

Prevalence and Clinical Significance of Cardiac Murmurs Detected During Routine Neonatal Examination

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ABSTRACT

Introduction: Congenital heart diseases contribute significantly to mortality and morbidity in children. Unrecognized heart disease in the newborn period can lead to a significant risk of death and disability in the child. The objective of the present study was to determine the clinical significance of cardiac murmurs detected during neonatal examination.

Material and Method: It was a hospital based prospective non-randomised study conducted on all asymptomatic newborns attending the neonatology ward of Lal Ded and GB Panth hospitals which are associated hospitals of Government Medical College Srinagar.

Result: A total of 4,500 subjects were included in the study comprising of 2,435 males (54.13%) & 2,065 females (45.8%). Out of which rural population constituted 61.3 %, while 38.7% belonged to urban areas. History of consanguinity was seen in 8.33% of newborns and family history of CHD was seen in 0.98 % of new borns.

Conclusion: The study yielded a sensitivity of 44% [95% CI (31-58%)], a specificity of 99.6%. and positive predictive values of 55% [95% (CI 39-69%)] confirming all the babies who have cardiac murmur on initial routine neonatal examination should be followed up with an echo study and a pediatric cardiology consultation if needed.

Key Words: Congenital heart disease, murmur, neonate

INTRODUCTION

Congenital heart disease (CHD) that are often defined as gross structural abnormalities of the heart or intrathoracic great vessels having either actually or potentially functional importance,¹ are known to carry serious risk of avoidable mortality, morbidity, and handicap among children.² A large number of studies have evaluated the predictive value of heart murmurs as a sole finding in the diagnosis of CHD. The rapid changes that take place within the cardiovascular system of the neonates as a part of adaptation to extra-uterine life can produce murmurs, often mistaken for heart disease.^{3,4} The prevalence of murmurs in neonates has been seen to vary from 0.9-77.4%⁵, their detection depends on the examiners skills, timing, frequency and conditions under which examination is carried out. Accurate diagnosis of CHD's has largely been made possible by echocardiography.⁶ In neonates CHD may be diagnosed on the basis of physical examination findings, such as overt cyanosis, tachypnea and murmurs however these findings may not be evident before hospital discharge. Newborns with critical CHD such as , valve atresia, and total anomalous pulmonary venous return

may not have a murmur. On the other hand, newborns with non-critical CHD may be completely asymptomatic or have murmur as their sole clinical manifestation. In most of the cases a careful history, general physical and cardiac examination should help the clinician in determining if the child needs further evaluation.⁸ A murmur should be evaluated to define its timing (early systolic, late systolic, pan systolic, diastolic), quality, location, intensity (graded 1-6), frequency and radiation. The point where highest frequencies are heard is more reliable for determining the location rather than loudness because the highest frequencies do not travel far from the lesion and the frequency of the murmur correlates with the pressure gradient across the lesion.⁹

MATERIALS AND METHODS

The study was carried out from Post-Graduate Department of Pediatrics of Government medical college Srinagar at G.B.Panth Hospital and Lal Ded (LD) Neonatology, (with the catchment area of both rural and urban populations) both being referral tertiary care hospitals. All newborns attending G.B.Panth neonatology /L.D.Neontology who were not premature (<35weeks of gestation), were not ill, did not require neonatal intensive care would undergo physical examination.

Approach

Routine neonatal examination was performed on all newborns that fulfilled inclusion criteria. To ensure universal examination, an age within 48 hrs of birth was chosen. All newborns with murmurs underwent echocardiography as early as possible within 14 days. The echocardiogram permitted early anatomical diagnosis of infants as either having a structural heart malformation or a physiological variant which would account for the murmur or a finding that in itself would not cause a murmur, or a completely normal

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How to cite this article: Shafat Ahmad, Vamiq Rasool, Sabha Rasool. Prevalence and clinical significance of cardiac murmurs detected during routine neonatal examination. International Journal of Contemporary Medical Research 2016;3(2):347-350.

echocardiogram. Data regarding true and false positives and as well as negatives was collected to determine the sensitivity, specificity and positive predictive value of cardiac murmurs in detecting CHDs.

RESULTS

A prospective study was conducted on all newborns, attending neonatology division of G.B.Panth and L.D hospitals, who were not premature (<35 weeks of gestation), were not ill, & didn't require NICU care, they comprised a total of 1650 and 2850 newborns respectively. Routine neonatal examination was performed on all newborns who fulfilled the above mentioned inclusion criteria. Neonatal examination was carried out within 48 hrs of delivery according to standards.

Present study included 2435(54.13%) male & 2065 female (45.86%) subjects (Table 1),out of which 61.3% were rural dwellers and 38.7% belonged to urban areas. History of consanguinity was present in only 8.33% of the total cases and was absent in the rest while as family history of CHD was present in 0.98% of cases. Out of 4500 newborns, 57.1% were born by vaginal delivery and 42.86% by caesarean section (vaginal delivery was mode of birth among 39.85% cases while it was mode of delivery among 44% cases visiting G.B Panth hospital).

Out of 4500 routine newborn examinations, 40 neonates were found to have a murmur. The prevalence of murmurs was found out to be 0.88%. All underwent echocardiography that confirmed a cardiac malformation in 22 and a structurally normal heart in 18.

Those 18 neonates who had a normal echo, a structurally normal heart with physiological findings that would account for the presence of a murmur was found in 7 (out of which patent foramen ovale (PFO) was found in four, a closing patent ductus arteriosus (PDA) in two, mild physiological pulmonary artery branch stenosis (PBS) in one). Eleven had entirely normal echocardiographic study.

All 22 babies with cardiac malformations were asymptomatic. Ventricular septal defect was the most common cardiac defect

A further 28 babies from the same birth cohort presented with congenital cardiac malformations after the routine neonatal examination failed to pick them up and before the age of 1 year were also included. Review of the hospital records of these infants confirmed that none had a murmur at the time of neonatal examination. The list of 28 cases which were thus picked up after routine neonatal examination is given below in Table 2.

The results of the study can be summarized as given below in Table 3.

Analysis of the routine neonatal examination results revealed **Sensitivity**=true positives/true positives+false negatives sensitivity=22/22+18=44%

Specificity=true negatives/true negatives+false positives specificity=4432/4432+18=99.6%

Positive predictive value=true positives/true positives+false Positives

Anatomical lesion	No. of neonates	Total (%)
Ventricular septal defects	12	54.5
Aortic stenosis	2	9.09
Coarctation of aorta	2	9.09
Atrial septal defect	2	9.09
Tetralogy of fallot	2	9.09
Pulmonic stenosis	1	4.54
Patent ductus arteriosus	0	0
Total anomalous pulmonary venous connection	0	0
Atrioventricular septal defect	1	4.54
Complex CHD	0	0
Total	22	100%

Table-1: Anatomical diagnosis of 22 neonates on echocardiography

Cases	No. of neonates	Total (%)
VSD	15	53.57
AS	2	7.14
Coarct.of Aorta	1	3.57
ASD	2	7.14
TOF	1	3.57
PS	3	10.71
PDA	2	7.14
TAPVC	1	3.57
COMPLEX CHD	0	0
AV Septal defect	1	3.57
Total	28	100%

Table-2: Cases of CHD detected during infancy but not on routine neonatal examination

Examination Findings	Heart disease	No heart disease	Total
Murmur present	22	18	40
Murmur absent	28	4432	4460
Totals	50	4450	4500

Table-3: Neonatal examination as a screening test

Positive predictive value=22/22+18=55%

Negative predictive value=true negatives+true negatives/False Negatives

Negative predictive value=4432+4432/28=99.4%

Results can be summarized as- a sensitivity of 44%[95% CI (31-58%)], a specificity of 99.6%. The positive predictive value was 55%[95%(CI 39-69%)].

DISCUSSION

Careful clinical examination is extremely important and is always the first step in ruling out CHD. It is not infrequent to find a heart murmur while examining a baby in the newborn nursery. The clinician is then faced with a decision whether the murmur is physiologic or pathologic. Soon after birth, the newborn baby is adapting to an extra-uterine life with dramatically new circulation in which oxygen exchange occurs in the lungs, and thermoregulation becomes more challenging. Experience and literature suggest that a

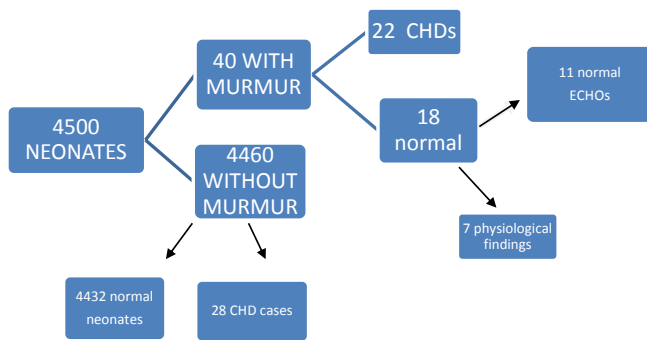


Figure 1: Summary of clinical and echocardiographic findings

'heart murmur' is probably the most common reason for cardiology consultation in most hospitals. It has been reported that "murmur in a baby" causes significant parental anxiety, which might be relieved by cardiology consultation. Detection of a murmur depends on how soon after birth the baby is examined, the condition under which the examination is performed, the expertise of the listener and the frequency of the examination. Hence, it is not surprising that the reported prevalence of heart murmurs in newborns is extremely variable from as low as 0.6% to as high as 77.4%. Murmurs heard in the first few hours of life might reflect a closing ductus or transient tricuspid regurgitation from perinatal stress or a peripheral pulmonic flow murmur due to turbulence resulting from sudden increase in pulmonary blood flow. The prevalence of heart murmurs decreases significantly over the first few days of life.

Clinical significance of cardiac murmurs along with its prevalence have been repeatedly worked on during recent past, and a detailed routine neonatal examination is the key to both findings. To determine the usefulness of these routine neonatal examination in detecting cardiac murmurs in Kashmir (thus CHDs), a hospital based prospective non-randomised study was conducted from April 2012 to March 2013 at Post-Graduate Department of Pediatrics in G.B.Panth Hospital and LD Neonatology, with the catchment area of both rural and urban populations and is a referral tertiary care hospital. The prevalence of murmurs was 0.88% this was comparable with study conducted by Lyon et al, Wren et al and Sein et al.^{5,7,10} The reported prevalence of murmurs in neonates varies from 0.9% to 77.4% and seems to be inversely related to the size of study.⁵ Laohaprasitiporn et al.¹¹ found the prevalence of murmurs in neonates equal to 7.38/1000 live births (7.38%).

All 40 neonates with murmur on examination underwent echocardiography which confirmed a cardiac malformation in 22 and a structurally normal heart in 18. The positive predictive value of the study was 55%, comparable to study conducted by Wren et al, Gregory, Gregory and Mirzarahimii and Saadati.^{7,12,13} It was however lower than that obtained by other workers like Alvares et al, Mellies et al Du et al.¹⁴⁻¹⁶ Those 18 neonates who had a normal echo, a structurally normal heart with physiological findings that would account for the presence of a murmur was found in 7 i.e. patent foramen ovale (PFO) was found in four, patent ductus arteriosus (PDA)

in two, mild physiological pulmonary artery branch stenosis (PBS) in one. Eleven had normal echocardiographic study. All 22 babies with cardiac malformations were asymptomatic-12 had a ventricular septal defect (VSD), 2 had coarctation of aorta, 2 had aortic stenosis (AS), 1 had pulmonic stenosis (PS), 2 had atrial septal defect (ASD), 1 had atrioventricular septal defect (AVSD), 2 had Tetralogy Of Fallot (TOF). A further 28 babies from the same birth cohort presented with congenital cardiac malformations after the routine neonatal examination and before the age of 1 year were analysed. Review of the hospital records of these infants confirmed that none had had a murmur at the time of neonatal examination. The sensitivity was found to be 44%, comparable to the results obtained by Sean et al, Richmond,^{10,17} but lower than that found by Farrer *et al*, Alvares et al, Mellies et al.^{14,15,18} The specificity was found to be equal to 99.6%, comparable to Sean et al, Richmond, Alvares et al, Farrer *et al*.^{10,14,17,18} but much higher than that found by Mellies et al,¹⁵ which was 50.0% only. Thus the study is suggestive of the fact that initial clinical examination conducted though echocardiographic evaluation of the neonates with cardiac murmur may contribute in identify of CHD, so that appropriate counseling can be carried out.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 10-12-2015; **Published online:** 01-01-2016