

Systemic to Pulmonary Shunting in 93 Cyanotic Neonates

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Background: Systemic to pulmonary shunting is still the main palliation option in many neonates with cyanotic heart disease.

Design: A Retrospective Study.

Setting: The Mohammed bin Khalifa bin Salman Al-Khalifa Cardiac Center, Bahrain Defence Force Hospital, Bahrain.

Method: All infants from January 1995 to December 2008 who had undergone systemic to pulmonary shunting procedures were included in the study.

Result: Ninety-three infants underwent 108 shunt type procedures, 39 females and 54 males. One hundred five Modified Blalock-Taussig Shunts (MBTS) and three classic Blalock-Taussig shunts were performed. Tetralogy of Fallot/Double Outlet Right Ventricle (DORV) with right ventricular outflow tract obstruction was the most common diagnosis, 51 (55%).

Early postoperative mortality was 1 (1%). Late postoperative mortality was 4 (4%); sepsis was the major cause. Early (<1 month postoperatively) shunt failure/occlusion occurred in 6 (6%) patients. Under 14 days of age at the time of shunting and shunt size of 5mm (18% versus 4.6%) were risk factors for early shunt occlusion/failure. Eight (8%) patients required late shunt revision at two months to 5 years post initial shunting. Fifty-one patients had undergone final corrective surgery.

Conclusion: MBTS shunting provides effective and safe palliation in small infants with complex cyanotic heart disease. Early shunting (<14 days of age), and 5mm shunt size are additional risk factors for early shunt failure.

All the infants had an initial diagnosis made by cross-sectional echocardiography. No patient required initial preoperative cardiac catheterization as the assessment of the anatomy was appropriate by echocardiography alone.

In the MBTS technique, the diameter of the Gortex tube graft used was directly related to the size of the pulmonary artery branch to which it was anastomosed. If the pulmonary artery branch was 4 mm or smaller by cross-section echocardiography a 4mm diameter Gortex tube graft was used.

Heparin (100units/kg) was continued 6-12 hourly postoperatively for 24-48 hours. All patients who underwent MBTS also received aspirin postoperatively at 3-5mg/kg/day indefinitely or until final corrective/palliative surgery was performed.

Shunt failure was defined as either clinical evidence of insufficient pulmonary blood flow with the absence of a shunt murmur and/or echocardiographic evidence of occlusion or insufficiency within one month of operation. Shunt revision was defined as either clinical evidence of insufficient pulmonary blood flow in the presence of a shunt murmur and/or echocardiographic evidence of insufficiency more than one month postoperatively. Clinical and cross-section echocardiographic follow up to evaluate patency of the MBTS was performed routinely in all patients until final corrective/palliative surgery was planned.

RESULT

Ninety-three infants underwent 108 shunt procedures, 39 females and 54 males. The majority of infants were of Bahraini origin, see figure 1. Forty eight (51.6%) were less than one

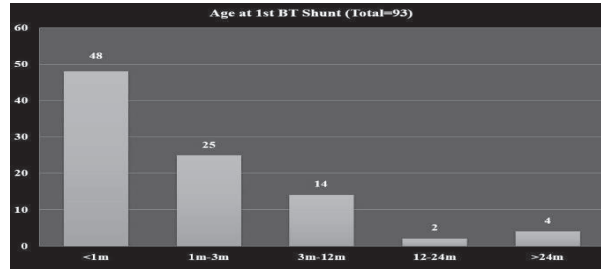


Figure 2: Age Distribution

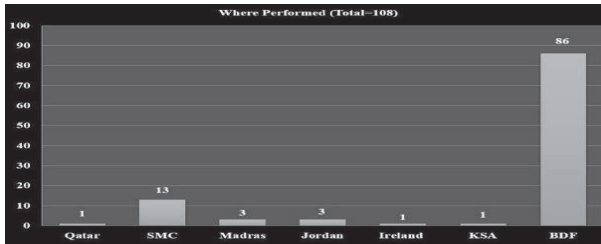
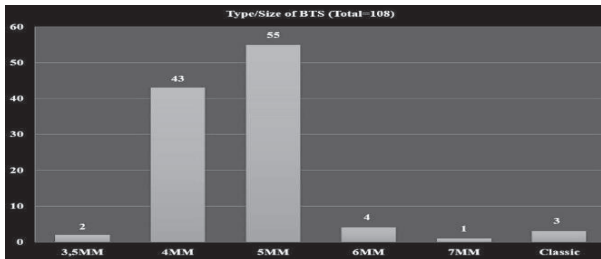
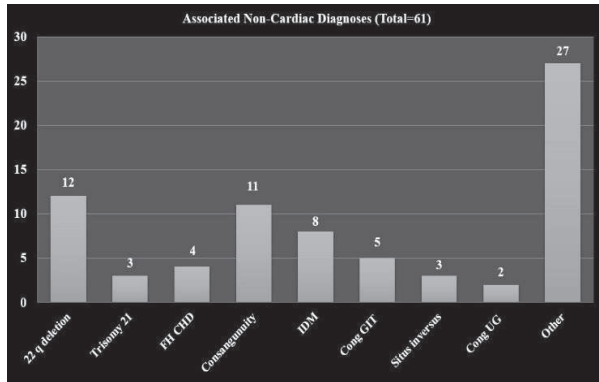


Figure 3: The Setting of the Procedure



SMC: Salmaniya Medical Complex
 KSA: Kingdom of Saudia Arabia
 BDF: Bahrain Defence Force Hospital

Figure 4: Type and Size of BTS



FH CHD: Family History of Congenital Heart Disease
IDM: Infant of Diabetic Mother
Cong GIT: Congenital Gastro-Intestinal Tract Anomaly
Cong UG: Congenital Uro-Genital Anomaly

Figure 5: Associated Non-Cardiac Diagnoses

Five (4.6%) deaths after initial MBTS were recorded. None were directly related to the procedure. One (1%) early death (12 days post MBTS) was due to a blocked endotracheal tube in an infant 2.7kg with tricuspid atresia. Four (4%) late deaths were encountered. Two at 2 and nine months postoperatively with proven sepsis, and two at 4 and nine months postoperatively with presumed sepsis. There were no deaths, early or late, in any patients who underwent second shunt operation.

Eight (8%) patients required late shunt revision two months to 5 years after initial MBTS operation, see figure 6. None of these late revisions were due to acute shunt occlusion, but rather chronic anastomotic stenosis and/or visceral outgrowth of the initial shunt.

Fifty-one patients have undergone final corrective/palliative procedures, see figure 6. Intracardiac repair of Tetralogy of Fallot/DORV with right ventricle outflow tract obstruction (RVOTO) is the most common procedures performed (63%). The rest of the infants are awaiting the second/final stage palliation or correction.

DISCUSSION

Recent advances in surgical techniques have resulted in many palliative procedures becoming obsolete. The systemic to pulmonary arterial shunts have however remained as mainstay palliation in many ill infants with ductal-dependent pulmonary circulation. It is often the first step in a multi-stage approach. This study confirms that there are still a significant number of cyanotic infants in whom early definitive care is not possible and will require shunting.

The MBTS has been found to be the preferred technique for such palliation, and the classic technique is now seldom used^{1,2,3,4}. Shunting is a relatively low-risk procedure with perioperative mortality ranging from 3%-35%^{5,6,7,8}. Improved mortality rates are probably due accurate diagnosis, earlier referral, liberal prostaglandin use, improved surgical/anesthetic techniques and postoperative care. This study showed that deaths were more common in the initially shunted infants with sepsis (proven/suspected). There were no deaths in infants undergoing a repeat shunt procedure.

Early shunt failure/occlusion (<1month postoperatively) remains a serious concern. Low-birth-weight(<2kgs), pulmonary artery size <4mm, not using postoperative heparin and/or low dose aspirin, low initial pH and preoperative

Potential Conflicts of Interest: None.

Competing Interest: None.

Sponsorship: None.

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Ethical Approval: Approved by the Mohammed bin Khalifa bin Salman Al-Khalifa Cardiac Center, Bahrain Defence Force Hospital, Bahrain.

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