Original Research Article

An evaluation of cardiac murmurs in new-born

Preethi S. Pillai*, Neelima Narayanan, Lyla Chacko

Department of Pediatrics, Government TD Medical College, Vandanam, Alappuzha, Kerala, India

*Correspondence:
Dr. Preethi S. Pillai,
E-mail: preethipillai@yahoo.com

ABSTRACT

Background: Congenital heart disease (CHD) is defined as a structural abnormality of the heart or intrathoracic great vessels that is actually or potentially of functional significance. The aim of the study is to assess the prevalence of congenital heart disease in new-borns with cardiac murmurs and to study the spectrum of cardiac diseases in new-borns with cardiac murmur.

Methods: All the new-borns with cardiac murmurs were evaluated with ECG, Chest X ray and ECHO. They were classified into normal, mild, moderate and severe heart disease.

Results: Of the 3375 babies analysed, 80 babies had murmur. ECHO could not be done in 8 babies. Of the 72 babies, 75% of new-borns with murmur had cardiac disease. The prevalence of cardiac disease in this population is 16 per 1000 new-borns. The prevalence of cardiac disease in new-borns with murmur is 750 in 1000 new-borns .94.5% had acyanotic heart disease and 5.5% had cyanotic heart disease. VSD was the most common lesion. 13.9% had severe heart disease, 20.8% had moderate heart disease and 40.3% had mild cardiac disease. There was good correlation between the degree of murmur and the severity of the cardiac disease. Chest X ray contributed only 12.5% to diagnosis of cardiac disease and ECG contributed only 5.3% to the diagnosis. If both ECG and Chest X ray were abnormal,there was 100% association with significant cardiac disease. No correlation was found between gestational age and birth weight and severity of heart Disease.

Conclusions: Present study has proved that any murmur in newborn requires evaluation with ECHO as 75% of new-borns with audible murmur had cardiac disease of which 34.7% was moderate to severe heart disease. Abnormal ECG and Chest X ray was 100% associated with severe heart disease.

Keywords: Congenital heart disease, Echocardiogram, Murmurs

INTRODUCTION

Congenital heart disease (CHD) is defined as a structural abnormality of the heart or intrathoracic great vessels that is actually or potentially of functional significance.[1] Congenital heart anomalies (CHA) are the most common congenital anomalies and emerge with a fairly constant incidence from 0.8 to 1% per 1000 live births.[2,3] Given that the CHA are leading cause of death among congenital anomalies, their early detection would greatly enhance the therapeutic procedures, and therefore the ultimate outcome of the disease.[4] CHD in new-born not only carries a high morbidity (and if untreated, mortality) but also has enormous financial and psychological implications for the child and parents. Hence differentiation of a pathological murmur from an innocent one is mandatory.

Heart murmurs in these children may mean a serious issue and in some potentially life threatening.[4,5] It may also be a result of the transition to adult circulation or the result of some benign structures causing turbulence.

Presence of murmur however causes undue anxiety among parents and treating paediatrician leading to many unnecessary investigations. There is a tendency, however, to miss or omit important aspects of the cardiovascular examination if the meticulous clinical examination methodology of cardiovascular system is not followed. Murmurs can be a single sole sign of presentation of Significant Heart Lesion (SHL) or it can be benign too.

CHD can be categorized into 3 groups of lesions based on current knowledge and the severity of the lesions.

- Severe CHD includes cyanotic CHD such as d transposition of the great arteries, Tetralogy of Fallot , hypoplastic right heart or left heart, single ventricle (SV), double outlet right ventricle (DORV), truncus arteriosus, total anomalous pulmonary venous connection (TAPVC), critical pulmonary stenosis (PS) and acyanotic CHD such as atrio-ventricular septal defect (AVSD), large ventricular septal defect(VSD), large patent ductus arteriosus (PDA), critical or severe aortic stenosis (AS), severe pulmonary stenosis (PS) and critical coarctation.
- Moderate CHD includes mild or moderate AS or aortic incompetence (AI), moderate PS or incompetence, noncritical coarctation, large atrial septal defect (ASD) and complex forms of VSD.
- Mild CHD includes small VSD, small PDA, mild PS, bicuspid aortic valve (BAV) without AS or AI and small or spontaneously closed ASD.

Presymptomatic detection and diagnosis of CHD helps in early intervention. Early detection of CHD and early intervention have decreased mortality rate in neonates.[6,7]

We have carried out a study to determine the incidence and clinical significance of murmur heard during routine examination of new-borns. There are little published findings that correlate murmurs during the new-born period with confirmed anatomical diagnosis. All the available data regarding cardiac murmurs in neonate are from developed countries. Very few publications are available from the Indian subcontinent. This cross-sectional study was designed to determine the clinical significance of murmurs during routine examination of new-borns and its contribution to detection of heart disease.

The aim of the study is to assess the prevalence of congenital heart disease in new-borns with cardiac murmurs and to study the spectrum of cardiac diseases in new-borns with cardiac murmur.

METHODS

This descriptive study was conducted in Government T.D medical college Alappuzha during the period January 2014 to January 2015 after obtaining approval of institutional Research committee and ethical committee of the medical college.

All new-borns with a cardiac murmur detected in the inborn nursery, out born nursery and postnatal ward of the hospital were included in the study. Babies in whom echo could not be done and babies whose parents did not consent to the study were excluded.

Sample size was calculated to be 72 based on previous studies. A written informed consent was taken from the parents. Antenatal natal and postnatal history was taken. Birth weight and gestational age were noted. Detailed examination of the new-born was done. Examination findings including details of murmur were noted. Murmur was graded according to Lavene grading. Chest X-ray and ECG were taken. Echo was done by an experienced cardiologist after sedating the babies.

Echo included two-dimensional, M-mode, and Doppler measurement in the standard projections: subcostal view, four-chamber view, five chamber view, long- and short-axial parasternal views, and suprasternal view, with examination of the anatomy of the atriums, atrioventricular valves, ventricles, and septums. The semilunar valves, outflow tracks, and the great vessels were evaluated and flow in the ductus arteriosus examined-mode measurements were for evaluation of left and right ventricular dimensions, thickness and motion of the ventricular walls, left ventricular ejection fraction, and fractional shorten.

The results were characterized as

- Severe CHD
- Moderate CHD
- Mild CHD
- Normal which includes normal variants like PFO

Statistical analysis

Data were analysed using computer software, Statistical Package for Social Sciences (SPSS), version 16. Data were expressed in frequency and percentage. To elucidate the associations, Chi Square test was used as a nonparametric test.

For all statistical evaluations, a two-tailed probability of value, <0.05 was considered significant. Descriptive statistics was used to describe data. Quantitative data was analysed using mean, median and standard deviation. Qualitative data was summarized using percentage and proportions. Associations were checked using Odd's ratio.

RESULTS

We have examined 3375 babies as part of the study. In this study, we have analysed 80 babies with murmur detected on new-born examination. Of them ECHO could not be done for 8 of them due to various reasons- 3 of them were referred to higher centre, 4 of them died before an ECHO could be done and one baby's parents were not

willing for ECHO. Hence, they were excluded from the study. So, we could include only 72 new-borns in the study.

Table 1: Severity of heart disease.

Heart Disease	Frequency	%
Severe CHD	10	13.9
Moderate CHD	15	20.8
Mild CHD	29	40.3
Normal	18	25
Total	72	100

Among the 72 new-borns with murmur, 43.1% were males and 56.9 were females. Male to female ratio is 0.75:1 .75% of the babies with murmur had heart disease. Of them, 13.9% had severe heart disease, 20.8% had moderate and 40.3% had mild heart disease (Table 1). 75% of the babies had grade 2 or 3 murmur (Figure1).
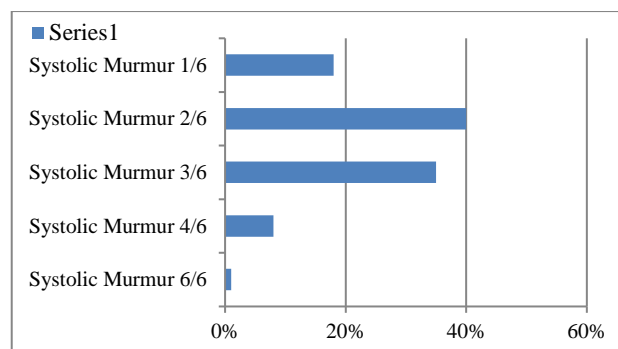
Figure 1: Grading of murmurs.

Higher grades of murmur were associated with significant heart disease (p<0.01). All the 10 cases of severe CHD had murmurs of grade 3 and above. Of the 15 cases of moderate CHD, 8 had murmur of grade 3 and above (Table 2).

Table 2: Association between heart disease severity and murmur.

Murmur	Heart Disease			Normal	Total
	Severe CHD	Moderate CHD	Mild CHD		
Systolic Murmur 1/6		2; 13.30%	5; 17.20%	6; 33.30%	13; 18.10%
Systolic Murmur 2/6		5; 33.30%	15; 51.70%	9; 50.00%	29; 40.30%
Systolic Murmur 3/6	7; 70.00%	6; 40.00%	9; 31.00%	3; 16.70%	25; 34.70%
Systolic Murmur 4/6	2; 20.00%	2; 13.30%			4; 5.60%
Systolic Murmur 6/6	1; 10.00%				1; 1.40%
Total	10	15	29	18	72
Chi Square: 29.610; P <0.01					

Table 3: Association between heart disease severity and chest X ray findings.

Murmur	Heart Disease			Normal	Total
	Severe CHD	Moderate CHD	Mild CHD		
Normal	3; 30.00%	13; 86.70%	29; 100.00%	18; 100.00%	63; 87.50%
Abnormal	7; 70.00%	2; 13.30%			9; 12.50%
Total	10	15	29	18	72
Chi Square: 36.952; P <0.001					

Table 4: Association between heart disease severity and abnormal ECG.

Murmur	Heart Disease			Normal	Total
	Severe CHD	Moderate CHD	Mild CHD		
Normal	7; 70.00%	14; 93.30%	29; 100.00%	18; 100.00%	68; 94.40%
Abnormal	3; 30.00%	1; 6.70%			4; 5.60%
Total	10	15	29	18	72
Chi Square: 14.188; P<0.01					

92.6% of the babies with heart disease had cyanotic heart disease.VSD was the most common heart disease followed by PDA and ASD (Figure 2). Large VSD was the most common severe heart disease.
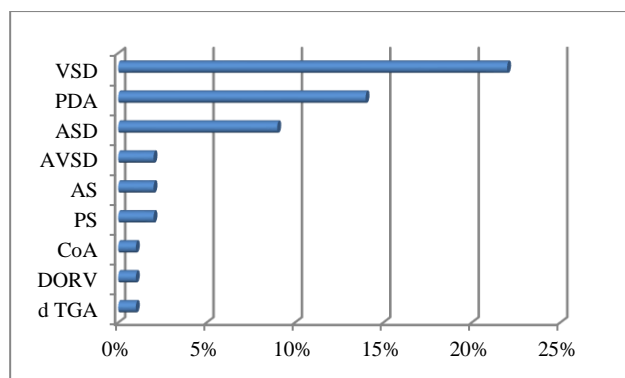
Figure 2: Spectrum of heart disease.

Most common type of mild heart disease was PDA. 12.5% of babies with murmur had abnormal chest X-ray. The association between abnormal chest X-ray and severity of heart disease was found to be significant (p <0.001) (Table3). 5.6% of the study population had abnormal ECG. Abnormal ECG was associated with severe heart disease (p< 0.01) (Table 4).

Most of the babies were above 32 weeks of gestational age and 1.5 Kg birth weight. No association was found between gestational age and severity of heart disease(p>0.05) (Table 5). Birth weight was also not found to be associated with heart disease severity (p>0.05)

Table 5: Association between heart disease severity and gestational age.

Gestational Age	Heart Disease			Normal	Total
	Severe	Moderate	Mild		
	CHD	CHD	CHD		
>37 weeks	4; 40.00%	6; 40.00%	16; 55.20%	8; 44.40%	34; 47.20%
32-36	4; 40.00%	8; 53.30%	9; 31.00%	5; 27.80%	26; 36.10%
<32 weeks	2; 20.00%	1; 6.70%	4; 13.80%	5; 27.80%	12; 16.70%
Total	10	15	29	18	72
Chi Square: 4.964; P>0.05					

Table 6: Association between heart disease severity and age of diagnosis.

Age at Diagnosis	Heart Disease			Normal	Total
	Severe	Moderate	Mild		
	CHD	CHD	CHD		
<24 Hrs	2; 20.00%	6; 40.00%	8; 27.60%	1; 5.60%	17; 23.60%
24-72 Hrs	4; 40.00%	5; 33.30%	6; 20.705	2; 11.10%	17; 23.60%
3-7 Days	4; 40.00%	4; 26.70%	15; 51.70%	15; 83.30%	38; 52.80%
Total	10	15	29	18	72
Chi Square: 12.912; P<0.05					

Only 2 babies had dysmorphism and they both had Down syndrome. Of the 10 cases of severe CHD 6 were diagnosed within 72 hours. Also of the 15 cases of moderate CHD, 11 were diagnosed within 72 hours. Thus, most of the severe and moderate heart disease were diagnosed within 72 hours (p < 0.05) (Table 6). Only 5.6% of the babies with heart disease were found to have a family history.

DISCUSSION

Murmurs in the neonatal period have been reported in 0.3-77.4% of babies, with prevalence dependent on several factors, including study size, auscultatory conditions and skill of the examiner.[4] However, not all neonates with congenital heart disease will be found to have a murmur at postnatal check, and not all those with murmurs will have congenital heart disease.[8] Although congenital heart disease is present at birth, there are often no signs and most babies are asymptomatic.

Of the 72 new-borns included in the study, 75% had cardiac disease, of which94.5 % were acyanotic heart disease and 5.5 % had cyanotic heart disease. This was in agreement with most of the studies.[9-11] Hence there is a prevalence of cardiac disease of 16 per 1000 of this study population. The prevalence of cardiac disease in new-borns with murmur is 750 in 1000 new-borns 13.9% had severe cardiac disease, 20.8% had moderate cardiac disease and 40.3% had mild cardiac disease. Thus, there is a need for an early assessment of cardiac murmurs which is often recommended.[12]

Thus, given that murmurs are rare, and that in many are a clue to the presence of asymptomatic heart disease, it seems appropriate to refer all such babies for early

definitive diagnosis. Most common lesion was VSD. Most of these defects were small and in the muscular portion of the interventricular septum. Several studies using Doppler echocardiogram has shown a high prevalence of muscular ventricular septal defects in neonates.[13-15]

Most of the babies (57%) had grade 2-3 murmurs. This was in agreement with other studies.[10] There was good correlation between the degree of murmur and the significance of cardiac disease. None of the babies with Grade 1 or 2 murmurs had severe cardiac disease. Most of the babies with grade 3, 4 or 5 murmur had moderate to severe heart disease. None of the babies had diastolic murmur. Auscultation therefore should be a part of routine neonatal examination.

Chest X ray contributed only 12.5% to the diagnosis of cardiac disease. ECG contributed only 5.3% to the diagnosis. Evidence currently available shows that electrocardiography and radiology have a sensitivity as low as 10% in the evaluation of well children with heart murmurs.[16,17] In present study there was a good correlation between both abnormal ECG and X-ray and heart disease. Hence an abnormality of both ECG and X ray suggests a heart disease.

In present study 43.1% were males and rest were females. No correlation with heart disease was found Most of the babies with cardiac disease were above 32 weeks of gestational age. No correlation was found between the gestational age and the severity of heart disease.50% of babies with cardiac disease were above 2.5 kg and 50% below 2.5 kg.

There was no correlation between birth weight and severity of heart disease. This was against most of the studies which had shown an increased incidence of CHD with decreasing gestational age and birth weight[18].This may be because our sample population had only few babies who were preterm and ELBW. Antenatal factors were analysed which contributed to the disease. None of the mothers had antenatal drugs or teratogen exposure. There were no features suggestive of intrauterine infection. No other antenatal risk factors could be identified. 13.9% had GDM and 18.1 had PIH.

Only 2 of the babies with cardiac disease had dysmorphism and both had Down syndrome. Both of them had severe cyanotic heart disease- atrioventricular septal defect. According to many studies extra-cardiac anomalies were found in one fifth of the children with heart disease, with Down's syndrome accounting for nearly one-third.[19,20] Most of the moderate to severe heart disease were detected in 72 hours of birth. This was in agreement with study by Max Godfey in which most cases were diagnosed in first 5 days of life.[18]

5.5% babies had family history of cardiac illness and the recurrence was as that of similar cardiac illness. Thus, these babies with family history of heart diseases require early screening for heart diseases.

Identification and treatment of heart disease before development of symptoms offers the prospect of an improved outcome. It should also be emphasized that the absence of a murmur does not exclude the presence of potentially serious heart disease.

CONCLUSION

Present study has proved that any murmur in new-born requires evaluation with echocardiogram as 75% of babies with audible murmurs in the neonatal period have a structural defect of the heart. ECHO helps in a definitive diagnosis of congenital heart disease or in authoritative reassurance of normal cardiac anatomy and function.

Most of the moderate to severe heart disease were detected within 72 hours. So early detection of murmur followed by early echocardiography will help detect most moderate to severe heart disease.

For the diagnosis or exclusion of congenital heart anomalies echocardiography of the heart is essential.

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