



PRIMARY SURGICAL CLOSURE OF VENTRICULAR SEPTAL DEFECTS IN CHILDREN LESS THAN 5 KGS.. OUR EXPERIENCE!

Cardiovascular and Thoracic Surgery

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ABSTRACT

We present our experience of primary surgical closure of large ventricular septal defects in children less than 5 kg. Forty six children met our criteria for inclusion. Patients had no major extra cardiac disease. There were 2 early deaths and 2 late deaths in the study group. No patient was subjected to a second vsd surgery and patients did not require anticongestive therapies for prolonged period. Our results proved that primary closure of vsd can be done in children less than 5 kg with less mortality rates and less serious complications in post operative period. Pulmonary artery banding and prolonged medical therapy is not necessary.

KEYWORDS

ventricular septal defect, intra cardiac repair, pulmonary vascular resistance

Introduction:

Pediatric Cardiac surgeons come across frequently with small children (less than 5 kg) with ventricular septal defects (VSD) associated with congestive cardiac failure (CCF), growth retardation and pulmonary hypertension. Majority tolerate procedure of vsd closure well but the results at most institutes in small children is not satisfactory. Few case series have demonstrated mortality rate ranging over 2-17% in children however it goes up to 9-75% in small children (1-5). Some surgeons have suggested prolonged medical management (3,5) until the child grows up and gains weight or pulmonary artery (PA) banding (8).

We report the results of primary vsd closure over last 7 years of all patients of vsd symptomatic, weight less than 5 kg, single with no associated major extracardiac disease. We observed and analysed the data of preoperative, intraoperative and postoperative variables.

Material and Methods :

The hospital records of children (less than 5 kg) who underwent surgical VSD closure at KEM Hospital between January 2011 and December 2017 were reviewed. During this period, 46 small children underwent primary surgical closure of a single VSD were included in the retrospective analysis. Children who underwent closure of multiple muscular VSDs after inadequate relief of symptoms after PA banding, as a part of tetralogy of Fallot, VSD associated with pulmonic valve stenosis or obstructing infundibular muscle bundles and complex cardiac malformations were excluded from this study. The cohort ranged in age from 3 to 18 months. Reasons for referral included intractable CHF, growth retardation, elevated PH. Children with severe CHF and growth retardation who showed little or no clinical improvement despite optimum treatment. 3 patients underwent preoperative cardiac catheterization.

The surgical technique for VSD closure did not vary substantially during the study interval. A median sternotomy was used in all patients. Cardiopulmonary bypass under moderate systemic hypothermia (28 to 30°C) with single dose del Nido cardioplegia was employed. A right atriotomy was performed in all patients and the VSD could be closed through this approach. Detachment of the septal leaflet of the tricuspid valve from the annulus was required to obtain adequate exposure in only a few cases. Ventricular septal defect closure was usually accomplished using a SFD patch secured with interrupted pledgeted sutures. Associated atrial septal defect and patent ductus arteriosus were treated at the time of VSD repair. Postoperative care remained same. All children had a postoperative echocardiogram before discharge to check of any residual VSD. Follow-up information was abstracted from records kept by the patient's pediatrician.

Results

The patients ranged in weight from 2.7 to 5.0 kg. 11 out of 46 patients had medically intractable CHF. None of the patients had major associated extracardiac diagnoses.

Table 1 . Preoperative Characteristics of the Patient Groups

Variable	Group
Mean age +/- SD (mo)	8.16 +/- 2.04
Mean weight +/- SD (kg)	3.4 +/- 0.5
CHF	11/46 (24%)
Major extracardiac disease	Nil
Prior cardiac operation	Nil
Associated cardiac defect	Nil
Mean RV/LV +/- SD	0.86 +/- 0.14
Mean Qp/Qs +/- SD	3.41 +/- 1.24
Mean PVR/SVR +/- SD	0.19 +/- 0.11
Perimembranous VSD	40/46 (87%)
Muscular/multiple VSD(s)	6/46 (13%)

PVR/SVR = ratio of pulmonary to systemic vascular resistance; Qp/Qs = ratio of pulmonary to systemic blood flows; RVLV = ratio of right ventricular to left ventricular systolic pressures; SD = standard deviation.

At the time of surgery, 4 patients were on ventilator. Some patients had additional ASD and PD. Patients were referred for VSD repair because of concerns of increased PH, CHF and growth retardation. The single major intraoperative complication in an infant was complete atrioventricular block requiring epicardial pacing to successfully discontinue cardiopulmonary bypass. This infant had a perimembranous VSD and recovered normal atrioventricular conduction shortly after operation. Overall mortality (early and late) was 8.6% for the entire cohort. 2 early deaths (before discharge from the hospital) occurred.

Table 2 . Operative Data

Variable	Group
Intraoperative complication	1/46 (2%)
Mean CPB +/- SD (min)	60.1 +/- 14.5
Mean ACC +/- SD (min)	31.9 +/- 6.7
Mean arrest +/- SD (min)	31.8 +/- 8.7

ACC = aortic cross-clamp; CPB = cardiopulmonary bypass; SD = standard deviation.

The infants who died in early post operative period with elevated PVR (PVR/SVR ratio = 0.6). Postoperatively, the children had development

of low cardiac output, intermittent atrioventricular conduction block and pulmonary hypertensive crises with cardiac arrest before dying on postoperative day 4 and 6. No postmortem examination was performed. Other major postoperative complications included sepsis in a 3.1 and 3.7-kg infants, transient left phrenic nerve palsy in a 4.6-kg infant, and pulmonary hypertensive crises with cardiac arrest in a 4.7-kg infant. In contrast, minor complications were more frequent, including junctional tachycardia, mild CHF, hypertension, transient seizures, atelectasis/pneumonia, stridor, and superficial sternal wound infections.

The duration of follow-up ranged from 3 to 60 months.

Table 3. Outcome Data

Variable	Group
Early death	2/46 (4.3%)
Major complication	4/46 (8.6%)
Minor complication	22/46 (47%)
Median ventilator days (range)	4 (2-21)
Median days to discharge (range)	11 (6-40)
Mean follow up +/- SD (mo)	24.1 +/- 18.6
Late death	2/46 (4.3%)

In the entire cohort, 3/46 (6.5%) of the infants had small VSD patch leaks detected by echocardiogram before hospital discharge. Other studies have reported a similar residual VSD detection rate with early postoperative echocardiographic examination (12). No patient required a second operation and only 5 infants (11%) had murmurs or echocardiographic evidence of residual VSD at the most recent follow-up evaluation. The anticongestive medications were given for 6 months of operation and no cases of persistent growth retardation due to residual cardiac disease have been documented. There have been two late deaths in group. Thus, the late mortality rates were 4.3%. One patient expired due to klebsiella infection and other due to swine flu.

Comments :

VSD is the most common congenital heart defect (13,14). It occurs in isolation or in combination with other cardiac abnormalities. Symptoms of CHF such as tachypnea, feeding difficulties and decreased growth. Very small infants and those with major extracardiac diseases seem especially prone to development of severe CHF if left to right shunt is large. Present outpatient anticongestive therapies often fail to improve symptoms. Over the past 2 decades, most pediatric cardiothoracic surgical services opt for primary surgical VSD closure when confronted with severely symptomatic infants. Early mortality rates noted are 5% (1-8), much lower than the 7% to 53% range observed for a two-stage approach of PA banding followed by later VSD repair and debanding (15-17). Primary VSD repair has reduced PA band-related complications and improved long-term hemodynamic outcomes and growth rates (6, 8, 18, 19). The risk of primary repair in these young infants has been equal to or in excess of that observed after a two-stage approach. The increased risk has mainly been due to respiratory infections, residual VSD, persistent CHF, ICU mismanagement and presence of associated lesions (1-6). Primary VSD closure was adopted as the preferred surgical management for all infants with VSD at our institution. The results of this retrospective study indicate that satisfactory results can be obtained after primary surgical closure of large or multiple VSDs in infants weighing less than 5 kg. The smaller infants suffered a comparably low incidence of major complications. The longer time and associated expense of hospitalization for these infants would be less than that expected from a two-stage surgical approach. No serious perioperative complications were noted in these infants. Higher expertise and technique, finesse to operate upon very small children. Experienced perfusionist, anesthetist, dedicated intensivist and dedicated nursing staff in ICU is needed to improve results.

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