Prevalence of cardiac murmur detected on routine neonatal examination

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ABSTRACT

The aim of this prospective study was to investigate the prevalence of cardiac murmurs detected on routine neonatal examinations. A total of 5,124 healthy newborn babies underwent routine neonatal examinations on days 1, 5 and 30 during a three-and-a-half-year period. Cardiac murmur was found in 115 neonates (2.24%) within one month after birth and echocardiographic examination was subsequently performed. Seventy-two of the 115 neonates with a murmur (1.41%) of the total of 5,124 neonates were found to have congenital heart diseases (CHD): 48 (0.94%) had ventricular septal defect (VSD), 11 (0.21%) had atrial septal defect (ASD), 7 (0.14%) had pulmonary valve stenosis (PS), 4 (0.08%) had patent ductus arteriosus (PDA) and 2 (0.04%) had Ebstein's anomaly of the tricuspid valve. We diagnosed the cardiac murmur in the remaining 43 neonates (0.84%) to be innocent heart murmurs: 30 (0.59%) had pulmonary branch stenosis (PBS), 2 (0.04%) had transient PDA and 9 (0.18%) showed a completely normal echocardiogram. Nine neonates in whom CHD was diagnosed showed clinical symptoms from early infancy on follow-up and 2 required cardiac surgery before 12 months after birth. Undergoing echocardiographic examination soon after a murmur is detected, may be a clue to the presence of asymptomatic heart diseases from early infancy.

INTRODUCTION

The noninvasive technique of echocardiography has had a major influence on the diagnostic and therapeutic management of cardiac diseases. The color Doppler technique is a reproducible diagnostic tool for the detection of shunt lesions of congenital heart diseases (CHD), such as small atrial septal defect (ASD), small ventricular septal defect (VSD) and patent ductus arteriosus (PDA). There are numerous statistical reports on cardiac murmurs in children, however most of them were done before the color Doppler technique of echocardiography was introduced. Although some large statistical reports of CHD in infancy using the color Doppler technique were published recently, there are few prospective studies of cardiac murmurs detected during the neonatal period. It is especially difficult to distinguish the cardiac murmur of CHD from innocent heart murmurs caused by circulatory changes which are part of the adaptation to extrauterine life soon after birth.

The objective of this prospective study was to determine the prevalence of cardiac murmurs found on neonatal routine examination by general pediatricians within one month after birth.
METHODS

This study included 5,512 live newborn babies born at Tokyo Medical University Hospital or Itabashi Chuo General Hospital, between 1 March 1998 and 28 February 2001. The 388 babies who were admitted to the neonatal intensive care unit (NICU) were excluded from this study. The remaining 5,124 healthy term babies had a routine neonatal examination with auscultation of the heart by general pediatricians, on days 1, 5, and 30 respectively. In this study, a cardiac murmur was defined as a systolic murmur of grade 1/6 or higher in intensity.

Two-dimensional (2D), M-mode, pulsed Doppler, and color Doppler echocardiographic examinations were performed with two commercially available systems (Hewlett-Packard, Sonos 2000, USA and Toshiba, SSA-380A, Japan) using 7.5 and 5 MHz transducers. All neonates were examined after sedation with triclofos sodium. When structural heart malformations were ruled out, we suspected innocent heart murmurs (physiological or functional heart murmurs) such as pulmonary artery branch stenosis (PBS), which were defined as an increase of the peak velocities of at least 50% between the main pulmonary artery and the branches. In this study, we paid attention to the interatrial shunt flow from both the subcostal four-chamber and sagittal views. These were done to distinguish between an ASD and a patent foramen ovale (PFO). Follow-up of echocardiographic examinations was performed every 2 or 3 months until the cardiac murmur had disappeared or the echocardiogram showed normal findings in patients who could continue to receive our follow-up examinations.

RESULTS

Of 5,124 healthy term babies, 115 had cardiac murmurs (2.24%). They all had received echocardiographic examinations after the murmur was detected. Seventy-two of the 115 neonates with a cardiac murmur (1.41%) of the total of 5,124 were diagnosed as CHD by echocardiographic examinations (Table). All 72 neonates with cardiac malformations were asymptomatic: 48 (9.94%) had VSD, 11 (0.21%) had ASD, 7 (0.14%) had pulmonary valve stenosis (PS) including 6 mild PS, 4 (0.08%) had PDA and 2 (0.04%) had Ebstein's anomaly of the tricuspid valve. We considered the cardiac murmurs in the remaining 43 neonates (0.84%) as innocent heart murmurs: 30 (0.59%) had PBS, 2 (0.04%) had transient PDA. Nine (0.18%) showed a completely normal echocardiogram.

Of the 48 VSD patients, 32 received follow-up examination by 6 months of age and the remaining 16 patients were lost to follow-up or moved away. The defect closed spontaneously in 6 out of the 32 VSD by that time. Three of the 32 VSD patients were given medication from early infancy. Follow-up examination could be done in all 11 ASD patients by 12 months after birth. Two patients showed evidence of right ventricular overload in infancy and the defect closed spontaneously in 7 out of the 11 ASD patients. Furthermore, 2 of 4 PDA patients required ductal ligation before 12 months of age.

Three hundred eighty-eight babies admitted to the NICU were either premature (<35 weeks of gestation) and/or low birth weight (<2,000 g), or required intensive care for respiratory diseases and the like. Twenty-five babies were found to have CHD in NICU (Table).

DISCUSSION

Most neonatal examinations in Japan are performed on days 1 and 5 (discharge day) in hospitals and on day 30 in outpatient departments. Auscultation for screening of CHD is one of the main reasons for this routine examination. Estimates of the frequency of cardiac murmurs vary from 1.7% to 77.4% in healthy neonates, based on previous studies. The difference depends on not only the size of the study, the examiner's skill and experience, and examination conditions, but also the timing of the examination and the definition of the heart murmur, including the threshold for the inclusion of very soft murmurs.

Recently, Ainsworth et al(9) reported that a cardiac

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Table Numbers and types of congenital heart diseases in 5512 neonates

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of patients</th>
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<tbody>
<tr>
<td>On routine examination</td>
<td></td>
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<tr>
<td>VSD</td>
<td>48</td>
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<tr>
<td>ASD</td>
<td>11</td>
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<td>PS</td>
<td>7</td>
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<td>PDA</td>
<td>4</td>
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<td>Ebstein</td>
<td>2</td>
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<tr>
<td>Admitted to NICU</td>
<td></td>
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<tr>
<td>VSD</td>
<td>10</td>
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<td>PS</td>
<td>3</td>
</tr>
<tr>
<td>TGA</td>
<td>3</td>
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<td>PDA</td>
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<td>DORV</td>
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murmur was detected in 46 neonates (0.6%) of 7,204 neonates by senior house officers in neonatal pediatrics or obstetrics, during a routine neonatal examination within 48 hours after the delivery. Among these 46 neonates with a murmur, CHD was diagnosed in 25 neonates (0.3%) including 2 ASDs. The remaining 8 neonates showed physiological findings such as PDA and physiological PBS, and 13 neonates showed normal hearts. Arlettaz et al.8 investigated innocent heart murmurs paying attention to PDA and PFO at an average of 40~60 hours after birth, and showed that the prevalence of the murmurs was 21 per 1,000 live births (2.1%).

Cardiac murmur was detected in 115 neonates (2.24%) of 5,124 healthy term neonates up to 30 days after birth in our study. Cardiac murmurs of CHD were found in 72 neonates (63%) and innocent heart murmurs in 43 neonates (37%). The reason for high prevalence of cardiac murmur in neonates depends on the timing of the examination, as well as the examiner’s skill and experience. Our study was done by general pediatricians who had no special neonatal or cardiac skills. It is quite possible that a careful auscultation of the heart could detect innocent heart murmurs of PBS which radiate to the axillae and the back. Another reason is the detection of small VSD (0.94%) which closed spontaneously within several months, as reported in recent studies9. Additionally, 11 neonates with ASD were diagnosed from early infancy in our study. In general, the diagnosis of ASD is difficult to determine in early infancy, because most infants with ASD are asymptomatic and the murmurs are rarely loud with turbulent flow. In this study, our method in which echocardiographic examinations were done for all neonates who had murmurs, could pick up an ASD with mild murmurs.

Nine neonates including 2 ASD cases in whom CHD was diagnosed showed clinical symptoms from early infancy on follow-up and 2 required cardiac surgery before 12 months of age. Undergoing echocardiographic examination soon after a murmur is detected, may be a clue to the presence of asymptomatic heart diseases from early infancy. It is important because the clinical presentation and deterioration may be sudden and some treatable defects may even cause death before diagnosis is made.

CONCLUSION

1. A total of 5,124 healthy newborn babies underwent routine neonatal examinations on days 1, 5 and 30 during a three-and-a-half year period. Cardiac murmur was found in 115 neonates (2.24%) and echocardiographic examination was subsequently performed.

2. Cardiac murmurs of CHD were found in 72 neonates (63%) and innocent heart murmurs in 43 neonates (37%). In 72 neonates with CHD, 9 neonates showed clinical symptoms from early infancy on follow-up and 2 required cardiac surgery before 12 months of age.

3. Undergoing echocardiographic examination soon after a murmur is detected, may be a clue to the presence of asymptomatic heart diseases from early infancy.

REFERENCES


新生児検診で聴取された心雑音の有病率

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【要旨】新生児検診で聴取された心雑音の有病率を検討することを目的とした。3年6ヶ月の間に出生した合計5, 124例の健康な新生児に対して、日齢1, 5, 30に通常の新生児検診を行った。生後1ヶ月までに115例（2.24％）に心雑音が認められ、全例に心エコーを施行した。心雑音が認められた115例中72例（1.41％）が先天性心疾患（CHD）と診断され、その内訳は心室中隔欠損症（VSD）48例（0.94％）、心房中隔欠損症（ASD）11例（0.21％）、肺動脈弁狭窄症（PS）7例（0.14％）、動脈管開存症（PDA）4例（0.08％）、エプスタイン奇形2例（0.04％）であった。残る43例（0.84％）は機能性心雑音と診断され、末梢性肺動脈狭窄症（PBS）30例（0.59％）、一過性のPDAが2例（0.04％）であり、9例（0.18％）では構造異常は認められなかった。CHDと診断された72例中9例で乳児期早期より臨床症状が認められ、うち2例で生後1年以内に外科治療が必要となった。新生児検診で心雑音をみつけ早期に心エコーを行うことは、無症候性の心疾患の発見に有用である。

〈Key words〉心雑音、機能性心雑音、先天性心疾患、心エコー