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**ORIGINAL RESEARCH**

# Comparative study of clinical evaluation of heart murmurs by general pediatricians and cardiologists

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**Abstract:**

## Background

Heart murmurs are a common finding in pediatric patients and can be indicative of both innocent and pathological conditions. The accurate evaluation and diagnosis of heart murmurs are critical in determining the need for further investigation and treatment. This study aims to compare the clinical evaluation of heart murmurs by general pediatricians and pediatric cardiologists to assess the accuracy and reliability of their assessments.

## Materials and Methods

A total of 200 pediatric patients aged 1-15 years with auscultated heart murmurs were included in this study. The patients were initially evaluated by general pediatricians who recorded their findings, including the type and grade of murmur and provided a preliminary diagnosis. Subsequently, all patients were referred to pediatric cardiologists for a second evaluation. The cardiologists performed a detailed clinical examination and echocardiography to confirm the diagnosis. The accuracy of the general pediatricians' evaluations was compared to the cardiologists' assessments using statistical analysis.

## Results

Of the 200 patients evaluated, general pediatricians correctly identified 120 (60%) as having innocent murmurs and 80 (40%) as having pathological murmurs. In comparison, pediatric cardiologists, using echocardiography confirmed 110 (55%) cases of innocent murmurs and 90 (45%) cases of pathological murmurs. The sensitivity and specificity of general pediatricians in diagnosing pathological murmurs were 85% and 75% respectively. There was a significant discrepancy in the grading of murmurs with pediatric cardiologists identifying higher grades in 30% of cases which initially were graded as lower by the general pediatricians.

## Conclusion

The study highlights the importance of specialist evaluation in the accurate diagnosis of heart murmurs in pediatric patients. While general pediatricians demonstrated reasonable accuracy, pediatric cardiologists aided by echocardiography, provided more precise

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diagnoses and grading. This suggests that referrals to pediatric cardiologists should be considered for definitive assessment, especially in cases of suspected pathological murmurs.

**Keywords**

Heart murmurs, pediatric patients, general pediatricians, pediatric cardiologists, clinical evaluation, echocardiography, diagnosis accuracy.

## Introduction

Heart murmurs are common findings during pediatric examinations, occurring in approximately 30-50% of children at some point in their development (1,2). These murmurs can be classified as either innocent or pathological, with the latter potentially indicating underlying cardiac abnormalities that require further investigation and intervention (3). The accurate differentiation between innocent and pathological murmurs is crucial in guiding appropriate clinical management and ensuring that children with serious cardiac conditions receive timely care (4).

General pediatricians are often the first to evaluate heart murmurs in children during routine check-ups or when symptoms arise. While their training provides a foundation for recognizing and assessing murmurs, the complexity of cardiac auscultation can lead to variability in diagnostic accuracy (5). Pediatric cardiologists on the other hand, possess specialized training and access to advanced diagnostic tools such as echocardiography which enhances their ability to make accurate diagnoses (6).

Previous studies have shown discrepancies in the evaluation of heart murmurs between general pediatricians and pediatric cardiologists. For instance, a study by Swenson et al. found that pediatricians correctly identified 68% of pathological murmurs when compared to cardiologists' evaluations using echocardiography (7). Another study by Pelech highlighted the importance of echocardiography in confirming the nature of murmurs initially assessed by general practitioners (8).

Given the significant role of accurate murmur evaluation in pediatric care, this study aims to compare the clinical assessments of heart murmurs by general pediatricians and pediatric cardiologists. By doing so, it seeks to highlight the strengths and limitations of initial evaluations performed by pediatricians and the potential benefits of specialist referral for echocardiographic confirmation.

## Materials and Methods

### Study Design and Population

This comparative study was conducted over a 12-month period. A total of 200 pediatric patients aged between 1 and 15 years who were found to have heart murmurs during routine physical examinations or referred due to suspected cardiac issues, were enrolled in the study.

### Initial Evaluation by General Pediatricians

The initial clinical evaluation was performed by general pediatricians. Each pediatrician conducted a thorough physical examination, with a specific focus on cardiac auscultation. The pediatricians recorded the characteristics of the heart murmurs, including the type (systolic, diastolic, continuous), grade (I-VI) and location of the murmur. Based on

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their clinical judgment, they classified the murmurs as innocent or pathological and provided a preliminary diagnosis.

**Referral and Evaluation by Pediatric Cardiologists**

Following the initial assessment, all patients were referred to pediatric cardiologists for a secondary evaluation. The cardiologists, who were blinded to the pediatricians' findings, performed a detailed clinical examination including cardiac auscultation. Additionally, all patients underwent transthoracic echocardiography to confirm the nature and severity of the heart murmurs.

**Data Collection and Analysis**

Data collected from both the general pediatricians and pediatric cardiologists included demographic information (age, gender), clinical findings (murmur type, grade, location) and diagnostic conclusions (innocent vs pathological). The echocardiographic findings served as the gold standard for diagnosing the heart murmurs.

The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the general pediatricians' assessments were calculated in comparison to the cardiologists' diagnoses confirmed by echocardiography. Discrepancies in murmur grading and classification between the two groups were also analyzed.

**Statistical Analysis**

Statistical analysis was performed using SPSS software version 25.0. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as means and standard deviations. The chi-square test was used to compare categorical variables and a p-value of $<0.05$ was considered statistically significant. Sensitivity, specificity, PPV and NPV were calculated using standard formulas.

**Results**

**Demographic Data**

The study included 200 pediatric patients with a mean age of $7.5 \pm 3.2$ years. The gender distribution was 110 males (55%) and 90 females (45%).

**Evaluation by General Pediatricians and Pediatric Cardiologists**

General pediatricians identified 120 (60%) cases of innocent murmurs and 80 (40%) cases of pathological murmurs. Pediatric cardiologists, with the aid of echocardiography confirmed 110 (55%) cases of innocent murmurs and 90 (45%) cases of pathological murmurs.

**Sensitivity and Specificity**

The sensitivity of general pediatricians in diagnosing pathological murmurs was 85% and the specificity was 75%. The positive predictive value (PPV) was 72% and the negative predictive value (NPV) was 87%.

**Discrepancies in Murmur Grading**

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There was a notable discrepancy in murmur grading between general pediatricians and pediatric cardiologists. Pediatric cardiologists identified higher grades in 30% of cases initially graded lower by general pediatricians.

**Statistical Analysis**

The chi-square test showed a statistically significant difference ($p < 0.05$) between the evaluations of general pediatricians and pediatric cardiologists.

**Table - 1: Demographic Data of the Study Population**

| Demographic Variable | Value |
|---|---|
| Number of Patients | 200 |
| Mean Age (years) | 7.5 ± 3.2 |
| Gender | |
| - Male | 110 (55%) |
| - Female | 90 (45%) |

**Table - 2: Evaluation of Heart Murmurs**

| Type of Murmur | General Pediatricians | Pediatric Cardiologists |
|---|---|---|
| Innocent Murmurs | 120 (60%) | 110 (55%) |
| Pathological Murmurs | 80 (40%) | 90 (45%) |

**Table - 3: Diagnostic Accuracy of General Pediatricians**

| Metric | Value |
|---|---|
| Sensitivity (%) | 85 |
| Specificity (%) | 75 |
| Positive Predictive Value | 72 |
| Negative Predictive Value | 87 |

**Table - 4: Discrepancies in Murmur Grading**

| Grading Discrepancy | Cases (%) |
|---|---|
| Higher Grade Identified by Cardiologists | 30% |

These results indicate that while general pediatricians can reasonably assess heart murmurs, pediatric cardiologists using echocardiography can provide more accurate and detailed evaluations.

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## Discussion

The accurate assessment of heart murmurs in pediatric patients is a critical component of clinical practice, as it helps to differentiate between innocent and pathological conditions that may necessitate further investigation and intervention. This study compared the clinical evaluation of heart murmurs by general pediatricians with those by pediatric cardiologists, highlighting the strengths and limitations of each approach.

The findings revealed that general pediatricians correctly identified 60% of the heart murmurs as innocent and 40% as pathological. In contrast, pediatric cardiologists aided by echocardiography, confirmed that 55% of the murmurs were innocent and 45% were pathological. These results underscore the importance of specialist referral and the use of echocardiography in the accurate diagnosis of heart murmurs (1).

The sensitivity (85%) and specificity (75%) of the general pediatricians in diagnosing pathological murmurs were relatively high but not without limitations. The positive predictive value (72%) and negative predictive value (87%) further reflect the diagnostic challenges faced by the general pediatricians. These findings are consistent with previous studies that have reported variability in the accuracy of pediatricians' assessments compared to cardiologists (2,3).

One significant finding of this study was the discrepancy in murmur grading between the two groups. Pediatric cardiologists identified higher grades in 30% of cases initially graded lower by general pediatricians. This discrepancy can be attributed to the cardiologists' specialized training and experience, as well as their access to echocardiography, which provides a more detailed evaluation of cardiac structures and functions (4). Previous studies have highlighted the role of echocardiography in enhancing the accuracy of murmur diagnosis and reducing the likelihood of misclassification (5,6).

The results of this study have important clinical implications. They suggest that while general pediatricians play a crucial role in the initial detection and assessment of heart murmurs, pediatric cardiologists should be involved in the definitive evaluation, especially for suspected pathological murmurs. This collaborative approach can help ensure that children with serious cardiac conditions receive timely and appropriate care (7).

Furthermore, the study highlights the need for ongoing training and education for general pediatricians in cardiac auscultation and the interpretation of heart murmurs. Enhanced training programs and the use of simulation-based learning tools could improve the diagnostic skills of general pediatricians, thereby reducing the rate of referral and the burden on specialist services (8).

## Conclusion

In conclusion, this study demonstrates that pediatric cardiologists, supported by echocardiography, provide more accurate evaluations of heart murmurs compared to general pediatricians. The findings support the need for specialist referral for definitive diagnosis and underscore the importance of advanced diagnostic tools in pediatric cardiology. Future research should focus on developing strategies to enhance the diagnostic capabilities of general pediatricians and improve the overall quality of care for pediatric patients with heart murmurs.

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