSD</td>
<td>22</td>
<td>10 45</td>
<td>2 9</td>
<td>12 54</td>
</tr>
<tr>
<td>III</td>
<td>TGA + VSD + LVOTO</td>
<td>9</td>
<td>3 33</td>
<td>1 11</td>
<td>4 44</td>
</tr>
<tr>
<td>IV</td>
<td>TGA + LVOTO</td>
<td>5</td>
<td>2 40</td>
<td>1 20</td>
<td>3 60</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>123</td>
<td>26 21</td>
<td>12 10</td>
<td>38 31</td>
</tr>
</tbody>
</table>

Abbreviations: TGA = transposition of the great arteries; VSD = ventricular septal defect; LVOTO = left ventricular outflow tract obstruction.

Results

Early Mortality

This is defined as death occurring within 30 days of surgery. There were 26 early deaths (table 4), an overall mortality of 21% for the whole series. The lowest mortality (13%) was encountered in group I. There were 10 deaths (45%) in group II. Of those 10, seven children had had no PA banding. Their mean PA pressures ranged from 36 to 70 mm Hg (average 62 mm Hg). The three remaining children had had no PA banding and one a Glenn procedure also. In group III, the mortality (33%) was lower than in group II despite the complexity of the repair.

In the last 2 years, the overall early mortality has declined to 15% (table 5). Once again, the mortality rate among patients in group III (17%) was less than that in group II (27%).

The causes of early death in total series are listed in table 6. Seven children with pulmonary hypertension were in group II. Four of five children who had low cardiac output were found at postmortem study to have some degree of left ventricular obstruction, either unrecognized or incompletely relieved at the time of operation. The remaining patient died following a 3-hour cardiopulmonary bypass for VSD closure, PA debanding, and infundibulectomy in addition to the intraatrial baffling procedure. Impaired atrioventricular (A-V) conduction leading to death occurred in the early cases in our series; routine implantation of epicardial pacemaker wires permits elective pacing to prevent sudden arrest. Pulmonary edema shortly after bypass may have been caused by pulmonary venous obstruction although this was not recognized at operation nor at the postmortem examination. Cardiac arrest occurred at induction in a 27-day-old infant who failed to respond to both Blalock-Hanlon and inflow occlusion atrial septostomy and was operated upon in an attempt to save his life.

Finally, the operative mortality was not related to the age at operation. There were 11 deaths in 58 children less than 2 years old (19%) and 15 deaths in 65 children more than 2 years old (26%). Only four infants were under 1 year of age, three with ventricular septal defects, and all succumbed.

Early Morbidity

This is defined as any complication occurring within 30 days of operation but not leading to death. Heart failure requiring digitalis was still

Table 5

Mortality after 72 Intraatrial Baffle Procedures Performed over the Past Two Years

<table>
<thead>
<tr>
<th>Group</th>
<th>Cases (no.)</th>
<th>Early mortality</th>
<th>Late mortality</th>
<th>Total mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>I</td>
<td>47</td>
<td>5 10</td>
<td>6 11</td>
<td>16 23</td>
</tr>
<tr>
<td>II</td>
<td>15</td>
<td>4 27</td>
<td>5 13</td>
<td>34 42</td>
</tr>
<tr>
<td>III</td>
<td>6</td>
<td>1 17</td>
<td>2 10</td>
<td>34 50</td>
</tr>
<tr>
<td>IV</td>
<td>4</td>
<td>1 25</td>
<td>2 25</td>
<td>50 60</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>11 15</td>
<td>6 8</td>
<td>17 23</td>
</tr>
</tbody>
</table>

Table 6

Causes of Early Death in 26 Children (30-Day Period)

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Pt (no.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary hypertension</td>
<td>7</td>
</tr>
<tr>
<td>Low cardiac output (LV obstruction in 4)</td>
<td>5</td>
</tr>
<tr>
<td>Impaired A-V conduction</td>
<td>4</td>
</tr>
<tr>
<td>Pulmonary edema</td>
<td>4</td>
</tr>
<tr>
<td>Postoperative hemorrhage</td>
<td>2</td>
</tr>
<tr>
<td>Cerebral hemorrhage</td>
<td>1</td>
</tr>
<tr>
<td>Hypoplastic right ventricle</td>
<td>1</td>
</tr>
<tr>
<td>Preoperative cardiac arrest</td>
<td>1</td>
</tr>
<tr>
<td>Air embolism</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
</tr>
</tbody>
</table>

Abbreviations: LV = left ventricular; A-V = atrioventricular.
present in 29 patients (23%) at the time of discharge. Postoperative bleeding necessitated reexploration in 12 patients (10%).

Five children had signs of superior vena caval obstruction, relieved in four after a few days in the sitting position. One was successfully reoperated on for a Dacron-patch enlargement of the baffle. There were three cases of postoperative phrenic nerve paralysis, one bilateral and two unilateral. Two children developed a chyllothorax; one responded to medical treatment; the other required thoracic duct ligation.

Late Mortality

There were 12 deaths in this category defined as occurring 30 days after operation. Ten (84%) occurred within the first year, one in the third year, and one in the fourth (table 7). Eight of the 12 children were in group I.

Heart failure was thought to be the cause of late death in four patients. Three of these four children were in congestive failure after operation and responded poorly to digitalis and diuretics. They died suddenly at 3, 11, and 12 months, respectively, after surgery. Cardiac failure contributed to the cause of death in the first and second patients following bronchoscopy and cardiac catheterization, respectively; the third child died at home. This last child, despite a preoperative mean PA pressure of 46 mm Hg, had not had a PA banding. His VSD had been closed through the right atrium. The fourth, a child from group III, had a right ventriculotomy performed for better access to the LVOTO. He remained in refractory cardiac failure postoperatively. Recatheterization 6 months later showed an end-diastolic pressure of 33 mm Hg in both ventricles. Tricuspid regurgitation could neither be detected clinically nor demonstrated by catheter study in any of the children.

Sudden death occurred in three children; two were in group I and had been well at 1 and 4 years postoperatively. One of the two children had junctional rhythm and the other one first-degree heart block on the last recorded ECG. One could speculate that arrhythmias might have been the cause of death. Neither child was receiving digitalis. No postmortem examination was performed. The third child, who was in group IV, had a good early result but, because of cardiac failure, was admitted to another hospital 4 months postoperatively. He presented with convulsions, and his blood sugar was 30 mg/ml just before death.

Pulmonary venous obstruction was responsible for three late deaths, all in patients of group I. Two occurred within 6 months of surgery. One of these, an 18-month-old child died at reoperation under deep hypothermia and circulatory arrest for plastic reconstruction and enlargement of the pulmonary venous atrium. The PA pressure remained at systemic level after correction, and the child could not be taken off bypass. The second child died at another hospital after admission for hemoptysis; the diagnosis of pulmonary venous obstruction was made at postmortem examination. The third death occurred 3 years postoperatively at the time of repeat cardiac catheterization when he was found to have a mean PA pressure of 100 mm Hg and a PA wedge pressure of 25 mm Hg.

Table 7

<table>
<thead>
<tr>
<th>Case</th>
<th>Group</th>
<th>Age at operation</th>
<th>Heart failure</th>
<th>Sudden death</th>
<th>PVO</th>
<th>PHT</th>
<th>Detachment of baffle</th>
<th>Time postop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>5 years</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 months</td>
</tr>
<tr>
<td>2</td>
<td>I</td>
<td>3 months</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 months</td>
</tr>
<tr>
<td>3</td>
<td>I</td>
<td>18 months</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>3 months</td>
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<tr>
<td>4</td>
<td>IV</td>
<td>3 years</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>4 months</td>
</tr>
<tr>
<td>5</td>
<td>III</td>
<td>12 years</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 months</td>
</tr>
<tr>
<td>6</td>
<td>II</td>
<td>19 months</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7 months</td>
</tr>
<tr>
<td>7</td>
<td>I</td>
<td>2 years</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>1 year</td>
</tr>
<tr>
<td>8</td>
<td>I</td>
<td>3 years</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 year</td>
</tr>
<tr>
<td>9</td>
<td>I</td>
<td>2 years</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>1 year</td>
</tr>
<tr>
<td>10</td>
<td>II</td>
<td>19 months</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>1 year</td>
</tr>
<tr>
<td>11</td>
<td>I</td>
<td>2 years</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 years</td>
</tr>
<tr>
<td>12</td>
<td>I</td>
<td>4 years</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 years</td>
</tr>
</tbody>
</table>

Abbreviations: PVO = pulmonary venous obstruction; PHT = pulmonary hypertension.

*Died at reoperation.
One child died at reoperation to correct detachment of the baffle. The last late death was due to pulmonary hypertension. This child, in group I, had not been previously banded, and his PA pressure was at systemic level. He died 7 months after surgery when his tracheal tube was being changed.

No child developed a late caval obstruction syndrome.

Status of Survivors

Ninety-seven patients survived the immediate operative period. There were 12 late deaths. Five patients were lost to follow-up, from 1 month to 4 years postoperatively.

Patients have been reexamined regularly over a period of up to 9 years in the Outpatient Department of The Hospital for Sick Children, and cardiologists caring for 14 patients from abroad or living far away have responded to a questionnaire. The latest postoperative ECG for every patient was examined. Catheterization studies have been performed postoperatively in 14 patients for a variety of reasons.

At follow-up, 73 patients (86%) are leading normal lives, are acyanotic, and are growing normally. Ten have been forbidden active sports (two had preoperative hemiplegia) because of cardiac enlargement. Five patients have restricted activities, two being confined to home with some degree of cardiac failure. On physical examination no child has signs of systemic venous obstruction. Ten have a systolic murmur along the lower sternal border, but this does not suggest tricuspid regurgitation in any. No tricuspid regurgitation was demonstrated by right ventricular angiography. Two children are taking propranolol-HCl (Inderal) for atrial flutter and intermittent atrial fibrillation. Twenty-nine children are still receiving digitalis, three for control of arrhythmias (rapid atrial flutter) and 26 for some cardiac failure, although the drug has been discontinued intermittently in 23 of them.

The ECG findings at the time of the last report are outlined in table 8. The origin of junctional rhythm has not been accurately determined in the absence of more detailed studies. Both children with complete heart block had a VSD repaired; one had a pacemaker implanted, and the other one tolerates a ventricular rate of 55 beats/min.

Finally, a survival curve was established using an actuarial method, knowing the status of the patient at the last report and the interval from operation to that report (fig. 1). This shows a 78.4% survival at 6 years.

Discussion

The incidence of TGA is approximately 5–10% of all congenital heart diseases, and before the introduction of balloon atrial septostomy (BAS) 90% of the infants born with TGA would have died within the first 7 weeks of life. Our data indicate that approximately 78% of the diagnosed cases survived 1 year following BAS. Our figures suggest that 78.4% surviving the early postoperative period after intraatrial baffling will be alive 6 years after operation.

Despite this obvious improvement, the intraatrial baffle operation still carries a total (early plus late) mortality of 31%. Other published series have total mortality rates between 26 and 40%. The main complications described are heart failure, pulmonary venous obstruction, conduction and rhythm disturbances, and tricuspid regurgitation. We have been able to evaluate these problems over a 6-year follow-up period.

![Figure 1](http://circ.ahajournals.org/)

**Figure 1**

Actuarial incidence of survival among 85 operative survivors. The dotted line indicates the portion of the curve based on less than 20 operations.
Table 9

Mortality Related to the Palliative Procedure Performed prior to Repair in 22 Children with TGA and VSD (Group II)

<table>
<thead>
<tr>
<th>Palliative procedure</th>
<th>Cases (no.)</th>
<th>Deaths (no.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA banding:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolated</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>+ Blalock-Hanlon</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>+ Glenn</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>+ Edwards</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>ASD creation (Blalock-Hanlon or BAS)</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>None</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>10</td>
</tr>
</tbody>
</table>

Abbreviation: BAS = balloon atrial septostomy.

This series includes our earliest operative cases and children from group II with pulmonary hypertension who had a correction without previous PA banding in whom the mortality is higher (table 9). In “ideal” cases, those of group I, the total mortality has decreased in the past 2 years to 16%.

What has been called late mortality in 12 patients deserves some comment. There were only three completely unexpected late deaths; two have been attributed to arrhythmias and one to hypoglycemia.

Four patients had refractory heart failure postoperatively. They should be considered delayed deaths. All had marked cardiac enlargement radiologically. Catheter restudy showed myocardial failure without tricuspid incompetence, and no evidence of pulmonary venous obstruction. At autopsy none of them had residual LVOTO. Heart failure seemed unrelated to the duration of aortic clamping or the presence of a ventriculotomy and remains unexplained.

Pulmonary venous obstruction represents a serious although technically correctable complication. Stark et al.,17 pointed out that the patients in their study with this complication had a history of breathlessness developing after operation. In our experience two of three children had evidence of heart failure clinically, without specific radiologic signs. The third child died suddenly. A catheter study should be performed when pulmonary venous

Figure 2

Preoperative AP contour study in the left ventricle in a child with TGA, VSD, and left ventricular outflow tract obstruction (LV pressure = 90/11 mm Hg).
obstruction is suspected, and every attempt should be made to obtain a pulmonary artery pressure and pulmonary artery wedge pressure. If both are elevated in the presence of a normal right ventricular end-diastolic pressure, a revision of the baffle must be attempted and the pulmonary venous channel enlarged. Postmortem study in our cases showed that, as well as contraction of the pericardial baffle, there was an adhesion-like process, which might well have started on the remnants of the atrial septum. The intraatrial groove should therefore be carefully oversewn after resection of the septum. Likewise, care should also be taken not to have too large a baffle. This is sometimes best achieved by tailoring the baffle as described by others.18

Arrhythmias occurred in 26 (30%) of the operative survivors. Despite this high incidence, late arrhythmias were either well tolerated, as in 15 cases of junctional rhythm, or well controlled by medical treatment, as in five cases of atrial flutter. Furthermore, arrhythmias were thought to be responsible for only two late deaths, although this was not proven. Different authors3,5 have described some modifications in the baffling procedure to lessen the incidence of arrhythmias. Our technic has been basically unchanged since first described,1 except for the direct cannulation of the superior vena cavae and closure of the former coronary sinus orifice, when it opens through a window into the original left atrium. An unavoidable technical step in the procedure is the resection of the remaining intraatrial septum, with interruption of the conduction pathways. We do not know the functional status of any remaining tract, and, therefore, the effect of cutting back the coronary sinus orifice. It is important, however, to anchor the baffle with superficial sutures in this area. If a pacemaker must be implanted after the procedure, we prefer an epicardial lead rather than a transvenous one to avoid both malposition in the left ventricle and possible late superior vena caval obstruction.

Tricuspid regurgitation has not been a problem and was not found in any of the 14 children restudied postoperatively. Tynan et al.16 could prove tricuspid valve incompetence in 17 selected
patients, nine with VSD, contributing to death in three of them. When a VSD is closed in TGA, special care should be taken to avoid damaging the valve or distorting its ring.

Our present policy in management of TGA is based on the analysis of the data presented in this report.

Every child in whom a TGA is diagnosed should have a BAS. If the child's condition deteriorates, recent success with deep hypothermia and circulatory arrest would lead us to undertake total correction rather than a further palliative procedure at any age.

In children with D-TGA and intact ventricular septum, in whom BAS is successful, total correction is undertaken when they reach the age of 1 year using conventional cardiopulmonary bypass; the current operative risk is less than 10%. We are now performing total correction earlier, although the threat of pulmonary vascular disease is minimal in these children before 1 year of age.

In TGA plus VSD our policy in any child with heart failure or pulmonary hypertension has been to band the PA and create an atrial septal defect usually by an Edwards procedure at 3–6 months of age. The baffling procedure associated with VSD repair and PA debanding and reconstruction is formidable. We had three operative deaths in 12 patients. The combined risk of palliation and total correction is such that we now recommend primary total correction before 6–8 months of age using deep hypothermia and circulatory arrest.

Children with LVOTO can usually wait for a longer period of time before any correction is undertaken. If necessary, palliation can be obtained by a systemic-to-pulmonary shunt, preferably a Blalock-Taussig anastomosis. The anatomy of the obstruction as defined by angiocardiography determines the definitive operative procedure. With valvular or discrete subvalvular obstruction, as sometimes encountered, a baffling procedure can be used to repair the transposition, and the LVOTO can be approached directly through the PA. If the subvalvular area is of the long tunnel type, we recommend waiting until the child is at least 5 years old. We have found an infraatrial baffle procedure associated with a relief of the LVOTO and closure of the VSD in children from group III to carry a
lower operative mortality than in those children from group II (17% over the past 2 years). Furthermore, we have been able to obtain a good opening in the outflow tract in most cases, as demonstrated in figures 2–5. However, in some cases Rastelli's operation 20, 21 may be safer than the direct approach to the lesion, although the long-term results of this recent procedure are unknown.

Acknowledgment
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