APPROACH TO HEART MURMURS IN PEDIATRIC PATIENTS

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ABSTRACT

Aim: Our aim was to investigate the clinical significance of heart murmurs and determine the best approach to children with heart murmurs.

Material and Methods: We retrospectively evaluated 128.900 patients aged 35 days-15 years out of the total of 139.904 that applied to our pediatric outpatient clinic between July 2007 and March 2012.

Findings: Mean patient age was 3.93±3.55 years (range: 35 days-15 years). Heart murmurs were detected in 434 patients (0.33%); 173 of them were female and 261 were male. Physical examination, ECHO, TELE and ECG showed congenital heart disease in 113 patients (0.08%) and innocent murmur in 321 (0.24%).

Results: Heart murmurs are the most common finding in physical examination of the cardiovascular system. While most heart murmurs are innocent, in less than 1% of cases they are the only sign of congenital heart disease. We recommend echocardiography in addition to physical examination to avoid overlooking minor cardiac pathologies and rheumatic heart disease. It can also help lessen parental concerns in families that self-educate with the help of the Internet.

Keywords: Murmur, congenital heart disease, echocardiography.

Running title: heart murmurs

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INTRODUCTION

Heart murmurs in children are a source of concern for doctors and parents alike until cardiac diseases are ruled out. While most heart murmurs are innocent, they can also be the first sign of previously asymptomatic structural heart disease, and for this reason they must not be overlooked (1, 2).

According to National Heart Lung and Blood Institute, a heart murmur is defined as an extra sound or an unusual sound auscultated during a heart beat (3). Innocent murmurs are generally caused by turbulent flow in the pulmonary artery or delayed cardiac development in newborns and prematurity (4, 5). The prevalence of heart murmur among newborns varies between 0.6-2.4% (6). This rate may reach 90% at some points in the life of infants and children. In 50-70% of cases, murmurs are discovered during routine examination (7, 8). Congenital heart disease accounts for under 1% of all childhood heart murmurs (9).

Correct early diagnosis of congenital heart disease allows to perform endocarditis prophylaxis before surgical treatment, thus preventing morbidity and mortality. The opposite scenario can cause parents to unnecessarily limit a healthy child's physical activities and become a source of constant stress. In such cases, it is important to provide information and reassurance to the family (10, 11).

In this study, we set out to investigate the prevalence of heart murmur and cardiac disease in children that applied to our hospital with no previous diagnosis. We also conducted a review of literature as to what the optimal approach to childhood heart murmurs should be.

MATERIAL AND METHODS

In this study, we retrospectively evaluated 128.900 patients aged 35 days-15 years out of the total of 139.904 that applied to our pediatric outpatient clinic between July 2007 and March 2012. Excluded from the patient sample were those under 30 days of age and those previously diagnosed with congenital heart disease or innocent heart murmur. Physical examinations were performed by a pediatrician, while cardiological evaluation and echocardiography (ECHO) were carried out by a pediatric cardiologist. The patients' physical examination, telecardiography (TELE), electrocardiography (ECG) and ECHO findings were recorded and analyzed.

Statistical analysis of obtained data was performed using the Number Cruncher Statistical System 2007 and PASS 2008 Statistical Software (Utah, USA). In addition to

descriptive statistical methods (mean, frequency), the chi-squared test was used for comparison of qualitative values. A p value of <0.05 was considered significant.

RESULTS

We retrospectively evaluated 128.900 patients that applied to our pediatric outpatient clinic between July 2007 and March 2012 and had not been previously diagnosed with congenital heart disease or innocent heart murmur. Patient age varied between 35 days-15 years. Heart murmur was detected in 434 patients (0.33%). Among those, 173 were female and 261 were male. Mean patient age was 3.93±3.55 years. Physical examination, ECHO, ECG and TELE showed congenital heart disease in 113 patients (0.08%) and innocent murmur in 321 (0.24%) (Table 1). Diagnostic criteria for innocent murmur were a 1-2/6 murmur heard in physical examination and normal TELE, ECHO and ECG findings. The most common congenital heart diseases were patent foramen ovale (PFO) in 29 patients (25.6%), ventricular septal defect (VSD) in 15 (13.2%) and mitral regurgitation in 15 (13.2%) (Table 2). A significant correlation was found between patient sex and congenital heart disease (p<0.01): heart disease was more common in females. There was also a significant correlation between patient age and heart disease: it was more prevalent in those under 1 year of age compared to all other groups (p<0.01) (Figure 1).

Table 1. Parameters Correlated to Presence of Heart Disease

		Heart Disease		
		Present (n=113)	None (n=321)	*p*
		n (%)	n (%)	
Sex	Female	61 (53.9)	112 (34.8)	*0,001***
	Male	52 (46.1)	209 (65.1)	
Age (Years)	<1 year	50 (43.9)	74 (23.1)	*0,001***
	1-4 years	24 (21.1)	135 (42.2)	
	5-9 years	28 (24.6)	88 (27.5)	
	≥10 years	11 (10.4)	24 (7.2)	

Chi-squared test *** p<0.01*

Table 2. Distribution of congenital heart disease according to patient sex

Congenital Heart Disease	N (%)	Female	Male
PFO	29 (25.6)	10	19
VSD	15 (13.2)	10	5
MR (secondary to hypoxia)	15 (13.2)	10	5
ASD	13 (11.5)	8	5
Small PDA	5 (4.4)	3	2
VSD+PFO	3 (2.6)	2	1
Pulmonary stenosis	3 (2.6)	1	2
ASD+small PDA	3 (2.6)	3	-
Bicuspid valve	3 (2.6)	-	3
MR+Aortic regurgitation	3 (2.6)	1	2
Aortic regurgitation	3 (2.6)	-	3
Mitral prolapse	2 (1.7)	1	1
ASD+pulmonary stenosis	2 (1.7)	2	-
Persistent left superior vena cava	2 (1.7)	1	1
MR+small PDA	2 (2.7)	2	-
MR+mitral prolapse	2 (1.7)	2	-
MR+PFO	1 (0.8)	1	-
Dextrocardia	1 (0.8)	-	1
Intracardiac mass	1 (0.8)	-	1
Left ventricular band	1 (0.8)	1	-
Hypertrophic cardiomyopathy	1 (0.8)	1	-
Pericardial effusion	1 (0.8)	-	1
Pulmonary stenosis+idiopathic pulmonary artery dilatation	1 (0.8)	1	-
MR+ASD	1 (0.8)	1	-

PFO: Patent foramen ovale; VSD: Ventricular septal defect; MR: Mitral regurgitation; ASD: atrial septal defect; PDA: patent ductus arteriosus.

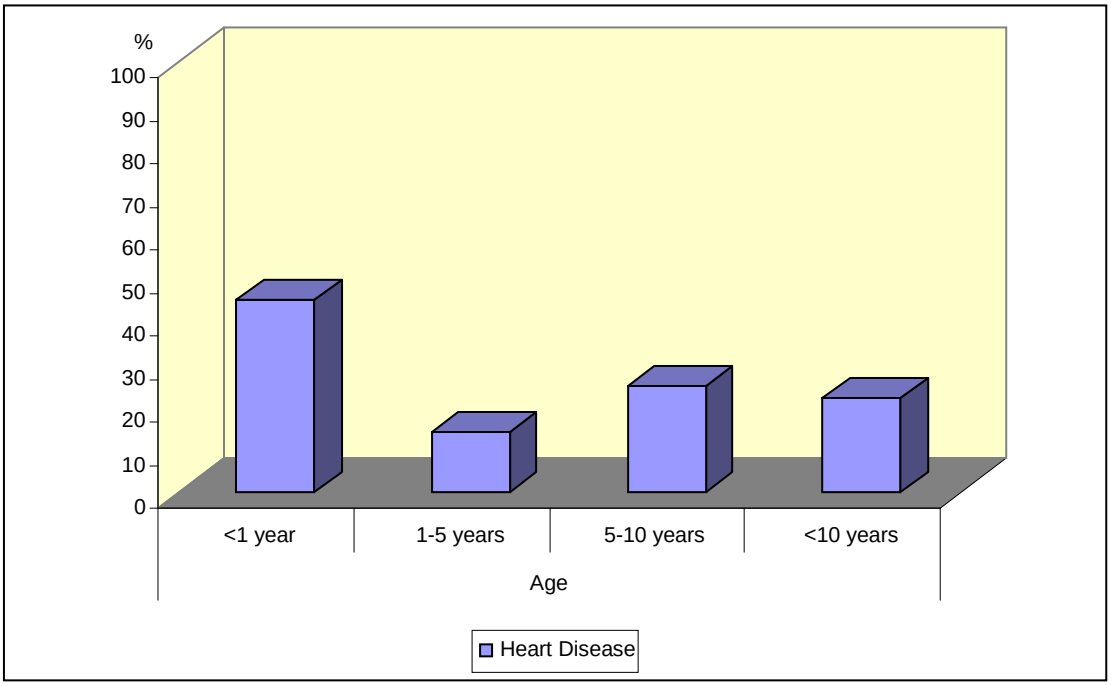

Figure 1. Heart disease prevalence distribution according to patient age.

DISCUSSION

Heart murmur is the most common finding of cardiovascular system examination and the third most common reason for referral to a pediatric cardiologist after chest pain and syncope (12). Murmurs may continue well into adulthood and change with normal growth and development. The fact that they may disappear and return throughout childhood is something families must be educated about (13).

In rare cases, heart murmurs may be a sign of congenital or structural heart disease (2). The diagnostic criteria for childhood and adolescent innocent murmurs are: normal physical examination; asymptomatic patient; no increased risk of structural heart disease in patient history; auscultation intensity of < 3 during early systole. However, these criteria do not account for newborns and infants under 1 year of age as asymptomatic structural heart disease is common in that period.

Reported prevalence rates of innocent murmur vary depending on the experience of the examining specialist and the patient population. Peak incidence of 50-70% for

preschoolers and schoolchildren is reported between ages 3-7 (14, 15). While most cases are innocent among this population, the important task of differentiating between innocent and pathologic murmur to detect rheumatic heart disease and congenital heart disease falls to primary care physicians (16). The prevalence does not vary between the sexes (17). According to the studies conducted in our country, prevalence rates for innocent heart murmur vary between 0.7-2.3% (18). Specifically, Aydin et al. report a 9.3% rate, Yalaki et al. - 2.8% and Uner et al. - 3.5% (19, 20, 21). This rate was only 0.24% in our study, possibly due to the exclusion of patients under 30 days old. In another of our studies, the rate of innocent heart murmur in 3629 newborns was 1.8%, while the rate of congenital heart disease was 2.2% (22).

Screening tests conducted at schools have yielded similar prevalence rates of congenital heart disease in Turkey and the world (19): 4.6-12.2 in every 1000 live births (23). This rate was 0.77% in an 8-year study by Baspinar et al., 0.4% in a study from Van and 0.7% in a study by Yalaki et al. (20, 21, 24). In our study, it was as low as 0.08%.

VSD is the most common congenital heart disease, accounting for 25% of all cases (25, 26). In a study of schoolchildren by Misra et al., the rate of congenital heart disease was 1.3%, and the most common diseases were VSD and ASD (27). In our study, the most common ones were PFO in 29 patients (25.6%) and VSD in 15 (13.2%), as we considered PFO a congenital heart disease as opposed to the more common interpretation as a physiological phenomenon (28, 29). Recent studies have demonstrated that PFO is a pathology that aggravates clinical condition, leads to cardiovascular and systemic complications and needs close monitoring. PFO must not be overlooked as it has been shown to provide the foundation for such conditions as ischemic stroke, paradoxical embolism, fat embolism, migraine, obstructive sleep apnea and amnesia (30, 31).

According to another disputed convention, further testing is unnecessary in heart murmurs as physical examination is sufficient for diagnosis (32, 33). However, many studies demonstrate that ECHO is the gold standard in diagnosis and clinical management of congenital heart disease, and can also be relied on as a noninvasive method of evaluating pulmonary hemodynamics and cardiac function (34, 35, 36). One study described performing ECHO not only diagnostically but also to meet the expectations of concerned parents, 80% of whom believed that it was necessary (37).

CONCLUSION

In order to rule out heart disease, a systemic approach is necessary in cases of heart murmurs detected in physical examination. Particular attention must be paid to patients under 1 year of age. Evaluation of the cardiovascular system is undoubtedly a major part of physical examination. However, physical examination may not suffice today when families take advantage of widespread Internet access to self-educate and can develop certain misperceptions. In a survey conducted among parents of children diagnosed with innocent murmur, 10% were convinced that their child had a heart disease (36). Echocardiography must be performed to rule out minor cardiac pathologies and rheumatic heart disease in addition to endocarditis prophylaxis where necessary.

Conflict of interest: The authors declare that they have no conflict of interest

REFERENCES

1. Etoom Y, Ratnapalan S. Evaluation of children with heart murmurs. Clin Pediatr (Phila). 2014 Feb;53(2):111-7.

2. Ronak J. Naik, , Nishant C. Shah, Teenage heart murmurs. Pediatr Clin North Am. 2014 Feb;61(1):1-16
3. National Heart Lung and Blood Institute. What is a Heart Murmur? http://www.nhlbi.nih.gov/health/dci/Diseases/heartmurmur/hmurmur_what.htm
4. Manning D, Paweletz A, Robinson JL. Management of asymptomatic heart murmurs in infants and children. *Paediatr Child Health*. 2008;19(1):25-29.
5. Richmond S, Wren C. Early diagnosis of congenital heart disease. *Semi Neonatol*. 2001; 6: 27-35.
6. Mahle WT, Newburger JW, Matherne GP, et al. Role of pulse oximetry in examining newborns for congenital heart disease: a scientific statement from the American Heart Association and American Academy of Pediatrics. *Circulation*. 2009;120(5):447-458.
7. Mahnke CB, Mulreany MP, Inafuku J, Abbas M, Feingold B, Paolillo JA. Utility of store-and-forward pediatric telecardiology evaluation in distinguishing normal from pathologic pediatric heart sounds. *Clin Pediatr(Phila)*. 2008;47(9):919-925.

8. Menashe V Heart murmurs. *Pediatr Rev*. 2007;28(4):e19-e22.
9. Biancaniello T. Innocent murmurs. *Circulation*. 2005;111(3):e20-e22.
10. Engle MA. Insurability and employability: congenital heart disease and innocent murmurs. Circulation 1977;56:143-5.
11. Bergman AB, Stamm SJ. The morbidity of cardiac nondisease in school children. N Engl J Med 1967;276:1008-13
12. Amaral F, Granzotti JA, Simões JG, Balestra DC, Dantas BG. Perfil ambulatorial em cardiologia pediátrica na cidade de Ribeirão Preto - resultados preliminares. Rev Paul Pediatria 2002;20:179-86
13. Wierwille, Lauren RN, MS, FNP-C Pediatric Heart Murmurs: Evaluation and management in primary care. Nurse Practitioner March 2011 - Volume 36 - Issue 3
14. Advani N, Menahem S, Wilkinson JL. The diagnosis of innocent murmurs in childhood. Cardiol Young 2000; 10: 340-2.
15. Danford DA, Nasir A, Gumbiner C. Cost assessment of the evaluation of heart murmurs in children. Pediatrics 1993; 91: 365-8.
16. Asprey DP. Evaluation of children with heart murmurs Lippincott's Primary Care Practice [1998, 2(5):505-513]
17. McCrindle BW, Shaffer KM, Kan JS, Zahka KG, Rowe SA, Kidd L. Cardinal clinical signs in the differentiation of heart murmurs in children. Arch Pediatr Adolesc Med 1996; 150: 169-74.
18. Koc A, Kostecik M, Atas A, Kilinc M. Prevalence of heart murmurs in primary school children. Ist Pediatr Clin J 1997;32:28-33.
19. Fedakar A. Poster 159. Prevalence of congenital heart disease in our hospital's newborn ward. 56th National Turkey Pediatrics Congress 2012.
20. Aydin BG, Olgunturk R, Tunaoglu S. Prevalence of innocent heart murmur and congenital heart disease in Ankara city center. T Clin J Pediatr 2001; 10: 121-124.
21. Uner A, Dogan M, Bay A, Cakin C, Kaya A, Sal E. The ratio of congenital heart disease and innocent murmur in children in Van, Eastern Turkey. Anadolu Cardiol J 2009; 9: 29-34.
22. Yalaki Z, Catakli T, Dallar Y. Retrospective evaluation of heart murmurs detected in preoperative examination.
23. Grech V. The evolution of diagnosis trends in congenital heart disease: a population-based study. J Paediatr Child Health 1999; 35: 387-391.

24. Prevalence and distribution of children with congenital heart diseases in the central Anatolian region, Turkey The Turkish Journal of Pediatrics 2006; 48: 237-243
25. Bassili A, Mokhtar SA, Dabous NI, Zaher SR, Mokhtar MM, Zaki A.Congenital heart disease among school children in Alexandria, Egypt: an overview on prevalence and relative frequencies. J Trop Pediatr 2000; 46: 357-62.
26. Hoffman JI, Kaplan S, Liberthson RR. Prevalence of congenital heart disease.Am Heart J 2004 ;147:425-39
27. Misra M, Mittal M, Verma AM, Rai R, Chandra G, Singh DP, Chauhan R, Chowdhary V, Singh RP, Mall AK, Khan MJ, Khare S, Yadav KB, Kumar R, Aeron AR, Verma PK. Prevalence and pattern of congenital heart disease in school children of eastern Uttar Pradesh. Indian Heart J. 2009 Jan-Feb;61(1):58-60
28. Tanman B, Cantez T, Dindar A. Congenital Heart Diseases. Neyzi O, Ertugrul T, (eds). Pediatrics. Istanbul, Nobel Medical Publishing, 2002. p. 947-73.
29. Bulut G, Balli S, Atlihan F, Mese T, Calkavur S, Olukman O. Retrospective evaluation of congenital heart disease in newborn ward. Izmir Dr. Behcet Pediatr Disease J 2012; 2(3):141-147
30. Shah S, Shindler D. Patent Foramen Ovale echoes from the past and questions for the future. New Jersey Medicine 2002; 99:25-26.
31. Dagli N, Akbulut M, Balin M, Yavuzkir M. Patent Foramen Ovale, TGKD Volume: 10, Issue: 3, August 2006.
32. Shub C. Echocardiography or auscultation? How to evaluate systolic murmurs. Can Fam Physician 2003; 49:163-167.
33. Alvares S, Ferreira M, Ferreira H, Mota CR. Initial assessment of heart murmurs in children: role of complementary diagnostic tests. Rev Port Cardiol 1997; 16: 621-624.
34. Attenhofer Jost CH, Turina J, Mayer K, et al. Echocardiography in the evaluation of systolic murmurs of unknown cause. Am J Med 2000; 108: 614-620
35. S Moss, D J Kitchiner, C W Yoxall, N V Subhedar. Evaluation of echocardiography on the neonatal unit. Arch Dis Child Fetal Neonatal Ed 2003;88:F287–F291
36. Advani N, Menahem S, Wilkinson JL. The diagnosis of innocent murmurs in childhood. Cardiol Young 2000; 10: 340-2.
37. McCrindle BW, Shaffer KM, Kan JS, Zahka KG, Rowe SA, Kidd L. An evaluation of parental concerns and misperceptions about heart murmurs. Clin Pediatr (Phila) 1995;34:25-31.