

## Original Research Article

# Clinical profile of infective endocarditis: a single centre experience

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**Received:** 05 September 2023

**Accepted:** 29 September 2023

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### ABSTRACT

**Background:** Infective endocarditis (IE) is an illness which still has a high rate of morbidity and mortality despite the availability of improved diagnostic and treatment amenities in the developing world. With an increasing number of children with congenital heart disease (CHD) undergoing corrective treatments, improved pediatric intensive care, better antimicrobial treatments, and a relative decrease in rheumatic heart disease (RHD) over the years, the epidemiology of pediatric IE in Bangladesh may be undergoing a change. The present study aims to describe the epidemiological, clinical, laboratory profile and outcome of IE among selected patients.

**Methods:** This prospective cross-sectional study was conducted with a total of 35 patient of IE from January 2020 to December 2021, who were admitted in pediatric cardiology department, Bangladesh Shishu hospital and institute were enrolled in this study which was diagnosed according to modified Duke criteria.

**Results:** There were 35 children diagnosed with IE during this period. The mean age at presentation was 84 months (range: 2-216 months). CHD (n=28/35, 80%) was the most common predisposing condition. A total of 20 % (7/35) patients had no preexisting structural heart disease. *Staphylococcus aureus* was the most common etiological agent. Blood culture positive IE was (n=18, 51.4%), blood culture-negative IE was (n=17, 48.6 %). Six patients (17.1%) died during the hospital stay.

**Conclusions:** Increasingly younger children are being diagnosed with IE in Bangladesh and a significant number of them are in the setting of a structurally normal heart.

**Keywords:** Clinical profile, IE, Single centre experience

## INTRODUCTION

Infective endocarditis (IE) emerges as a condition still burdened with considerable morbidity and mortality rates. Analyzing data from both population and hospital-based sources, an estimated incidence ranging from 1.5 to 11.6 per 100,000 individuals within the general populace becomes evident.<sup>1</sup> This ailment materializes due to the direct invasion of cardiac valves or mural endocardium by diverse pathogens like bacteria, fungi, and rickettsia.<sup>1</sup> Notably, the landscape of IE related to rheumatic diseases has undergone a significant shift in developed nations, gradually making way for instances linked with CHD, degenerative heart valve ailments, prosthetic valves, and

cardiac implantable electronic devices.<sup>3</sup> Particularly, children afflicted by CHD, especially those with acyanotic heart disease, face heightened vulnerability to developing IE. Amid these changes, it emerges that *Staphylococci*, often tied to healthcare-associated contexts and invasive procedures, have supplanted streptococci as the predominant pathogen causing IE.<sup>4</sup> In a draft statement from the American heart association (AHA) in 2015, a reference is made to a recent multicenter report.<sup>5</sup> This report underscores that the annual incidence rate of IE in the United States ranged approximately from 0.05 to 0.12 cases per 1,000 pediatric admissions from 2003 to 2010. The statement also signals a rising trend in the overall frequency of endocarditis

among children. This escalation is attributed to improved survival rates among at-risk children, encompassing those with CHD, whether having undergone surgery or not, as well as hospitalized infants. Over the past decades, the profile of IE has undergone a discernible transformation.<sup>6</sup> A divide in the epidemiological landscape becomes evident when comparing developed and developing countries. The prevalence of RHD waning in developed nations has rendered IE relatively uncommon within this subset of patients. During the past two decades, CHD has surfaced as the foremost predisposing condition for IE in children aged 2 years and above.<sup>7-9</sup> The changing disease pattern in developing countries is also a result of advancements in healthcare. On one hand, the early surgical rectification of CHD lesions, historically a prominent risk factor for IE, has reshaped the disease's underlying landscape. Conversely, postoperative IE looms as a long-term risk, especially in complex CHD cases marked by residual defects or previous corrective or palliative procedures, alongside implanted vascular grafts, patches, or prosthetic cardiac valves.<sup>10-13</sup> However, the scenario contrasts in Bangladesh, where only a minute fraction of infants burdened with CHD receive any form of palliative intervention.<sup>14</sup> Consequently, this epidemiological facet may not be translatable to our context. Given the scarcity of data on pediatric IE from Bangladesh, our study endeavors to assess the predisposing factors, microbiological composition, complications, and mortality patterns pertaining to pediatric IE within the Bangladeshi population.

**METHODS**

This prospective cross-sectional study was carried out at Bangladesh Shishu hospital and institute, a tertiary care teaching hospital. The study included patients diagnosed with IE based on modified Duke's criteria. The study enrolled patients aged 1 month to 216 months who were admitted between January 2020 and December 2021. Comprehensive data, including medical history, clinical findings, echocardiography, blood culture reports, treatment, and follow-up information, were recorded. Patients were evaluated post-discharge, with CBC, CRP, blood cultures, and echocardiography. Empirical antibiotic therapy was initiated with a minimum of three blood cultures taken on the first day. Follow-up cultures were used for assessment. Data analysis involved means, ranges, and proportions using SPSS Statistics software version 22.

**RESULT**

The distribution of patients by sex revealed that 57.1% (20) were male, while 42.9% (15) were female. In terms of age groups, 34.3% (12) fell within the 1-60 months range, 51.4% (18) were aged between 61 and 120 months, and the remaining 14.3% (5) were over 121 months old. With regard to residence, a majority of patients, constituting 71.4% (25), hailed from rural areas, whereas 28.6% (10) resided in urban settings.

**Table 1: Socio demographic profile of patients with IE, (n=35).**

Variables	N (%)
<b>Sex</b>	
Male	20 (57.1)
Female	15 (42.9)
<b>Age group (months)</b>	
1-60	12 (34.3)
61-120	18 (51.4)
>121	5 (14.3)
<b>Residence</b>	
Rural	25 (71.4)
Urban	10 (28.6)

**Table 2: Clinical profile in children with IE, (n=35).**

Variables	N (%)
<b>Fever</b>	35 (100)
<b>Congestive heart failure</b>	21 (60)
<b>Splenomegaly</b>	20 (57.1)
<b>Dental caries</b>	7 (20)
<b>Embolism</b>	2 (5.7)
<b>Neurological symptoms</b>	2 (5.7)
<b>Joint symptoms</b>	4 (11.4)
<b>Janeway's lesion</b>	3 (8.6)
<b>Osler's node</b>	2 (5.7)

All patients, constituting 100%, presented with fever as a prominent symptom. Congestive heart failure was observed in 60% (21) of cases, indicating a prevalent cardiovascular complication. Notably, 57.1% (20) exhibited splenomegaly, while a smaller proportion, 20% (7), displayed dental caries. Embolic events were less frequent, being present in 5.7% (2) of cases. Similarly, neurological symptoms and joint symptoms were each observed in 5.7% (2) and 11.4% (4) of cases, respectively. Janeway's lesions were documented in 8.6% (3) of cases, and Osler's nodes, another clinical indicator of endocarditis, were found in 5.7% (2) of cases.

**Table 3: Positive blood culture in children with IE, (n=18).**

Microorganisms	Different organisms grown in blood culture, (n=18) (%)
<i>Staphylococcus aureus</i>	6 (33.3)
<i>Streptococcus viridians</i>	3 (16.7)
<i>Pseudomonas aeruginosa</i>	3 (16.7)
<i>Acinetobacter</i>	2 (11.1)
<i>Aeromonas</i>	1 (5.6)
<b>Fungi</b>	3 (16.7)

The 18 out of the 35 patients had positive blood cultures. Among the diverse microorganisms isolated, *Staphylococcus aureus* was the most prevalent,

accounting for 33.3% (6) of cases. *Streptococcus viridians* and *Pseudomonas aeruginosa* each constituted 16.7% (3) of the cases. A smaller proportion, 11.1% (2), exhibited growth of *Acinetobacter* species. Notably, *Aeromonas* was observed in 5.6% (1) of cases. Additionally, fungal pathogens were identified in 16.7% (3) of cases, reflecting the microbial diversity associated with IE cases.

**Table 4: Underlying conditions in children with IE, (n=35).**

Variables	N (%)
<b>CHD</b>	28 (80)
Ventricular septal defect	6 (21.4)
Patent ductus arteriosus	3 (10.7)
Tetralogy of fallot	3 (10.7)
Tetralogy of fallot (post-total correction)	4 (14.3)
Pulmonary atresia (post total correction with conduit)	2 (7.2)
Pulmonary stenosis	3 (10.7)
Bicuspid aortic valve with aortic stenosis	4 (14.3)
Mitral valve prolapses with MR	3 (10.7)
Without prior structural heart disease	7 (20)

The 80% (28) had congenital heart disease, indicating its significant association with the ailment. Ventricular septal defect was the most prevalent congenital condition, accounting for 21.4% (6) of cases. Patent ductus arteriosus and Tetralogy of Fallot were each observed in 10.7% (3) of cases. Tetralogy of Fallot cases that had undergone post-total correction constituted 14.3% (4) of cases, while pulmonary atresia following total correction with conduit represented 7.2% (2). Pulmonary stenosis and bicuspid aortic valve with aortic stenosis were each documented in 10.7% (3) of cases. Notably, mitral valve prolapse with mitral regurgitation was observed in 10.7% (3) of cases. A subset of 20% (7) exhibited IE without a prior history of structural heart disease.

**Table 5: Echocardiographic features in children with IE.**

Variables	N (%)
<b>Location</b>	
Tricuspid valve	9 (25.8)
Mitral valve	10 (28.6)
Aortic valve	6 (17.1)
Pulmonary valve	6 (17.1)
Pulmonary valve conduit	2 (5.7)
Aortic and mitral valve	2 (5.7)
<b>Size</b>	
<10 mm	6 (17.1)
>10 mm	29 (82.9)
<b>Number</b>	
Single	33 (92.3)
Multiple	2 (5.7)

In terms of location, involvement of the tricuspid valve was evident in 25.8% (9) of cases, followed by the mitral valve in 28.6% (10) of cases, the aortic valve in 17.1% (6) of cases, and the pulmonary valve in 17.1% (6) of cases. A smaller proportion exhibited involvement of the pulmonary valve conduit (5.7%, 2 cases) and aortic and mitral valves simultaneously (5.7%, 2 cases). Regarding size, lesions smaller than 10 mm were observed in 17.1% (6) of cases, while larger lesions exceeding 10 mm were present in the majority of cases, accounting for 82.9% (29). Furthermore, concerning the number of affected valves, single-valve involvement was predominant, constituting 92.3% (33) of cases, while multiple valve involvement was seen in 5.7% (2) of cases.

**Table 6: Outcome of children with IE, (n=35).**

Variables	N (%)
<b>Complete recovery</b>	27 (77.2)
<b>Referred to surgery</b>	2 (5.7)
<b>Died</b>	6 (17.1)

A substantial proportion, 77.2% (27) of cases, achieved complete recovery. A smaller number, 5.7% (2), were referred for surgical intervention. Tragically, 17.1% (6) of cases resulted in fatalities.

**DISCUSSION**

Within the scope of our study, the average age of the patients amounted to 84 months, encompassing a range extending from 1 month to 216 months. Notably, 34.3% of the patient population was comprised of individuals below the age of 5 years. It is evident that this age category trends younger in comparison to earlier series concerning pediatric IE published within India. Notably, congenital heart disease (CHD) emerged as the principal predisposing factor for pediatric IE in our study, accounting for 80% (n=28/35) of cases. Contrastingly, in the period preceding the 1970s, 30 to 50% of children in the U.S. diagnosed with IE showcased underlying RHD. Over the past two decades, the landscape has shifted, with CHD overtaking as the predominant underlying condition for IE in children older than 2 years within developed countries.<sup>10</sup> Nevertheless, studies among adults in India continue to indicate RHD as the prevailing predisposing condition.<sup>15</sup> Moreover, within our study cohort, a notable subset of patients, amounting to 20% (n=7/35), manifested IE without preexisting structural heart disease. This statistic is significantly higher than the corresponding figures reported within Western literature, where approximately 8 to 10% of pediatric IE cases unfold without any structural heart issues.<sup>13</sup> The interplay of factors such as adverse socioeconomic conditions, malnutrition, inadequate sanitation, crowded living conditions, illiteracy, lack of healthcare access, and suboptimal immunization coverage may contribute to heightened susceptibility to severe infections during early life stages. None of the patients exhibited indwelling catheters, prematurity, or chronic renal disease as risk

factors for developing IE. Dhawan et al reported that 16.6% (n=6/37) of IE cases were associated with structurally normal hearts, with *S. aureus* being the most frequent causative organism.<sup>6</sup> Furthermore, an intriguing prospective study uncovered that the incidence of IE among children with *Staphylococcal bacteremia* could rise up to 20%.<sup>16</sup> This suggests that *Staphylococcal* infection itself might serve as a predisposing factor for IE. Consequently, vigilant suspicion for IE is recommended among pediatricians treating children with *Staphylococcal* infections. Conversely, it is advisable to actively seek out extracardiac sources of infection, such as pustules, osteomyelitis, and septic arthritis, among children diagnosed with *Staphylococcal* IE. Notably, the majority of our patients were affected by blood culture-negative IE (n=17, 48.6%). Nevertheless, this differs from findings in China, where this phenomenon usually accounts for 2.5 to 31% of IE cases.<sup>11</sup> The high rate of culture negativity was anticipated given that a significant proportion of enrolled patients had received antibiotics prior to admission. This aligns with findings from other studies.<sup>6-8</sup> Echocardiography findings and fever were consistent across all patients. Blood culture positivity was observed in 51.4%, a result similar to previously reported pediatric studies conducted in Bangladesh. Merely three patients fulfilled Duke's major microbiological criteria. While Duke's criteria have been validated for children, a recent study from the Cleveland clinic demonstrated a reported sensitivity and specificity of around 70%.<sup>19</sup> This sensitivity further diminishes in instances of culture-negative endocarditis. As predisposing cardiac conditions stand as a minor criterion for IE, the increasing prevalence of IE within structurally normal hearts could likely further reduce the sensitivity of Duke's criteria. The easy accessibility of over-the-counter antibiotics, coupled with a high rate of prior antibiotic use, as commonly observed in our setting, inevitably leads to elevated blood culture negativity rates and challenges in meeting Duke's microbiological criteria. Although rheumatological manifestations have been documented in 25-42% of adults with IE, exploration of this phenomenon in pediatric cases remains limited.<sup>20</sup> Within our cohort, four patients exhibited joint pain as presenting symptom of IE, even in absence of RHD. This underscores the importance of considering IE as potential differential diagnosis when fever is accompanied by joint involvement. Physicians should be mindful that rheumatological manifestations also fall within spectrum of IE presentations. Our in-hospital mortality rate of 17.1% aligns with figures reported in other Indian studies, yet significantly surpasses the rates documented in Western contexts, which range from 2% to 8%.<sup>5,6,8,14,20</sup> Deaths primarily resulted from complications like congestive cardiac failure and septic shock.

### Limitations

The major limitations of our study were the small number of patients and a lack of microbiological confirmation of the diagnosis of IE.

### CONCLUSION

Increasingly younger children are being diagnosed with IE and a significant number of them are in the setting of a structurally normal heart in Bangladesh. Most of the patient getting antibiotic before sending blood sample for culture and sensitivity. Even in blood culture-positive cases, most of the patients only fulfilled Duke's minor microbiological criteria. As this is a rare disease, multicenter studies may be needed to study a larger number of patients.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Munsi MAS, Akter M, Sayeed MA. Clinical profile of infective endocarditis: a single centre experience. *Int J Contemp Pediatr* 2023;10:1606-10.