SPONTANEOUS CLOSURE OF ISOLATED VENTRICULAR SEPTAL DEFECT IN THE FIRST FIVE YEARS OF LIFE

Tishk M Salam*, Aso F Salih** and Jamal A Rashid***

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ABSTRACT

Background

Isolated VSD is the most common congenital heart defect. The defect can be in any portion in the septum and of different size that play an important role in the clinical outcomes of its spontaneous closure.

Objective

To correlate the size and location (excluding inlet type) of isolated VSD with spontaneous closure rate in the 1st 5 years of life.

Materials and Methods

This is a retrospective study for patient's record with VSD that visited Sulaimani Pediatric Teaching Hospital during 1st of January 2006 to 30th of February 2011 in Echocardiography Unit observed and studied by the same operator. The data analysis of 87 children records with isolated VSD had been studied on frequent outpatient clinic visits and followed up for a maximum period of 5 years or until spontaneous closure had occurred. Results from two dimensional, and Doppler (spectral and color) echocardiography examinations were evaluated for each patient.

Results

The age range of patients at time of initial examination who received follow up was 5 days to 12 months old. Spontaneous closure occurred in 43(49.4%) of the 87 cases that were followed up for 5 years. Thirty six (62.1%) cases of small, 7 (35%) cases of moderate and none of the patients with large VSDs had spontaneous closure. Spontaneous closure was noted in 34 (72.3%) of 47 cases of muscular defects and in 9 (22.5%) of 40 patients with perimembranous VSD. The time of spontaneous closure ranged from 1 to 60 months and it occurred most commonly during the first 24 months of age. By the 1st, 2nd, 3rd and 4th year cumulative spontaneous closure occurred in 28.7%, 43.6%, 47.1%, and 48.2% respectively and at the 5th year it was seen in all 43 cases.

Conclusion

More than half of the small and one third of moderate size VSD had spontaneous closure by 5 year of age. Two thirds of muscular and nearby one fourth of perimembraneous defects have closed spontaneously.The majority of spontaneous closures occurred in the first 2 years of life.

Keywords: *Ventricular septal defect*, *Spontaneous closure*, *Perimembranous*.

* Sulaimani Pediatric Teaching Hospital, Sulaimani Directorate of Health.
** Department of Peidatrics, School of Medicine, Faculty of Medical sciences, University of Sulaimani: Corresponding email asofaek@hotmail.com
*** Department of Peidatrics, School of Medicine, Faculty of Medical sciences, University of Sulaimani.

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INTRODUCTION

Ventricular septal defect (VSD) is the most common form of congenital heart disease if bicuspid aortic valve is excluded. The defect can be in any portion of the ventricular septum, and the physiologic consequences can range from none to severe [(1)]. VSDs account for 25% of congenital heart disease [(2)] and are slightly more common in females.

For Perimembranous defects (paramembranous, conoventricular, subaortic or perimembranous): Multiple factors are involved in closure of the region encompassing the perimembranous septum. 75% of VSDs are perimembranous. Perimembranous VSDs lie just beneath the aortic valve and behind the septal leaflet of the tricuspid valve. Often these defects have extension into the inlet or muscular septum and can undergo partial or complete closure by apposition of the septal leaflet of the tricuspid valve, forming a tricuspid valve "pouch" or "aneurysm of the ventricular septum" [(3)]. Less commonly, they can be closed by prolapse of an aortic cusp into the defect [(4)].

Subpulmonic (outlet): VSDs that are superior and anterior in location are referred to as subpulmonic or outlet defects (also called supracristal, infundibular, conal septal, or doubly committed subarterial defects). These defects account for approximately 5% of defects in North America and western Europe [(5)], but are more common (approximately 30%) in the Asian population [(6)]. Subpulmonic defects are located immediately beneath the valves of both arterial trunks. They commonly are associated with prolapse of the right coronary cusp of the aortic valve with or without aortic regurgitation. Outlet defects rarely close spontaneously.

AV canal (inlet): approximately 5 % of VSDs are inlet or AV canal- type defects they do not close spontaneously. Muscular defects: 10-15% of VSDs are muscular. Muscular defects often close spontaneously [(7)].

Small VSD: In patients with small VSDs, parents should be reassured of the relatively benign nature of the lesion, and should be encouraged to live a normal life, with no restrictions on physical activity [(2)]. A significant number (30-50%) of small defects closes spontaneously, most frequently during the 1st 2yr of life. Small muscular VSDs are more likely to close (up to 80%) than membranous VSDs (up to 35%), the vast majority of defects close before the age of 4 year [(2)].

Medium and large VSD: It is less common to close spontaneously, although even defects large enough to result in heart failure my become smaller and up to 8% may close completely.

MATERIALS AND METHODS

A retrospective data analysis of the 87 children with isolated VSD was performed in whom the condition was observed during the period from 1st of January 2006 to 30th of February 2011 in the Pediatric Echocardiography Unit/Sulaimani Pediatric Teaching Hospital. Regular follow up was done in the outpatient clinic of the hospital.

The 87 patients that were enrolled in this study were followed up for a maximum period of 5 years or until spontaneous closure had occurred (the VSD was considered spontaneously closed if the characteristic murmur was no longer heard during auscultation and when echocardiogram of the ventricular septum was normal). The variables that were studied included: size of the defect, VSD position and age at spontaneous closure of the defect.

Two dimensional, and Doppler (spectral and color) echocardiography examinations were obtained for each patient using a commercial instrument with 3V2C and 7V3C MHz transducers (adjusted according to Patient's chest wall thickness) Acuson Cypress, Siemens Company. The examination was performed for each patient involved in this study in a dimly light room while they were at rest with partial left lateral decubitus position when needed. Sedation was not needed.

The echo measurements were recorded according to the standards recommended by the American Society of Echocardiography. Transthoracic cross-sectional echocardiography usually allows clear demonstration of all the intracardiac anatomy.

The data collected were analyzed by SPSS software version 19 using Chi–square test and P value ≤ 0.05 was regarded as significant.

RESULTS

The age of patients who were followed-up ranged from 5 days to 12 months at the time of initial examination.

Regarding VSD size, of the 87 cases, 58 (66.7%) had small (<0.5cm^2 in diameter), 20 (23%) had moderate (0.5-1cm^2) and 9 patients (10.3%) had large VSD (>1cm^2).

Thirty six cases (62.1%) of the 1st group, 7cases (35%) of the 2nd group while none of the 3rd group respectively had spontaneous closure during the follow up period (p-value=0.00), figure 1.

Regarding the site of the VSD; spontaneous closure was noted in 34 (72.3%) of 47 cases of muscular defects and in 9 (22.5%) of 40 patients of perimembranous VSD (p-value=0.00), figure 2).

As inlet VSD type was associated with other CHD (not isolated) and no spontaneous closure was noted in our study, this type was excluded.

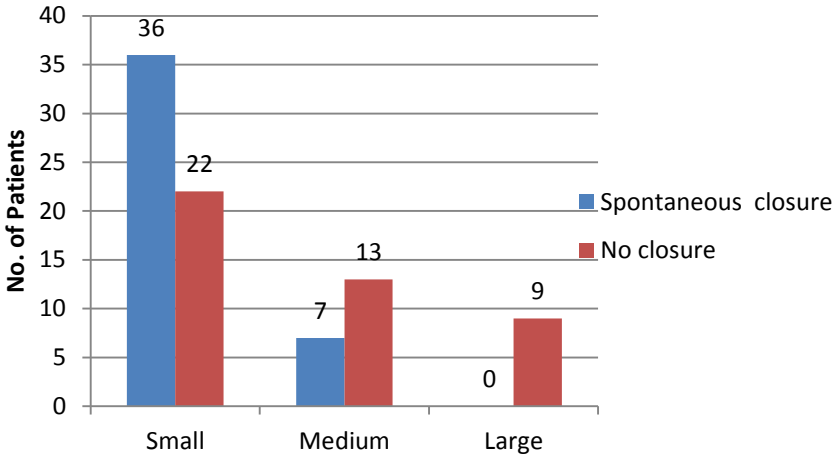

Figure 1. Spontaneous VSD closure rate in relation to VSD size.

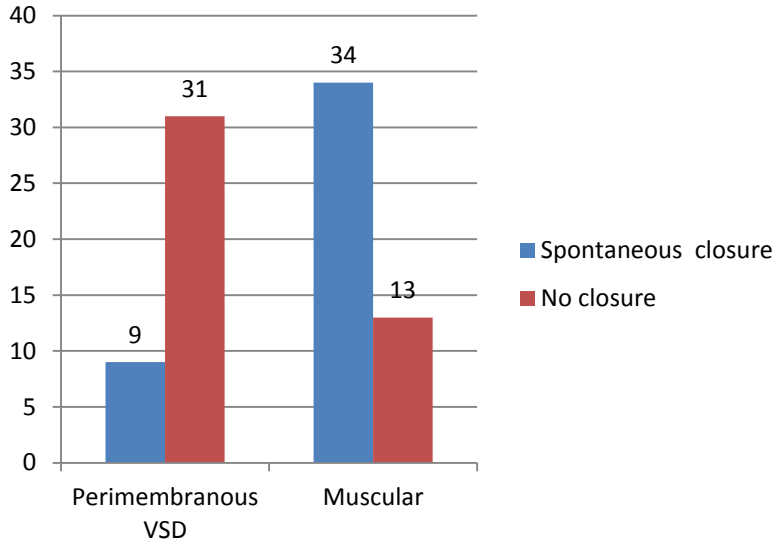

Figure 2. Spontaneous VSD closure rate in relation to VSD location.

Spontaneous closure occurred in 43 (49.4%) of 87 cases. Figure 3 shows the relation of the site of the spontaneously closed VSD with the size of the defect. The time of spontaneous closure was ranged from 1 to 60 months. Majority of spontaneous closure was noted during the 1st two years of life (38 of 43 cases), figure 4. By the 1st, 2nd, 3rd and 4th year cumulative spontaneous closure occurred in 28.7%, 43.6%, 47.1%, and 48.2% respectively and at the 5th year of follow up it was seen in all 43 cases, table 1.

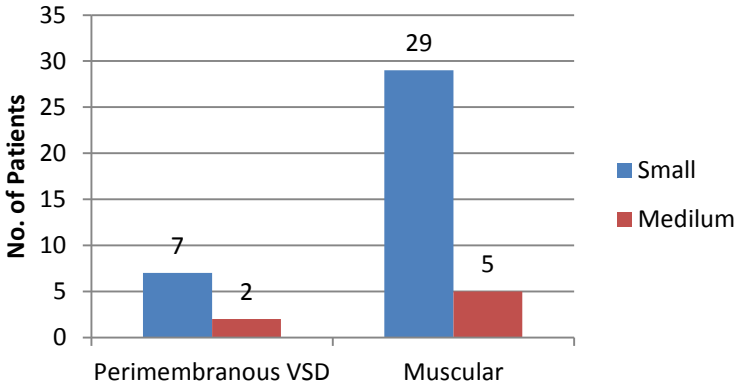

Figure 3. The site of the spontaneously closed VSD in relation to the size of the defect.

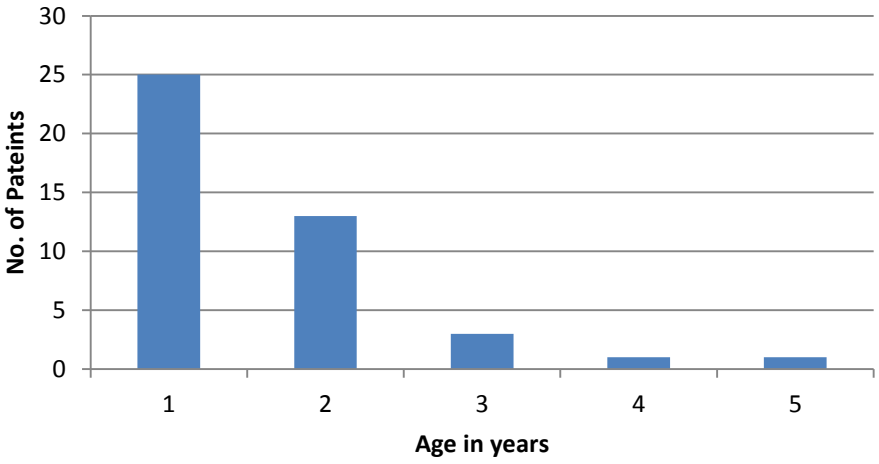

Figure 4. Number of spontaneous VSD closure in relation to the patient's age during follow up period.

Table 1. The spontaneous VSD closure by age.

Age at time of the Spontaneous closure(years)	Number of patients	Percentage
≤1	25	58.1
-2	13	30.2
-3	3	6.98
-4	1	2.35
-5	1	2.35
Total	**43**	**100**

P-value <0.05

DISCUSSION

Some investigators have suggested that small ventricular septal defects are not a malformation and that early spontaneous closure of these defects is a normal developmental process [8]. Large VSDs and those associated with Down's syndrome or heart failure are less likely to close spontaneously. Smaller defects and muscular defects tend to close spontaneously more frequently than others [9]. In this study spontaneous closure of VSD occurred in 43(49.4%) patients of the total 87 cases and there was a high closure rate for small VSD (62.1%) compared to moderate and large size VSD closure of 35% and none respectively, this result was near to the spontaneous closure of 67.3% and none for small and large defect respectively, but higher than 14.2% for moderate size defect closure that demonstrated by S W Turner and S Hunter [10].

Spontaneous closure of muscular VSD is a well-known phenomenon and is believed to occur in the majority of cases within the 1st few years of life [11]. During follow up period in our study 72.3% of muscular and 22.5% of perimembranous VSD closed spontaneously. There is evidence that this spontaneous closure occurs more frequently in muscular VSD cases when compared to the perimembranous VSD, as demonstrated by Mehta and Chidambaram [12] at percentages of 42% and 23%, respectively, in these two locations. The same relation, at even higher proportions than the aforementioned one, was demonstrated by Miyake *et al*. [13], corresponding, respectively, to 83% in the cases with muscular VSD and to 45% in those with perimembranous VSD. Moe and Guntheroth [14] also demonstrated this closure in 50% of the muscular VSD and in 37% of the perimembranous ones. Other authors were also in accordance with this result; in addition, Lin *et al*. [15] verified closure of the defect in 83% of the muscular VSD and 24% of the perimembranous ones.

In our study majority (88.3%) of the spontaneous closures of VSDs had occurred in the first 2 years of life in those patients who were followed up for 5 years and this result is near to Sands A[16] and Hiraishi S [17] studies that found a very high frequency for isolated VSDs when term neonates were routinely investigated using echo-cardiography, Most of the defects were small and muscular, 78% had closed by 6 months of age and 76% had closed by the 1st birthday in the first and second aforementioned studies respectively.

Overall spontaneous closure of VSD in our study was 28.7% at 1year and 49.4% at 5 years which was close to 34% at one year but lower than 67% at five years in Mehta and Chidambaram study [12] and similar to Atik's E study who was found spontaneous closure rate of 34.48% and 49.89% in the 1st and 5 years respectively [18].

In conclusion, more than half of the small and one third of moderate size VSD had spontaneous closure by 5 year of age. Two third of muscular and nearby one fourth of perimembranous ducts were closed spontaneously. The majority of spontaneous closure occurred in the first 2 years of life.

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