Original Article

Ventricular Septal Defect – Surgical Outcome.

Noor Ali , Ishtyak Ahmed Mir , Arvind Kohli.

Abstract

Background

Ventricular septal defect is a hole or multiple holes in the interventricular septum. Hearts with these primary defects may have minor coexisting morphologic abnormalities, or may be part of another major cardiovascular anomaly. Peri membranous ventricular septal defects are among the most common cardiac malformations and constitute 80% of these defects. Ventricular septal defects may be small, moderate or large size.

Material and Methods

The study was conducted in the Department of Cardiovascular and Thoracic Surgery on patients operated for ventricular septal defects.

Results

A total of 9 patients, mostly in second decade, irrespective of age, sex, clinical presentation and surgical outcome were included in the study. Male patients were more. Tachypnoea was the presenting symptom, and pansystolic murmur common clinical observation. Two-dimensional echocardiography was the investigation of choice, and around 80% had peri membranous type of defect. All the patients were operated under cardiopulmonary bypass, patch repair was common surgical procedure. There was no mortality.

Conclusion

Early and precise diagnosis, followed by definitive management (Device closure / Open Surgical repair) gives excellent results.

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Introduction

Ventricular septal defect (VSD) a congenital defect, is a hole or multiple holes in the interventricular septum. The interventricular septum can be considered as having muscular components that are called the inlet septum, the apical trabecular septum, an outlet (or infundibular) septum. In addition, a fourth component that is fibrous and is called the membranous septum. Tricuspid and mitral valve are attached to the ventricular septum at different levels, so that the tricuspid valve attachment is apically displaced compared with that of the mitral valve. Thus, a portion of the ventricular septum is left and is placed between the right atrium (RA), and left ventricle (LV), which is called atrioventricular muscular septum, and it is usually present in most hearts with an isolated VSD. The defects may be membranous, completely surrounded by muscular tissue or sub arterial. The defect may be so small, that it goes undetected for years, or may be large enough to warrant early surgery. About half of the patients having surgical treatment for primary VSD, have an associated lesion, coarctation of aorta, patent ductus arteriosus, and valvular or sub valvular aortic stenosis may be present in 12%, 6%, and 4% respectively. The magnitude and the direction of the shunt across VSD depends on the size of the defect and the pressure gradient across it during the various phases of the cardiac cycle. When the defect is large, it offers little resistance to flow, and small pressure differences between the two ventricles result in shunting. Even the size of the defect may vary during various phases of cardiac cycle, and an apparently large VSD may

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Keywords

Ventricular septal defect, Patch repair.

be partially closed during ventricular systole by flap of muscle or tissue, also defects in muscular septum may be smaller during systole. In left to right shunt at ventricular level, pulmonary blood flow is increased above normal and systemic blood flow. The flow through the left atrium (LA) and mitral valve (MV) orifice is similarly increased and greater work is done by both the ventricles. The flow and pressure changes reflect as larger than normal left ventricle (LV), dilated right ventricle (RV). Raised LA and pulmonary venous pressure cause many infants with VSD to have an increased amount of interstitial fluid in lungs, as a result they tend to have recurrent pulmonary infections. Spontaneous closure may be complete by one year, but complete closure takes longer time. Severe pulmonary vascular disease develops in patients with large VSD, and these patients usually don't live beyond 40 years. Infants may present with features of tachypnoea, growth failure, clinical examination may reveal liver enlargement and pansystolic murmur. Two-dimensional echocardiography and doppler flow interrogation are highly reliable. Cardiac catheterization, angiography and magnetic resonance imaging (MRI), are rarely done but are of immense value in complex anatomy, severe disease, in older children's and adult patients. Besides minimally invasive techniques, and device closure, VSDs are repaired either through RA, RV, or in special circumstances through pulmonary artery (PA) and LV. But RV and LV approaches are rarely used. In open surgical repair patients are operated under cardiopulmonary bypass (CPB) at appropriate temperature. Continue. Late post-operative cardiac function is essentially normal if when repair is done during first two years of life, residual shunting is rare, but if severe pulmonary hypertension persists after operation, it may worsen the passage of time and may cause premature death.

Material and Methods

The study was conducted in the Department of Cardiovascular and Thoracic Surgery. All the patients irrespective of age, sex, clinical presentation, and surgical outcome were included in the study. Besides a detailed history a thorough general and systemic examination was contemplated in all. Two-dimensional transthoracic echocardiography (TTE) and colour flow interrogation were highly reliable, Cardiac catheterization, angiography and magnetic resonance imaging (MRI), were rarely used. Transoesophageal echocardiography (TEE) was used in few. After the diagnosis was confirmed, patients were prepared for preanesthetic check-up and surgery, by carrying out various tests, such as Complete blood count, liver / Kidney function, Coagulogram, Cultures, Serology, Blood grouping, blood sugar, TSH, X-Ray Chest and PFT. An informed consent was taken from the patient or from the parents / guardians of the patients. Heart was approached by median sternotomy, after purse string sutures, patients were heparinised (as per desired ACT) and cannulated. Heart was arrested by using hypothermic cardioplegia / ice slush. VSD was repaired under cardiopulmonary bypass, and aortic cross clamp. After the intracardiac procedure patients were weaned off bypass gradually, and decannulated systematically. Haemostasis was achieved, effect of heparin neutralised, sub-sternal tube drains were placed, in case of breach of pleura in pleural cavities also, temporary pacing wires were fixed, and chest was closed. Intraoperative findings were recorded, adverse events were noted.

All the patients were shifted to intensive care unit. Post-operative complications were recorded, after discharge patients were followed in outpatient department. Morbidity and mortality were recorded.

Results

Only referred patients with isolated cardiac defects, irrespective of age, sex, and without any other major associated anomaly were included in the study. Of the nine patients operated. 77.77% were male, 44.44%, were in first and an equal number in second decade of life. Tachypnoea was the presenting symptom, in 88.88% and pansystolic murmur was observed in all, Cardiomegaly, biventricular hypertrophy was observed on X-Ray chest and electrocardiography respectively. Echocardiography was diagnostic in all. 55.55% were in functional class-II. All had perimembranous defects. Heart was approached by median sternotomy in all, after pericardiotomy, pericardial stay sutures were placed, and intrapericardial anatomy assessed. The patients were heparinized, systematic arterial, venous cannulation was done. CPB was established with perfusate temperature at 32 C. Cardioplegic needle was placed in ascending aorta, aorta was clamped, and cold cardioplegic solution injected. The caval tapes were snugged and RA opened obliquely, traction sutures were placed from the edges of the atriotomy to secure the atrial flaps to the subcutaneous tissue. Fine sutures were placed on the tricuspid valve leaflet and traction was maintained by retractors. Dacron patch closure using continuous synthetic, monofilament, nonabsorbable polypropylene suture was done in 77.77%, direct repair using sutures placed over felt pledgets was done in others. No other simultaneous procedure was performed. The RA was closed in two layers, horizontal mattress and over and over continuous suture 5-0 polypropylene. Deairing was done and cross clamp removed. Cardiac activity was smooth and uneventful in majority. After hemodynamic stability or at least one third of the cross-clamp time, patients were weaned of bypass gradually, and decannulation was done systematically. Cross clamp time ranged from 35 to 50 minutes, and CPB time from 60 to 100 minutes. Patients were ventilated overnight, and extubated next morning. Some needed prolonged ventilation. One was reexplored for excessive bleeding. There was no mortality. Two had features of residual shunt at follow up one was confirmed by TTE and the other one was lost to follow up.

Discussion

Isolated VSD is the common congenital heart defect, and surgical closure of this defect is the most common open-heart procedure performed in paediatric age group [1] is in accordance to the observations of the present study. Cardiac hypertrophy is the common denominator in all cases reported in VSD associated sudden death [2].Arrhythmias and sudden death suggests that damage to the ventricles is due to pressure overload [2-3].Although 80% of patients with VSDs presenting before age 1 month will have spontaneous closure of the defect, patients in whom closure does not occur may require surgery [4]. Morphological classification of VSD conforms to the consensus of the congenital heart surgery nomenclature and database project [5]. Large VSDs are approximately the size of the aortic orifice or larger, they offer little resistance to flow, moderate (if diameter is more than 25% but less than 75% of aortic annulus) although restrictive, are of sufficient size to raise RV systolic pressure, and small VSDs are of insufficient size to raise RV systolic pressure, but multiple small defects behave in aggregate as a large defect. VSDs can occur in all portion of the septum. Though the incidence of isolated VSD is unrelated to sex, race, maternal age or birth order, more male patients in present study are at variance to 44.4% reported in other studies [6], but cannot be taken as authentic because ours was a limited study, on very few patients, however, VSD more in male patients has been reported by others also. 22 About 44.44% in second decade of life has been reported by others also, this could be because patient prefer management of symptoms at local level only, or symptoms were not severe enough to warrant consultation at specialized centres, our observations are at variance with regard to mean age at operation reported as 37 months [7]. Presentation is variable, small defects only lead to minimal left-to-right shunt, medium size cause moderate LV volume overload, mild pulmonary artery hypertension (PAH), but can present late in childhood with congestive heart failure (CHF). Those with large defects develop CHF early in childhood due to severe LV overload and severe PAH. Clinical findings in present study are in accordance to the global observation, in addition CHF may be associated with poor growth and development, frail cachectic appearance, asymmetric left thoracic bulge and Harrison's groove [8].High-quality two-dimensional echocardiography imaging of VSD with colour flow evaluation of the shunt flow as the investigation of choice has changed traditional views about preoperative studies [9], and when the morphology is clearly defined cardiac catheterization and cineangiography are not necessary before closure of primary VSDs [10-11]. Most of the patients 55.55% in functional class III is an indicator from the reports in literature that without surgical treatment, about 9% of infants with large VSD die in first year of life [12], but ours was a small study, besides only patient referred from other department were included in the study. Perimembranous defect as the most common defect is well known [13], but perimembranous defect as the only defect is not reported, since we had few patients only, and drawing such an inference is not possible. Nearly half of the patients undergoing surgery for a primary VSD have an associated cardiac anomaly [14], is not in accordance to present study, because only patients with isolated VSDs were included in the study. Median sternotomy was done in all and the defects were repaired through RA, which approach is recommended by others also [15]. Primary or Dacron patch closure is the preferred technique for VSD repair [16], and we are in agreement with this approach. The feasibility of an atrial approach is well established [17], along with hypothermic circulatory arrest [18], also routine primary repair of VSD has been reported to be superior to pulmonary banding [19]. Mortality was high in early years, but with the advancement in diagnosis, myocardial management, and post-operative care has significantly come down, adults who undergo surgical VSD closure in childhood generally do well, but survival is lower than that of the general population, late mortality is about 4%, and another 4% may require pacemaker implantation because of sinus node disease, [20], though we had no mortality, but lacked long-term follow-up data. It has been observed that even in patients with low body weight, increased ventilation time and prolonged hospital stay, results of surgical VSD closure are excellent with no mortality and low morbidity [21]. Overall long-term survival in patients with isolated perimembranous VSD seems to be good but not uneventful, residual shunt of 22.22% in present series is similar to observations by others [22]. In small defects surgery can be withheld as long as left-to-right shunt is definitely less than 50% and signs of LV volume overload are absent, and if there is no evidence of aortic regurgitation, arrhythmia or endocarditis [23]. This study is limited because few patients were operated, all were above 4 years of age and had only perimembranous defect, none had any other associated cardiac anomaly, and long-term follow-up was not available. In conclusion patients with VSD can present at any age in any functional class. Detailed history, thorough general / systemic examination is helpful, echocardiography helps confirm diagnosis, patch / primary repair under CPB gives excellent results. However, patients / guardians of the patients must be explained in detail the benefits of minimally invasive techniques over open surgical repair, and all patients who want to avail the benefits of such techniques must be offered that.

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