Prevalence of Ventricular Septal Defect among Congenital Heart Defects in Children attending Ibn Al-Nafees Hospital, BAGHDAD-IRAQ, 2015

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Abstract

Background: Congenital malformation according to Iraqi Ministry of Health annual report 2013 was 0.4 of live births, relatively 502,982 babies suffered from at least one type of congenital malformation. Therefore latitude of congenital heart defect (CHD) reflects dystrophic challenge for Iraq in general and in practically the health system.

Objectives: To measure the prevalence of VSD, its association with certain factors, and assesses the anthropometrical measures among Mother and children with CHD.

Patients & methods: Hospital based cross sectional study was conducted on 349 under five children with CHD attending Ibn Al-Nafees Teaching Hospital. The nutritional status of under five children was assessed, meanwhile 296 Mother's Body Mass Index (BMI) was assessed to point out an association over CHD and VSD . **Results**: The prevalence of VSD was 54.7%, followed by ASD 29.2%, the combination of VSD and ASD was on the top of congenital heart malformation 61.4%. Nutritional status assessment showed that wasted children as almost three doubles over normal distribution which exhibit acuteness with no evidence on disease chronicity.

Conclusion: There were no statistically significant association between VSD and other CHD regarding residency, Mother's age, child's age, Father's and Mother's education, consanguinity, family history, febrile illness, passive smoking, certain medication received, anemia and DM.

Keywords: Congenital heart defect (CHD), ventricular septal defect (VSD), and congenital anomalies.

1. Introduction

In general all birth defects despite heart defect impose substantial costs on both families and society because of medical, developmental, and special education needs. Caring for children with birth defects and heart defect in specific may influence caregiver time and impact the family. However, the economic cost of caregiver time and other impacts on the family has received far less attention than traditional healthcare costs (Tilford *et al* 2001).

CHD have a wide spectrum of severity in infants; about 2-3 in 1000 newborn infants will be symptomatic with heart disease in first year of life. The diagnosis is established by first week of age in 40-50% of patients with CHD and by one month of age patients (Kliegman *et al* 2011). CHDs are the most common type of birth defect among newborns (80 cases per 10,000 live births), and are a leading cause of mortality from birth defects. Although there has been substantial progress in recent years in understanding genetic and chromosomal risk factors, there remain relatively few recognized non inherited, modifiable risk factors for CHD. Consistent associations have been reported between CHDs and relatively uncommon maternal conditions during pregnancy, such as rubella infection and pre gestational diabetes mellitus; associations with more prevalent modifiable risk factors, such as maternal cigarette smoking, also have been reported (Ferencz *et al* 1993 & Ferencz *et al* 1997).

Assuming that the incidence of CHDs in Iraq is similar to what it is worldwide-about one in one hundred, these factors (long disease course combined with lack of treatment) easily demonstrate why tens of thousands of kids are in line and on waiting lists for surgery.

VSD is the most common cardiac malformation and accounts for 25% of CHD. Defect may occur in any portion of ventricular septum, but most are of membranous type. These defects are in posteroinferior position, anterior to the septal leaflet of the tricuspid valve (Kliegman *et al* 2011).

The total incidence of CHD was related to the relative frequency of VSDs, the most common type of CHDs. The incidence of CHD depends primarily on the number of small VSDs included in the series, and this number in turn depends upon how early the diagnosis is made. The incidence of moderate and severe forms of CHD is about six per 1,000 live births (19/1,000 live births if the potentially serious bicuspid aortic valve is included), and of all forms increases to 75/1,000 live births if tiny muscular VSDs present at birth and other trivial lesions are included. Given the causes of variation, there is no evidence for differences in incidence in different countries or times (Hoffman and Kaplan 2002).

The former studies were usually passive and diagnosis is made in a high-quality pediatric cardiology center but relies on referral of patients from local doctors. Thus, if a local physician is comfortable with the management of a tiny VSD or a mild pulmonary stenosis (PS), that patient might not be referred to a center and so not be counted. In addition, some defects with subtle physical findings, such as atrial septal defects (ASDs), might not be detected until they appear in adult life (Abu-Harb *et al* 1994). Meantime some neonates with severe critical heart disease may die in the first few days after birth, and without cardiologic or autopsy diagnosis would not be correctly identified (Kuehl *et al* 1999). On the other hand, the more intensive studies, for example, of all neonates in a nursery, will detect all forms of CHDs and allow for early deaths, but the incidence of uncommon forms of CHDs will be inadequately assessed because of small numbers.

Isolated VSDs are by far the most common form of CHDs. Some studies done by taking echocardiograms on every newborn infant in a nursery, including some with no murmurs, have found huge numbers of tiny muscular VSDs, the incidence of these varying from 2% to 5% (Tikanoja 1995). About 85% to 90% of these defects close spontaneously by one year of age (Sands *et al* 1999). Therefore, the incidence of VSDs will be much higher if all newborns are examined, lower if only those newborns with murmurs are examined and lower still if accession of these subjects is delayed until one year of age. Although these small defects that close spontaneously place little burden on the health care system, correct identification of their incidence has a possible bearing on studies of causation.

2. Patients & Methods

This is a Hospital based cross sectional study on 349 under five children with CHD attending Ibn Al-Nafees Teaching Hospital who were subjected to questionnaire prepared by the researcher after testing on 10 patients.

The questionnaires consist of socio-demographic variables and possible risk factors that affect pregnancy outcome. CHD diagnosis confirmed through an Echo examination for all cases included in the study.

The study data was computerized using Computer software Statistical Package for the Social Sciences (SPSS) and analyzed to measure the proportion of measurement of the study variables using Chi-square when available, furthermore extent Fisher's Exact test applied whenever Chi-square was not applicable. The nutritional status of under five children was assessed through an anthropometric measures and compared along with z-score of CDC 2000, meanwhile 296 Mother's Body Mass Index (BMI) was assessed to point out an association among CHD and VSD.

Almost all children involved in the study assessed for nutritional status and the results compared with Multiple Indicators Cluster Survey IV 2011 (MICS IV 2011). In addition under two years children's nutritional status assessed by measuring their head circumference and through comparing this study figures with that of the WHO child growth reference standard the nutritional status of less than 2 years expressed.

The prevalence of VSD among congenital heart defects, socio-demographic characteristics and possible factors associated with VSD rather than other defects were evaluated. WHO standard Anthro plus software used to measure the nutritional status of cases based on the anthropometric measurement. Required statistical test used to measure the significant difference among these variables. The results presented in tables and illustrated using appropriate graph.

3. Results

The study demonstrated socio-demographic characteristics as 84.2% urban residency, 84.2% of the Mothers aged between 20-39 Years old, almost two thirds of the children were infants less than one year, as shown in Table (1).

Table (2) showed that inter family marriage constituted 58.5% of the total sample and only 8.3% reported positive family history, 30.4% Mothers reported febrile illness during first trimester. Passive smoking reported by 48.7% and almost two thirds of the interviewed Mothers had overweight problem.

Regarding nutritional status; 21.8% were classified as wasting according to weight for height z-score anthropometric index, among those 12.3% had severe wasting; as shown in Table (3).

Figure (1) showed that more than a half (54.7%) of the sample had VSD, followed by ASD (29.2%). Other anomalies were scattered between PS, PDA and TOF, which constituted almost a third of study sample. Other anomalies were very infrequent, like (AVS), I-Transposition of the Great Arteries, Pulmonary Atresia, (CoA), d-Transposition of the Great Arteries, Inter Ventricular Canal and Dextra Cardia, these anomalies collectively constituted 3.9%.

The study sample was classified according to the presence of VSD and its relation to the cardiac congenital defects into 3 groups. These were isolated VSD (38.5%), VSD combined with other anomalies (16.4%) and other anomalies (45.1%); as shown in Figure (2).

4. Discussion

VSD as an isolated anomaly and combined with other anomalies constituted more than half of the study sample while other anomalies were 45.1%. In general VSD only was 38.5% which can be considered as one of the highest rank. The reason behind this favorism for VSD compared to other CHDs might be related to the nature of the study location as being a referral Hospital, also could be attributed to that the study was conducted in a tertiary centre to which cases are referred from all parts of Iraq; in addition the simplicity of the VSD diagnosis and the availability of the facility to do so to some extent has an influence or it's related to disease nature and good prognosis with VSD cases even the tiny cases compared with other anomalies that might lead to child death before management or even diagnosis. In Iraq CHD constitute 14.25% of all congenital birth defects (MOH 2012). It is worthy to show that the reported Iraqi figure of CHD incidence among new born is 4.4/10,000, which is much lower than the US Atlanta (Reller *et al* 2008) figures for only the VSD. The problem with recording and notification in Iraq is a big one till now .

Out of all VSD combined with other anomalies there was 61.4% combined with ASD which was the highest among other anomalies and this goes with normal trend of other researches (Hoffman and Kaplan 2002), while the combination of other anomalies constituted 1.8%. Among the lower frequencies was 0.9% for each of AVS, I-Transposition of the Great Arteries and Pulmonary Atresia. Meanwhile COA, d-Transposition of the Great Arteries, Inter Ventricular Canal and Dextra Cardia recorded among the lowest frequencies with 0.3% for each, collectively it follows normal tendency of CHD globally (Van der Linde *et al* 2011).

The socio-demographic characters of the study sample were explored in different aspects, residence distinguished as urban and rural and the results came with 84.2% for urban, this might have several reasons related to Ibn Al-Nafees Hospital accessibility regarding its location in the middle of Baghdad (selection bias), or it might be due to preference of the responder to such question .

Another aspect was Mother's age and it was found that 83.6% aged between 20 – 39 years old and the rest divided between <20 years and > 40 years old, the reasons beneath might related to reproductive activity at this age group; it was found that 74.5% of married women aged between 20 – 39 years according to Iraq – Women Integrated Social and Health Survey (I-WISH 2011). In addition this age group represents high proportion of the population, according to Central Statistical Organization, Iraq; the estimation of 20 -39 years old was 33% female and almost 17% of total population (The population projection for some age group in 2015).

Child age was grouped and the result revealed almost two thirds of them were infants (under one year), 38.7% were under six months. This can be explained as bad prognosis cases will not pass the first year, on the other hand the infants reach health facility more often due to vaccination schedule which make an easy diagnosis of such cases and relatively better recording .

Father's and Mother's education levels were explored and the results showed decline of CHD frequency with higher educational level as it might be due to better health knowledge accompanying with high education level;

foreseen this study presented 83.1% (either illiterate or just Read & Write), meanwhile 83.4% was either non-educated or had primary education (I-WISH 2011).

Consanguineous marriage constituted 58.5% of the study sample, 25.5% was first relative and 21.5% for second relative which goes with normal trend of other anomalies with higher risk inside interfamily marriage. Furthermore I-WISH 2011 revealed that 55.4% of Iraqi women between 15-49 years old expressed consanguinity with 20.2%, 11.8 and 23.4% for first, second and third relation respectively (I-WISH 2011). The idea was to measure the effect of consanguinity on the three studied groups (isolated VSD, VSD combined with other anomalies and other anomalies) in order to remark an association. It is obvious that the CHD frequencies with consanguinity is higher than that of no consanguinity and the incidence of CHD is higher in consanguinity regardless the type of anomalies (Khalid *et al* 2006). It's well known that the risk of CHD recurrence increased when there is a positive family history (Burn *et al* 2006). This study revealed small proportion of positivity less than 9% which goes parallel with normal trend .

Only 1.1% observed receiving medication during concerned pregnancy, although the study considered only antiepileptic drugs, Retinoid and NSAID administration. Still the results showed less frequencies compared with other studies (Matalon *et al* 2000, Lammer *et al* 1985, Huhta *et al* 1987, Ericson and Kallen 2001).These results subjected to information bias either due to dependence on the Mother's recall or it can refer to Mother's experience and knowledge about drugs item. In addition haphazard usage of pain killers without doctor consultation is one of the main problems, the patient might consider items like indomethacin or mafnamic acid as safe drugs while the real picture is quite different.

Literature showed that the association with febrile illness was strongest for tricuspid atresia, left obstructive defects, transposition of the great arteries and ventricular septal defects (Botto *et al* 2001). Taking into consideration the recurrence of CHD is higher among pregnant women who reported febrile illness, febrile illness during first trimester constituted only 30.4% from the study sample, which can be referred to recall bias since some of cases happened years ago. The association of febrile illness during first trimester among three study groups indicated no statistical significant.

Mother's anemia during first trimester results into 114 cases with anemia, relative frequency with positive anemia was 33% for this study which is not far from a similar Iraqi estimate of 37.9% reported by Iraq Family Household survey (IFHS) 2007. This figure was based on examination of blood samples obtained from the pregnant women. Although the present study figure is smaller than the Iraqi figure, one should notice that the present study refers to first trimester of pregnancy only, which is expected to be much higher when the whole period of pregnancy is included. Referring to the previous argument it seems that anemia during pregnancy as a risk factor for CHD is not such important as it was highlighted in published articles .

This study showed that only 2 % of the mothers were with positive history of Diabetes Mellitus (DM), comparing this figure to that of Chronic Non-Communicable Diseases Risk Factors Survey in Iraq 2006 which indicated DM in 10.4%. Such matches minimize the effect of DM on CHD; sequentially the association between DM and CHD was observed and excluded .

Mother's obesity assessed among 296 interviewed Mothers, overweight and obesity was a problem with 63.6%, obesity constituted 26.4%. Articles found that underweight women (body mass index <16.5) were less likely to have a child with a major isolated heart defect whereas the risk was elevated among overweight or obese women body mass index >26 (Watkins and Botto 2001). In Iraq, according to the Ministry of Health report the prevalence of obesity in women in reproductive age was 38.2% in 2006 (MOH 2006). Moreover in Baghdad between 1997 and 2007 the prevalence of obesity among women in reproductive age increased from 23.6% to 25% (Al-Twail *et al* 2007), in conclusion there was no effect of the obesity since study figures were close to population one .

Assessing the nutritional status of the studied children revealed that 17.9% were underweight, 8.8% were severely underweight; this figure is almost double the population estimation from Multiple Indicators Cluster Survey (MICS IV 2011), it's not known whether causes behind were multiple infections of child with CHD due to low immunity or the malnutrition of the child was the cause for multiple infections or simply the effect of poor health .

Height for age indicator seems close to that of MICS IV, 20.7% were stunted and 12.9% out of them were severely stunted, while MICS IV figures are 10% severely stunted out of 22% stunted (MICS IV 2011). This value revealed no chronicity and no long period of the disease due to the fact of two thirds of the sample were less than one year. In fact it's known that stunting reflect chronic malnutrition as a result of inadequate nutrition over long period or recurrent or chronic illness (MICS IV 2011). On the other hand this similarity with that of

general population could be explained as all the cases were newly diagnosed and if they will be followed further without proper treatment the results will be more than that of the general population.

The current study revealed that 12.3% and 9.5% of the children were severely wasted and wasted respectively, taking into consideration that wasting is a reflection of recent nutritional deficiency, these exhibit seasonal shifts accompanied with changes in the availability of food or disease prevalence. The figures of this study sample are almost three double over that of MICS IV which shows 7% wasted out of them 3% severely wasted (MICSIV 2011), this study can provide evidence of recent illness effect on the child nutritional status. This explanation goes closely with trend of the acuteness of the disease and the close monitoring of the diagnosed cases that visited Ibn Al-Nafees Hospital .

Child age divided into four groups (< 6 months, 6-12 months, till 2nd year and > 2 years) and segregated according the three groups (other anomalies, VSD only and VSD combined with other anomalies), although the figures of 6-12 months and 2nd year are slightly different over study groups rather than that of <6 months and >2 years but still it cannot be considered statistically significant; statistically we can say that there is no association between CHD and child age no matter it is VSD alone or combined with other anomalies .

Although most of studies focusing on positive smoking of the Mother three months before and during pregnancy, the present study pointed out the contribution of passive smoking to the overall risk of CHD. More than half of Mothers in the current study reported passive smoking during pregnancy and no smoker case was reported. Reference to Chronic Non-Communicable Diseases Risk Factors Survey in Iraq 2006, about 8% of women aged 25-44 years were smoker (MOH 2006), the time being no case reported smoking in this study sample which can be refereed to respondent desire to react with no rather than yes in line to culture aspect, the picture was different with passive smoking (relative smoking) were the figure 48.7% was near to that of Chronic Non-Communicable Diseases Risk Factors Survey in Iraq 2006 (MOH 2006). Passive smoking effectiveness during concerned pregnancy among study groups shows no statistically significant. The query of these indices related to the fact of almost equal frequencies of passive smoking to that of no passive smoking during concerned pregnancy, this might be due to quantity of the passive smoking, how close the relative is and others .

Residence, Mother's age, Father's & Mother's education, consanguinity, family history, medication received, febrile illness, anaemia and DM all were assessed and statistic measures applied, the results show no significant for VSD over other CHD and no statistically observation was recorded among three study groups.

5. Conclusion

The current study revealed that the prevalence of VSD in Iraq was higher than what was expected there were no statistical significant correlations between VSD and other CHD regarding residency, mother's age, child's age, Father's and Mother's education, consanguinity, family history, febrile illness, passive smoking, certain medication received, anemia and DM.

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Table 1: Frequency distribution of study sample by socio- demographic and possible risk factors

Socio- demographic and possible risk factors		Ventricular Septal Defect(VSD)-groups						P Value
		Other heart anomalies rather than VSD		VSD only		VSD combined with other heart anomalies		
		N	%	N	%	N	%	
Residence	urban	131	83.4	113	84.3	49	86.0	NS[1]
	Rural	26	16.6	21	15.7	8	14.0	
	Total	157	100.0	134	100.0	57	100.0	
Mother's age group (years)	<20	12	7.6	11	8.2	6	10.5	NS
	20-29	91	58.0	75	56.0	27	47.4	
	30-39	45	28.7	35	26.1	20	35.1	
	40+	9	5.7	13	9.7	4	7.0	
	Total	157	100.0	134	100.0	57	100.0	
Child's age group	<6 months	61	38.9	51	38.1	23	40.4	NS
	6-12 months	32	20.4	39	29.1	17	29.8	
	2nd year	34	21.7	17	12.7	5	8.8	
	>2 years	30	19.1	27	20.1	12	21.1	
	Total	157	100.0	134	100.0	57	100.0	
Mother's education level	Illiterate	30	19.1	25	18.7	8	14.0	NS
	Read & write	100	63.7	91	67.9	35	61.4	
	Secondary school	13	8.3	13	9.7	9	15.8	
	Vocational[2]	13	8.3	4	3.0	4	7.0	
	Higher education	1	.6	1	.7	1	1.8	
	Total	157	100.0	134	100.0	57	100.0	
Consanguineous marriage between parents	No consanguinity	67	42.7	55	41.0	23	40.4	NS
	Yes consanguinity	90	57.3	79	59.0	34	59.6	
	Total	157	100.0	134	100.0	57	100.0	
Family history of CHD	Negative Family history	142	90.4	126	94.0	51	89.5	NS
	Positive Family history	15	9.6	8	6.0	6	10.5	
	Total	157	100.0	134	100.0	57	100.0	
Febrile illness during first trimester of pregnancy	Afebrile illness	112	71.3	92	68.7	38	66.7	NS
	Febrile illness	45	28.7	42	31.3	19	33.3	
	Total	157	100.0	134	100.0	57	100.0	
Passive smoking during concerned pregnancy	Negative passive smoking history	84	53.5	65	48.5	29	50.9	NS
	Positive passive smoking history	73	46.5	69	51.5	28	49.1	
	Total	157	100.0	134	100.0	57	100.0	

[1] Not significant
[2] Vocational(Academy and Diploma)

Table 2: Association of 4 selected definition of malnutrition among the three studied groups of CHD

Child nutritional status	Ventricular Septal Defect(VSD)-groups						P value
	Other anomalies		VSD only		VSD combined with other anomalies		
	N	%	N	%	N	%	
Underweight/severe underweight							NS
Acceptable zone	126	81.3	106	82.2	46	83.6	
Underweight/ sever underweight child	29	18.7	23	17.8	9	16.4	
Total	155	100.0	129	100.0	55	100.0	
Stunting/severe stunting							NS
Acceptable zone	120	78.9	104	81.9	40	74.1	
Stunting/severe stunting child	32	21.1	23	18.1	14	25.9	
Total	152	100.0	127	100.0	54	100.0	
Wasting/severe wasting							NS
Acceptable zone	111	75.5	97	77.6	45	86.5	
Wasting/severe wasting child	36	24.5	28	22.4	7	13.5	
Total	147	100.0	125	100.0	52	100.0	
Malnutrition/severe malnutrition							NS
Acceptable zone	90	76.9	83	79.0	35	76.1	
Malnutrition/severe malnutrition child	27	23.1	22	21.0	11	23.9	
Total	117	100.0	105	100.0	46	100.0	

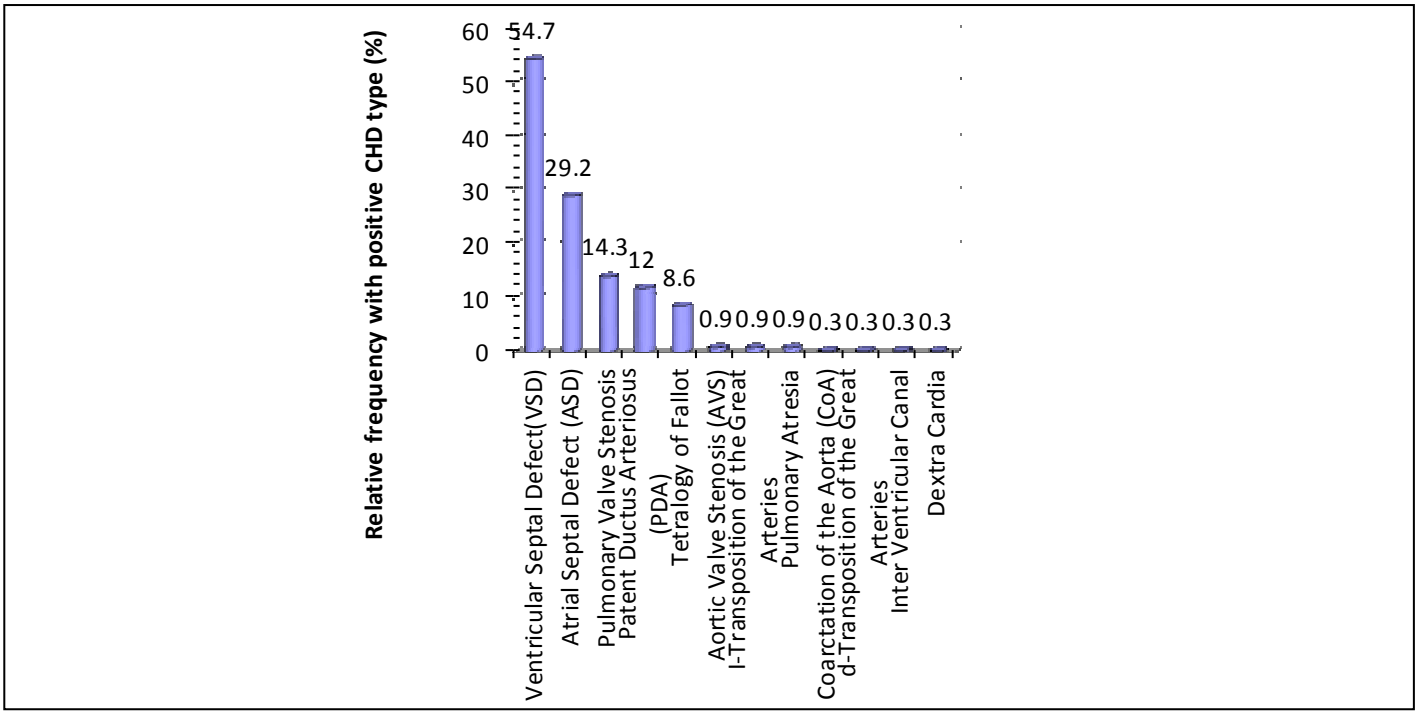

Figure 1: Frequency distribution of CHD types among the whole study sample.

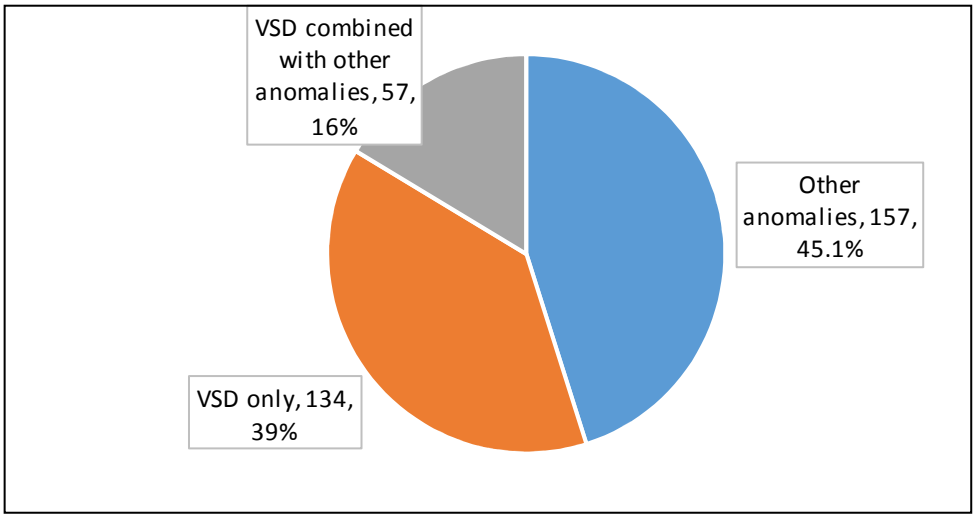

Figure 2: Distribution of children CHD by presence of VSD (Isolated Vs combined).

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