Original Research Article

Cardiac murmur in a neonate: how significant is it?

Gargi H. Pathak, Anuya V. Chauhan*, Kesha B. Nayak

Department of Pediatrics, BJ Medical College, Asarwa, Ahmedabad, Gujarat, India

*Correspondence:
Dr. Anuya V. Chauhan,
E-mail: raj1785@yahoo.com

ABSTRACT

Background: There is a popular belief 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 of study was conducted to determine the clinical significance of cardiac murmur as a sole clinical sign in neonate.

Methods: 100 neonates having cardiac murmur were selected from neonatal intensive care unit of department of pediatrics BJMC Ahmedabad from June to November 2019. Murmurs were clinically classified as innocent or significant murmur. Echocardiography was done at UN Mehta institute of cardiology for confirmation of the diagnosis and then patients were reclassified as innocent murmur and structural heart defect. structural heart defects were further subdivided into physiological variant or significant heart defect.

Results: Amongst 100 neonates studied, sixty two percent cases with murmur were found to have structural heart defect and 38% had innocent murmur. Among the cases with structural heart defect. 65.3% were found to have significant heart defect and 34.7% were physiological variant. Clinical suspicion was able to differentiate innocent murmur or structural heart defect (p<0.05) as well as physiological variant versus significant heart defect (p<0.05).

Conclusions: Confident diagnosis 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. 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. CHD occurs in 6 to 9.3 per 1000 live births. Low birth weight (<2500 gm) and prematurity (<37 weeks of gestation) had occurrence rate of 34 and 26% of CHD respectively.[1]

Approximately one third of these neonates require intervention in the first month of life. Early detection of CHD and new modalities of their treatment have decreased mortality rate in neonates. A systolic murmur is not infrequently recognized in healthy newborn infants, especially those with a low birth weight. A left-to-right shunt, particularly due to ventricular septal defect, may cause a cardiac murmur even on the first day of life. Shortly after birth murmurs are less common in the most severe conditions such as under development of the left heart or transposition of great arteries. As a result, normal clinical examination of healthy newborn babies does not exclude serious congenital cardiac malformations. However, a cardiac murmur may be the first sign of a serious structural cardiac disease, especially in the

neonate. The neonatal examination takes place at a time of rapid change within the cardiovascular system as part of adaptation to extra uterine life. These changes may produce murmurs which can be mistaken for heart disease. Some murmurs in neonates, many in infants and most in childhood are 'benign' or 'innocent'. The reported prevalence of murmurs in neonates varies from 0.6 to 77.4%. Differentiation of such murmurs from those due to structural cardiac disease, so called 'pathological' murmurs, is largely clinical. Pediatricians are capable of differentiating one from the others, provided a detailed evaluation is done. 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. 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. A very few publications are available from Indian subcontinent. 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.[2]

METHODS

Study design was observational prospective study carried out for period of 2 months from September to November 2019.

Inclusion criteria included all the neonates admitted in NICU of civil hospital BJMC Ahmedabad during period of 1st September to 1st December 2019.

Exclusion criteria excluded the neonates admitted in NICU of civil hospital BJMC Ahmedabad having emergency surgical abnormalities, syndromic babies, as well as diagnosed cases of congenital heart disease.

This cross-sectional study was conducted during the period of September to December 2019 at BJMC Ahmedabad. 100 neonates found to have a cardiac murmur during routine clinical examination were selected from NICU of civil hospital Ahmedabad. 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 to hospital was recorded in a proforma. 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 <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.[3]

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, hemodynamically insignificant persistent ductus arteriosus (PDA) or mild physiological peripheral pulmonary artery stenosis were classified as physiological variant of heart defect. 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. Echocardiography was done at UN Mehta institute of cardiac care by Paediatric cardiologist. 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 $p<0.05$ was considered significant.[4]

RESULTS

Mean age of all the cases was 10.1±9.1 days, ranging from 1 day to 28 days. Mean admission weight was 2.45±587.3 gram, ranging from 1000 to 3600 gram. Out of 100 cases 62% were male and 38% female, male female ratio 1.6:1. Most of the patients (65%) were term babies clinically in 34.7% cases, murmurs were suspected as insignificant or innocent and in 65.3% cases they were suspected as significant (Figure 1). After doing echocardiogram, out of the 100 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. Out of the 35 cases with significant heart defects, ASD and VSD were found in 11 (31%) cases each, ASD with VSD in 8 (8%), ASD with TR grade II 3 (3%) (Table 2).[5]

Table 1: General characters of the study population (n=100).

Age (days, mean±SD)	Admission weight (gm)	Sex distribution (%)	Gestational age (%)
10.1±9.1 (range 1-28)	2455.5±587.3 (mean±SD) (range 1000-3600)	Male 62 (62) Female 38 (38)	Preterm 35 (35) Term 65 (65)

A study of 100 neonates was done. Neonates had age range(days) 10.1±9.1, admission weight range (gm) 2455.5±587.3.

Neonates in the study have sex distribution percentage is 62% male and 38% female, gestational age 35% preterm and 65% term.

Table 2: Echocardiogram findings of the neonates with murmur (n=100).

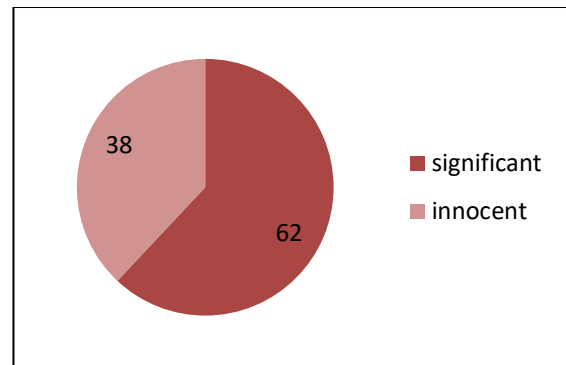| Diagnosis	N (%)
No cardiac defect found	32 (32)
PFO	9 (9)
PDA	6 (6)
PDA with PFO	8 (8)
Peripheral pulmonary artery stenosis	3 (3)
ASD	11 (11)
VSD	11 (11)
ASD with VSD	8 (8)
ASD with TR grade II	3 (3)
VSD with hypertrophic cardiomyopathy	3 (3)
D-TGA with VSD	1 (1)
TOF with PDA	3 (3)
AV canal defect with pulmonary Hypertension	1 (1)
PAPVC with ASD with PDA with TR grade I with moderate PAH	1 (1)
Total	100 (100)

Figure 1: Study of murmurs

Innocent murmur was suspected in 38(38%) cases, out of them, almost two third 30 (80%) were diagnosed as having innocent murmur and 8 (8%) cases had structural heart defect. Among 62 cases with significant heart defects most 56 (90.3%) were diagnosed as having structural heart defect (16 cases with physiological variant) and 6 (9.6%) were normal. the 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 83.3 and 57.6% respectively (Table 3). 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 varian of heart defect was 82.3 and 81.2% respectively (Table 4).[6]

Table 3: Relation between clinical significance of murmur and diagnosis (n=100).

Clinical suspicion about significance of murmur	Diagnosis		
	Structural N (%)	Normal N (%)	Total
Significant	56 (56)	6 (6)	62 (62)
Innocent	12 (12)	26 (26)	38 (38)
Total	68 (68)	32 (32)	100 (100)

Table 4: Relation between clinical suspicion about significance of murmur and types of structural heart defect (n=68).

Clinical suspicion about significance of murmur	Types of structural heart defect		
Variables	Significant heart defect (N)	Physiologic variant (N)	Normal	Total
Significant	40	16	6	62
Innocent	8	04	26	38
Total	48	20	32	100

Sensitivity 82.3%, specificity 81.2%, positive predictive value 90.3%, negative predictive value 68.4%.

Sensitivity 83.33%, specificity 57.6%, positive predictive value 64.5%, negative predictive value 78.9%

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, pre-symptomatic diagnosis. In vast majority of children with CHD the diagnosis can be made on the basis of thorough history and physical examination. But experience regarding CHD in neonate is mixed.[7]

Routine neonatal examination can fail to detect heart defects in more than half of babies with heart defects. In this study, among 100 neonates with cardiac murmurs 68 (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. Moss et al 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 (77.7%) were significant heart defect and only (22.3%) 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. 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. defect (p<0.05) with a sensitivity and specificity of 95.8 and 50% respectively. 8 cases having innocent murmurs in whom Echo detected CHDs were not life-threatening CHDs.[8]

Unfortunately, this study has some limitations because the study period and sample size were small and it was conducted in a single center. Moreover, all the neonates admitted to NICU. 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 India.

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. 2D echo is recommended even if the murmur is clinically an innocent murmur. This will result either in a definitive diagnosis of congenital heart disease or in authoritative reassurance of normal cardiac anatomy and function.

Clinically, if the murmur appears to be significant then the 2D echo should be done as early as possible. But if the murmur appears to be innocent and the neonate is hemodynamically stable, 2D echo is indicated but need not be done on emergency bases.

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