

Investigating the Relationship Between Echocardiography and Infective Endocarditis in Rheumatic Heart Disease Patients

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Abstract

Background and Aim: There is a scarcity of Indian studies on infective endocarditis. Additionally, the majority of research has focused on the paediatric age group. The purpose of this study was to investigate the microorganisms responsible for infective endocarditis in patients with rheumatic heart disease in patients attending Medicine OPD of Smt NHL Municipal Medical College, Ahmedabad. Additionally, the study aimed to assess the effectiveness of medical treatment and evaluate the prognosis of the cases.

Material and Methods: Our study took place at the Department of General Medicine, a Smt. NHL Municipal Medical College, Ahmedabad, over the course of one year. We thoroughly investigated patients who were clinically suspected of having infective endocarditis. A study was conducted on 40 patients with Rheumatic heart disease who met the diagnostic criteria for infective endocarditis. A comprehensive set of medical tests were performed, including a complete hemogram, urinalysis specifically to check for microscopic haematuria, chest X-ray, and EGG. Prior to starting treatment, blood cultures were collected. A comprehensive M mode and 2 D echocardiographic examination was conducted for all individuals suspected of having the condition, with additional TEE performed for cases that required further clarification.

Results: A significant number of patients presented with a combination of mitral and aortic valve lesions. The most frequently observed combined lesions in our patients were mitral and aortic regurgitation. The patients included in our study experienced mild to moderate grade fever. At the time of admission, nineteen patients in the study group had a leukocyte count exceeding 10,000 cells per cubic millimetre. The majority of patients in the study group exhibited elevated ESR levels. Out of the total 40 patients, 11 had a positive blood culture (27.5%). Surprisingly, in 29 patients, the blood culture remained negative even after multiple sample collections and a seven-day incubation period. Most patients initially received a standard recommended dose of injection Penicillin G and Gentamicin on an empirical basis. However, as per the sensitivity pattern, appropriate antibiotics were administered thereafter.

Conclusion: Treatment of endocarditis was more successful when suitable antibiotics were started after culture and sensitivity rather than the empirical treatment.

Key Words: Aortic Regurgitation, Echocardiography, Endocarditis, Rheumatic Heart Disease

Introduction

Infective endocarditis (IE) is a serious infection that affects the cardiac valves or mural endocardium. It is caused by bacteria and fungi, which can lead to a range of systemic signs and symptoms. These can occur through different mechanisms, including the formation of both sterile and infected emboli, as well as various immunological phenomena. The modified Dukes' diagnostic criteria are commonly used to define cases of definite or possible IE.¹ It is characterized by significant toxicity and gradually develops over a period of days to weeks, resulting in valve damage and the spread of infection. This type of infective endocarditis, which is typically caused by certain types of bacteria, develops gradually over a period of weeks to months. It generally does not cause severe illness and rarely spreads to other parts of the body.² This complication is a significant concern for individuals with rheumatic valvular heart disease.

Recent studies conducted in developed countries have revealed a shift in the patterns of infective endocarditis. This change can be attributed to various factors such as improved diagnostic capabilities, longer life expectancy among patients with valvular diseases, more aggressive surgical interventions, the emergence of new risk groups for infective endocarditis (including intravenous drug abusers, individuals with prosthetic heart valves, and those with

nosocomial bacteremia), and a decrease in the incidence of rheumatic heart disease.^{3,4} Echocardiography has significantly enhanced the diagnostic accuracy for confirming or ruling out infective endocarditis.⁵ Vegetative lesions can be detected, which is an important finding to consider. Echocardiography is crucial in identifying complications of endocarditis, such as perivalvular abscesses, aneurysms, fistulas, valvular leaflet rupture, chordae and papillary muscle damage, or interventricular septum issues.

There is a scarcity of Indian studies on infective endocarditis. Additionally, the majority of research has focused on the paediatric age group. The data from Indian studies vary from that of most western countries in several aspects. These include the population at risk for infective endocarditis, the incidence of rheumatic heart disease, the availability of transesophageal echocardiography and other diagnostic facilities, as well as emergency facilities for surgical correction, among others. More research is needed to better understand infective endocarditis in India.

Material and Methods

Present cross-sectional; study was conducted at the Department of General Medicine, Smt. NHL Municipal Medical College, Ahmedabad, Gujarat for the duration of 1 year in patients of clinically suspected of having infective endocarditis were thoroughly investigated. Those cases of rheumatic heart disease, labeled as having infective endocarditis has been taken for further study. The study was done on 40 selected patients of Rheumatic heart disease, fulfilling the diagnostic criteria for infective endocarditis. Diagnostic criteria proposed by DUKE university was applied for the study.⁶

A complete clinical history and physical examination along with special attention to predisposing factors and complication were taken according to the points as per Performa. A complete hemogram, urinalysis especially for microscopic hematuria, chest X-ray and EGG

was undertaken routinely. Before initiation of therapy blood cultures were taken. A detailed M mode and 2 D echocardiographic study was performed in all suspected cases, and doubtful cases underwent TEE. Further investigations were done to document and confirm complications wherever it was indicated. Informed consents were taken from all the patients and the ethics committee approval was obtained prior to study initiation.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2019) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were described as means and standard deviations or median and interquartile range based on their distribution. Qualitative variables were presented as count and percentages. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

A study has identified 40 cases of Rheumatic heart disease that meet the diagnostic criteria for infective endocarditis. The age range of the patients included in the study spanned from 10 to 50 years, with a majority falling within the 10–20-year age group. A significant number of patients presented with a combination of mitral and aortic valve lesions. The most frequent combined lesions observed in our patients were mitral and aortic regurgitation, accounting for 25% of cases.

All patients in our study experienced mild to moderate grade fever (100%). Upon examination, nearly all patients exhibited pallor. There were 8 patients experiencing altered sensorium, some of whom also had focal neurological deficits. A cardiac murmur was detected in all of the patients. A total of fourteen patients, accounting for 35% of the group, experienced congestive heart failure. Clubbing was observed in fourteen patients (35%),

which is a common peripheral sign of infective endocarditis. No other signs, such as Osler's node, Janeway lesion, or Roth's spots, were observed in any of the patients. In the study group, 18 patients had an enlarged spleen (Table 1).

All 40 cases in the study had below-normal levels of hemoglobin, with 4 patients experiencing severe anemia with hemoglobin levels below 7gm/dl. According to Table 2, nineteen patients in the study group had a leukocyte count exceeding 10,000 cells per cubic millimeter upon admission. The study group showed a high number of patients with elevated ESR levels, with 38 individuals affected. Out of all the patients, only six displayed signs of microscopic haematuria. Out of all 40 patients, 11 tested positive for blood culture (27.5%). Interestingly, despite repeated collection of samples and a seven-day incubation period, blood culture was negative in 29 patients (Table 2). *Staphylococcus aureus* was the most frequently detected organism, found in 5 out of 40 blood samples from patients. In three samples, *Staphylococcus aureus* showed sensitivity to aminoglycosides, while it was resistant in two samples. All 4 patients showed resistance to penicillin G when it came to *Staphylococcus aureus*. Two commonly used antibiotics are Oxacillin and Vancomycin. Three patients' blood cultures were found to have grown *Streptococcus viridans*. The bacteria showed sensitivity to penicillin G and aminoglycosides. Vegetations were found on echocardiography in 38 out of 40 patients. The aortic valve was the most commonly involved valve, affecting 24 patients (60%). Eleven patients (27.5%) had involvement of the mitral valve. Many patients have vegetations on AML. Vegetation was found in both the mitral and aortic valves of two patients.

Treatment was initiated based on empirical evidence in all patients following the submission of 5 blood samples for blood culture. For the treatment, the patients were given injections of Penicillin G in 12 to 18 million IU, divided into 6 doses. Additionally, they received

injections of gentamicin in 3 to 5mg/kg/day, divided into 3 doses. This treatment was administered to 32 patients, which accounted for 80% of the total. Fourteen patients successfully responded to the treatment, becoming afebrile within just 8 days. The treatment was administered for a duration of only 2 weeks. After 10 days of treatment, eight patients in the study were no longer experiencing a fever. To ensure complete recovery, they were prescribed an additional 2 weeks of penicillin G injections, resulting in a total treatment duration of 4 weeks. Eight patients (20%) were administered ceftriaxone injections of 2gm IV OD. The mortality rate was notably high, with causes of death including septicaemia, refractory heart failure, acute renal failure, and arrhythmia/sudden death.

Table 1: Relative incidences of different clinical features and complications in patients presenting with infective endocarditis

Symptoms	Number	Percentage (%)
Fever	40	100
Malaise	28	70
Anorexia	3	7.5
Oedema	33	82.5
Arthralgia	5	12.5
Myalgia	5	12.5
Altered sensorium	9	22.5
Oliguria/ anuria	8	20
Breathlessness	16	40
Signs		
Fever	40	100
Altered sensorium	8	20
Pallor	40	100
Clubbing	14	35
Pedal edema	8	20

Lymphadenopath	6	15
JVP (raised)	14	35
Murmurs	40	100
Splenomegaly	18	45
Petechiae	2	5
Peripheral emboli	8	20
Complications		
Refractory heart failure	9	22.5
Cerebro vascular accidents	6	15
Acute renal failure	7	17.5
Peripheral arterial embolism	7	17.5
Septicemia	5	12.5
Upper GI bleeding	2	5

Table 2: Different investigations in patients presenting with infective endocarditis

Variables	Number	Percentage (%)
Hb% (mg/dl)		
Normal >14	0	0
Mild Anaemia 11-14	16	40
Moderate anaemia 7-10	20	50
Severe anaemia <7	4	10
Total leucocyte count		
<10,000 cells/mm ³	19	47.5
Blood culture positivity		
Positive (+ve)	11	27.5
Negative (-ve)	29	72.5
Vegetations on echocardiography		

Aortic	24	60
RCC	18	45
NCC	3	7.5
Both RCC and NCC	3	7.5
Mitral	11	27.5
AML	10	25
PML	2	5
Both aortic and mitral	2	5

Discussion

IE is a rare disease that doesn't occur frequently, but it is still a significant concern in the field of modern medicine. Diagnosing IE requires a keen sense of suspicion, and treating it involves a comprehensive approach. There has been a belief that the occurrence of IE has risen in recent years, but there is a lack of current population-based data to substantiate this claim. There have been only a limited number of studies conducted on the profile of patients with IE in the Western India region over the past decade.^{7,8} In patients from FNQ with RHD, the incidence of native valve IE was extremely low at 0.7 cases per 1000 patient-years of risk. The majority of IE cases were found in patients with prosthetic heart valves. In addition, it is worth noting that despite the serious outlook for IE, especially in cases of prosthetic valve IE, there were no fatalities from IE within the study group during the designated period.

The age range in this study spanned from 10 to 45 years, with the highest number of patients falling between the ages of 10 and 20. The average age recorded was 25 years. According to our study, there were 32 male patients and 8 female patients. This figure aligns with findings from other studies conducted in India.⁹

In the present study, it was found that 32% of cases had lone involvement of the aortic valve, while 48% of cases had combined involvement of both the aortic and mitral valves. In 25% of cases, a solitary mitral valve lesion was observed. These findings align with studies conducted in both India and the Western world.^{6,8} Tricuspid valve involvement and pulmonary valve issues are both uncommon, as indicated by several studies. In our study, the tricuspid valve was found to be involved in 4% of the cases, often in conjunction with a mitral valve lesion. No instances of isolated tricuspid valve involvement were found in our study.

Only 20% of cases had a detected source of infection in this study, which aligns with findings from other researchers.¹⁰ Our study found that 45% of the patients had already been diagnosed with rheumatic heart disease, while only 20% were receiving long-acting penicillin prophylaxis. It appears that our patients are not following the prescribed guidelines.

Fever is a common symptom of infective endocarditis. All patients in our study experienced mild to moderate grade fever. Infective endocarditis often presents with a common finding of moderate normocytic normochromic anemia. All patients in our study exhibited pallor. This is in accordance with various Indian studies.^{8,9} On the other hand, the occurrence of anemia in western series showed a wide range of 34-91%. It is likely that the high prevalence of anemia among Indians can be attributed to inadequate nutrition and delayed medical attention. Out of the total number of patients, 18 individuals (45%) had an enlarged spleen, as observed in the current study. It has been observed to happen in 36-60% of patients in India. Clubbing was observed in 14 patients (36%) as a peripheral sign of IE. The occurrence of clubbing in Indian studies ranges from 32-80%. Currently, only 10-20% of cases in the west are associated with clubbing. Clubbing is frequently observed in Indian studies due to the delayed presentation of patients. In our study, two patients experienced petechial

haemorrhage, accounting for 5% of the cases. Several studies have indicated that these findings of IE are not very common.^{10,11,12}

When examining the culture positivity of cases of IE, it becomes apparent that Indian studies tend to underreport the definitive microbial cause compared to Western literature. For instance, Subramanian et al., Math et al., and Garg et al. reported culture positivity rates of 23%, 41%, and 67% respectively. In contrast, the European heart survey found that a much higher percentage, 86% to be exact, of their patients had culture positive endocarditis.^{13,14}

In the present study, it was found that all patients had low levels of Haemoglobin, with 90% of them experiencing mild to moderate anemia. This finding aligns with the results of several studies conducted in India. The occurrence of leucocytosis ranges from 39-58% in different studies.¹⁵ Leucocytosis was observed in 47.5% of the patients in our study. The majority of cases involved acute IE with a history of less than 4 weeks. In the present study, it was found that 92% of patients had elevated ESR levels. Studies have found that the percentage of patients with elevated ESR levels can vary from 72% to 100%.^{1,2,10} Microscopic haematuria was found in 16% of the patients in this study. There have been similar occurrences observed in various Indian series. There has been an increase in cases reported from the western region.

According to the study, blood culture was found to be positive in 27.5% of cases. Interestingly, in Indian studies, the positivity rate of blood culture has been reported to range from 21% to 97%. In western series culture, positivity levels range from 73% to 97%. The study found that *Staphylococcus aureus* was the most commonly isolated organism, accounting for 12% of cases. *Streptococcus viridans* was found in 8% of cases, while coagulase negative *Staphylococcus* and *Acinetobacter* were each isolated from one case. The

results in these studies differ from those of various western studies, but they align with some of the Indian studies.¹⁶

The study revealed a significant mortality rate associated with staphylococcal infective endocarditis. One of the main reasons for mortality is the lack of access to surgical facilities, coupled with the financial challenges faced by our patients who are unable to afford the high cost of cardiac surgery. This surgery could potentially save the lives of patients suffering from severe heart failure and uncontrolled sepsis. Recent studies indicate that timely surgical interventions can significantly reduce mortality rates to 10-13%.

There were certain limitations to this study. All patients diagnosed with IE were included in the study, regardless of whether they were primary or referral cases. Interestingly, the study did not find a single case of endocarditis of a prosthetic valve.

Conclusion

The average age of our patients remains lower compared to the western part of the world. The most common presentation includes fever and constitutional symptoms. It is quite common to experience mild to moderate anaemia, leucocytosis, and a high ESR. In our study, Staphylococcus was found to be the most common cause of infection. Effective treatment of endocarditis is more likely when appropriate antibiotics are prescribed based on culture and sensitivity testing, rather than relying on empirical treatment. It is crucial to recognise the seriousness of the illness and initiate early treatment to improve outcomes in these cases, as previously discussed.

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