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Clinical Significance of Cardiac Murmur in Neonate

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Abstract

Background: There is a popular believe that cardiac murmurs are common in neonate and most are innocent or physiological. However, a cardiac murmur may be the first sign of a serious structural cardiac disease in neonate.

Objective: This study was conducted to determine the clinical significance of cardiac murmur as a sole clinical sign in neonate.

Methodology: Fifty neonates having cardiac murmur were selected from in-patient department of Dhaka Shishu Hospital from March '06 to October '06. Murmurs were clinically classified as innocent or significant murmur. Echocardiography was done for confirmation of the diagnosis and then patients were reclassified as innocent murmur and structural heart defect. And structural heart defects are further subdivided into physiological variant or significant heart defect.

Results: Sixty eight percent cases with murmur were found to have structural heart defect and 32% had innocent murmur. Among the cases with structural heart defect 70.6% were found to have significant heart defect and 29.4% were physiological variant. Clinical suspicion able to differentiate innocent murmur or structural heart defect ($p < 0.05$) as well as physiological variant versus significant heart defect ($p < 0.05$).

Conclusion: Confident exclusion of heart disease in the newborn period on clinical examination is probably possible by pediatricians or neonatologists. However, for confirmation of diagnosis, early echocardiographic evaluation is necessary.

Keywords: *Murmur, neonate, heart defect.*

Introduction

Congenital heart diseases (CHD) are the most common types of heart diseases among children and are very serious problem of current perinatology. The difficulties in detecting heart diseases at neonatal examination are well known[1,2]. Routine examination of apparently healthy newborn babies detects less than half of those with congenital cardiac malformations, because they are asymptomatic and without signs. On the other hand more severe cardiac malformations are not detected more easily[3-7].

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CHD occurs in 6 to 9.3 per 1000 live births[8,9]. Low birth weight (<2500 gm) and prematurity (<37 weeks of gestation) led occurrence rate of 34% and 26% CHD respectively[10,11]. Approximately one third of these neonates require intervention in the first month of life[8]. Early detection of CHD and new modalities of their treatment have decreased mortality rate in neonates[10,12].

A systolic murmur is not infrequently recognized in healthy newborn infants, especially those with a low birth weight[13]. A left-to-right shunt, particularly due to ventricular septal defect, may cause a cardiac murmur even in the first day of life[14]. Shortly after birth murmurs are less common in the most severe conditions such as underdevelopment of the left heart or transposition of great arteries[15]. As a result normal clinical examination of healthy newborn babies does not exclude serious congenital cardiac malformations[3,6]. However, a cardiac murmur may be the first sign of a serious structural cardiac disease, especially in the neonate[4,14].

The neonatal examination takes place at a time of rapid change within the cardiovascular system as part of adaptation to extra uterine life[16]. These changes may produce murmurs which can be mistaken for heart diaease[17]. Some murmurs in neonates, many in infants and most in childhood are 'benign' or 'innocent'[18]. The reported prevalence of murmurs in neonates varies from 0.6% to 77.4%[4]. Differentiation of such murmurs from those due to structural cardiac disease, so called 'pathological' murmurs, is largely clinical. Paediatricians are capable of differentiating one from the others, provided a detailed evaluation is done[19]. Thus, detection of a murmur depends on the examiner's skill and experience, the timing and frequency of examination and the condition under which examination takes place[4].

CHD in newborn not only carry a high morbidity (and if untreated, mortality) but also have enormous financial and psychological implications for the child and parents. Hence differentiation of a pathological murmur from the other is mandatory.

There is little in published findings that correlate murmurs during the newborn period with confirmed anatomical diagnosis. All the available data regarding cardiac murmurs in neonate are from developed countries[1-6]. A very few publications are available from Indian subcontinent[18,20]. According to the knowledge of the authors in our country only one publication was available regarding congenital heart disease in neonate and role of cardiac murmur and other clinical features for the clinical diagnosis[21]. This cross sectional study was designed to determine the clinical significance of finding of murmurs during routine examination of neonates and its contribution in detection of congenital heart disease.

Materials and Methods

This cross sectional study was conducted during the period of 1st March 2006 to 31st October 2006 at Dhaka Shishu (Children) Hospital, which is the largest tertiary level paediatric teaching hospital in Bangladesh.

Fifty (50) neonates found to have a cardiac murmur during routine clinical examination were selected from Neonatal ward, Cardiac ward and Intensive Care Unit of Dhaka Shishu Hospital. Cases excluded were patients having emergency surgical abnormalities, syndromic babies, as well as diagnosed cases of congenital heart disease.

For each baby, a detail history and condition on arrival in hospital was recorded in a questionnaire. Each case was thoroughly examined. Murmur was detected and grading was done by the investigator and reconfirmed by the respective consultant of the unit. Considering location, characters, timing, grading of murmur and patients' condition and other physical findings, murmurs were clinically classified as innocent murmur or significant/ pathological murmur. Murmurs were considered innocent in grade $\leq$ 3/6, localized, not diastolic, not harsh, soft in intensity and short, vibratory (or musical) in quality, which varies with position. Diagnosis was confirmed by echocardiogram with or without color doppler. After echocardiogram, patients were reclassified. Patients having no cardiac abnormalities were classified as innocent murmur and those having any type of abnormalities were termed as structural heart defect, which were further subdivided into two groups. Neonate found to have a "trivial" structural abnormality such as patent foramen ovale, haemodynamically insignificant persistent ductus arteriosus (PDA) or mild physiological peripheral pulmonary artery stenosis were classified as physiological variant of heart defect[20,22]. And any cardiac lesion that would potentially cause patient's morbidity, require cardiac follow up, and / or require endocarditis prophylaxis are defined as significant heart disease[23].

Echocardiography was done in Dhaka Shishu (Children) Hospital by paediatrician trained to do paediatric echocardiograms including neonate. When necessary, color doppler was done outside the hospital by paediatric cardiologist experienced of doing neonatal echocardiography.

One of the investigators (Hasan MNA) did data entry. Data was also scored, keyed and verified by the investigators. Individual patients were given a code number to maintain confidentiality and to prevent biasness. SPSS for Windows version-12 was used for data entry and analysis. χ^2 test was done to determine the level of significance. A p value of <0.05 was considered significant.

Results

Mean age of all the cases was 9.1±8.8 days, ranging from 1 day to 28 days. Mean admission weight was 2475.5±587.3 grams, ranging from 1000 grams to 3600 grams. Out of 50 cases 60% were male and 40% female, male female ratio 1:0.7. Most of the patients (66%) were term baby (Table - I).

Table-I

General characters of the study population (n=50)

Age (days, mean±sd)	9.1±8.8 (range 1-28)
Admission weight (gm, mean±sd)	2475.5±587.4 (range 1000-3600)
Sex distribution	
Male	20 (40%)
Female	30 (60%)
Gestational age	
Preterm	17 (34%)
Term	33 (66%)

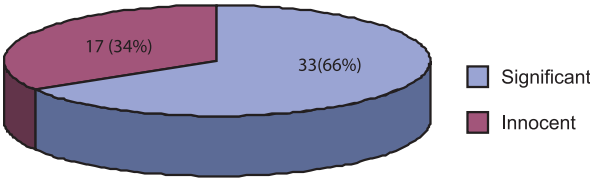

Fig.-1: *Clinical suspicion about significance of murmur (n=50)*

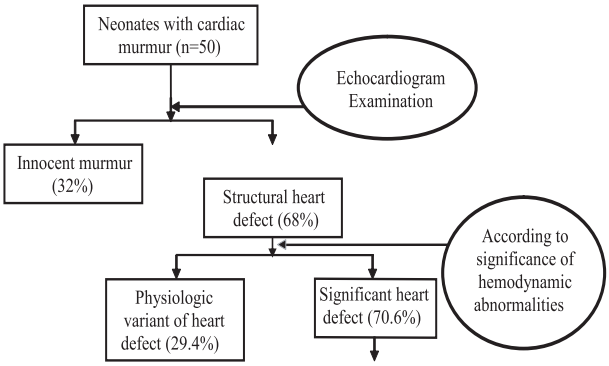

Fig.-2: *Reclassification of murmur after echocardiogram*

Clinically in 34% cases, murmurs were suspected as insignificant or innocent and in 66% cases they were suspected as significant (Fig.-1). After doing echocardiogram, out of the 50 cases 68% were found to have structural heart defect and among them more than two third (70.6%) of the cases found to have significant heart defects (Fig.-2). Out of the 24 cases with significant heart defects, ASD and VSD found in 6 (12%) cases each, ASD with VSD 4 (8%), D-TGA with VSD 2 (4%) cases (Table-II).

Table-II

Echocardiogram findings of the neonates with murmur (n=50)

Diagnosis	n (%)
No cardiac defect found	16 (32)
PFO	5 (10)
PDA	1 (2)
PDA with PFO	3 (6)
Peripheral pulmonary artery stenosis	1 (2)
ASD	6 (12)
VSD	6 (12)
ASD with VSD	4 (8)
ASD with TR grade II	1 (2)
VSD with hypertrophic cardiomyopathy	1 (2)
D-TGA with VSD	2 (4)
TOF with PDA	1 (2)
Pentalogy of Fallot	1 (2)
AV canal defect with pulmonary hypertension	1 (2)
PAPVC with ASD with PDA with TR grade I with moderate PAH	1 (2)
Total	50 (100)

Table-III

Relation between clinical suspicion about significance of murmur and diagnosis (n=50)

Clinical suspicion about significance of murmur	Diagnosis		Total	p*
	Structural heart defect n (%)	Innocent murmur n (%)	n (%)	
Significant	28 (56)	5 (10)	33 (66)	0.001
Innocent	6 (12)	11 (22)	17 (34)	
Total	34 (68)	16 (32)	50 (100)	

Sensitivity 82.4%, specificity 68.8%, positive predictive value 84.9%, negative predictive value 64.7% and accuracy 78%

*χ^2 test

Table-IV

Relation between clinical suspicion about significance of murmur and types of structural heart defect (n=34)

Clinical suspicion about significance of murmur	Types of structural heart defect		Total n (%)	p *
	Significant heart defect n (%)	Physiologic variant n (%)		
Significant	23 (67.6)	5 (14.7)	28 (82.4)	0.005
Innocent	1 (2.9)	5 (14.7)	6 (17.6)	
Total	24 (70.6)	10 (29.4)	34 (100)	

Sensitivity 95.8%, specificity 50%, positive predictive value 82.1%, negative predictive value 83.3% and accuracy 82.4%

*χ^2 test

Innocent murmur was suspected in 17 (34%) cases, out of them, almost two third (11, 22%) were diagnosed as having innocent murmur and 6 (12%) cases had structural heart defect. Among 33 (66%) cases of clinically suspected significant heart murmur, most (28, 56%) were finally diagnosed as having structural heart defect and only 5 (10%) had innocent murmur. This clinical classification of murmur was statistically significant ($p < 0.05$) with a sensitivity and specificity of clinical examination to differentiate innocent murmur and murmur due to structural heart defect was 82.4% and 68.8% respectively (Table-III).

Out of 6 (17.6%) clinically suspected innocent murmur most (5, 14.7%) were found to have physiological variant of heart defect and only 1 (2.9%) case was found having significant heart defect. Among 28 (82.4%) cases with significant heart defects most (23, 67.6%) were diagnosed as having significant heart defect and 5 (14.7%) had physiological variant of heart defect. Clinical suspicion was able to differentiate between physiological variant and significant heart defect significantly ($p < 0.05$) with a sensitivity and specificity of clinical examination to differentiate significant and physiological variant of heart defect was 95.8% and 50% respectively (Table-IV).

Discussion

Although congenital heart disease is present at birth, there are often no signs and most babies are asymptomatic. Detection of a murmur on routine neonatal examination may be a clue to the presence of heart disease and offers the possibility of early, presymptomatic diagnosis[3]. In vast majority of children with CHD the diagnosis can be made on the basis of thorough history and physical examination[4]. But experience regarding CHD in neonate is mixed. Routine neonatal examination fails to detect heart defects in more than half of babies with heart defects[3,4,6,9]. In this study, among 50 neonates with cardiac murmurs 35 (68%) cases were found to have structural heart defect on echocardiography. Most of the studies also showed increased chance (39-84%) of underlying cardiac malformation in neonate having murmur[20,21,24]. Moss et al[25] showed that in a neonatal unit among clinically suspected cases, abnormality of structure and/or function was identified in about 70% by echocardiogram. In this study we also found that among the cases with structural heart defect more than two third (70.6%) were significant heart defect and only 29.4% were physiological variant of heart defect. In a study among 20,323 live births it was found that 86% neonate having murmur had anatomical heart defect including physiological variant and significant heart defect was present in 68% cases[26].

Several studies showed that if examination was done by paediatric cardiologist accuracy was higher for discriminating heart disease from innocent murmur[19,27,28]. Paediatric cardiologists' auscultatory examination had a sensitivity of 96%, specificity of 95% but the adult cardiologists' however misclassified up to 33% innocent murmurs[29]. Although lower accuracy (33%) was found in paediatric residents[29], given appropriate guidelines, senior house officers with minimum 6 months experience in paediatric or neonatal cardiology had the skills to assess the significance of, and decide on appropriate management for neonatal murmurs[2]. We found role of clinical suspicion to differentiate innocent murmur and structural heart defect was significant ($p<0.05$). On clinical ground it was also possible to differentiate between physiological variant and significant heart

defect ($p < 0.05$) with a sensitivity and specificity of 95.8% and 50% respectively.

Unfortunately this study has some limitations because the study period and sample size was small and it was conducted in a single center. Moreover, all the cases were hospitalized sick neonate. So, a multicenter study with prolonged duration and large sample size including well and sick neonate is required for better understanding of the situation in Bangladesh.

Conclusion

Auscultation of the heart in the newborn period could provide opportunity for early recognition of cardiovascular malformations. Confident exclusion of heart disease in the newborn period on clinical examination is probably possible by paediatricians or neonatologists. However, as 68% neonatal cardiac murmur may have structural heart defect and among the structural heart defect 70.6% may have significant heart defect, early echocardiographic evaluation is necessary for confirmation of diagnosis. This will result either in a definitive diagnosis of congenital heart disease or in authoritative reassurance of normal cardiac anatomy and function.

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