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A Clinico-Bacteriological profile of Infective Endocarditis in a Tertiary Care Medical College Hospital in Tamil Nadu

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ABSTRACT

Background: Infective endocarditis is a vascular-associated infectious disease that affects the vascular endothelium outer layer of the heart, intravascular as well as a prostheses control valve. Infective endocarditis (IE) is a widespread infectious disease that necessitates the collaboration of an interdisciplinary approach to cure fatal infections. IE is a rapidly evolving disease with a significant death and morbidity rate. The incidence rate of IE in advanced nations ranges from 1.7 to 6.2 for every 100,000 people.

Aims and Objectives: This study intends to evaluate the demographics, clinical features, microbiological status, echocardiographic results and outcomes of the various treatment among the patients of Infective Endocarditis who were admitted to the tertiary care hospital in Tamil Nadu.

Methods: A retrospective study was conducted on patients with IE was performed by collecting various required data demographic, clinical features, echocardiographic, treatment and outcomes data. The data was evaluated and studied accordingly based on the types of endocarditis (native valve

endocarditis or prosthetic valve endocarditis), cultures (positive or negative), etc.

Results: The study found that all the PVE cases were community-acquired. The study has shown that 89% of the patients but absent in 11% of them. Before hospital admission, fevers lasted between 30 and 90 days in 31%, over 90 days in 47% of patients, and over 90 days in 11% of patients. 34% of patients reported weight loss and 19% of patients with neurological problems (focal deficits and headache). In

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12% of patients, who presented with IE, there was evidence of a distant abscess, past bacteremia, or septic foci, and 4% of patients had undergone a previous dental operation. Diabetes mellitus (14%), chronic renal disease (11%), decompensated chronic liver disease (4%), and exposure to steroids or other cytotoxic drugs (6%), among other co-morbidities, were all significant ($p<0.05$). NVE shows high culture-positive cases (88.3%) than PVE (11.7%). Dead cases are 13.3% in culture-positive and 15% in culture-negative.

Conclusion: The study concluded that rheumatic heart disease was the main risk factor. Hospital-acquired IE is also on the rise and trans-oesophagal echo (TEE) is a crucial diagnostic technique with exceptional sensitivity for finding vegetation.

Keywords: infective endocarditis, culture positive, rheumatic disease, bacteriological profile

INTRODUCTION

Infective endocarditis is a vascular-associated infectious disease that affects the vascular endothelium outer layer of the heart, intravascular as well as prostheses control valve, as well as intra-cardiac devices like implantable devices (pacemakers). Classification of IE can be based on the location of the vegetation as well as the valve associated, the existence or absence of intra-cardiac equipment as well as prosthetic control valve, as well as the method of acquirement (nosocomial, intravenous drug utilize associated) [1]. Even with the good treatment and prevention facilities in underdeveloped countries, infectious endocarditis remains a severe problem to obstinately significant death in addition to morbidity [2].

Infective endocarditis (IE) is an uncommon infection caused. Abnormalities such as heart failure as well as vegetation pulmonary emboli towards the brain and other internal organs can be fatal. Despite the advances in diagnostic testing, surgical and medical therapy, physicians face issues due to disease presentation variability, and the death rate keeps rising. In-hospital mortality is approximately 15-20% [3,4], including one-year mortality of approximately 40% [4-6]. Early detection, antibiotic therapy, or surgeries are all required.

Infective endocarditis (IE) is a widespread infectious disease that necessitates the collaboration of an interdisciplinary approach to cure fatal infections [7-11]. In preceding decades, the incidence rate of IE in the advanced world's general populations varied widely from between three and ten instances for every 100,000

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individuals each year. Recent studies in epidemiology nevertheless, indicate that the prevalence of IE is rising [12]. Notwithstanding the developments in accurate detection as well as surgical treatment in IE patient populations in the twenty-first century, in-hospital death rates have not improved in the last three decades [8, 9, and 12].

Despite medical and surgical advances, IE is related to an elevated death rate of around 20% in developed countries [9-11]. IE mortality ranges from 19 to 46% in small as well as medium-revenue nations [14]. The morbidity in addition to death rates of IE in these countries is comparable towards individuals stated in North America besides Europe in the mid-20^{th} span [11,12].

IE is a rapidly evolving disease with a significant death and morbidity rate. The incidence rate of IE in advanced nations ranges from 1.7 to 6.2 for every 100,000 people. However, it appears to be about 14.5 for every 100,000 people annually in India [1, 13]. One of the most difficult aspects of trying to treat Infective Endocarditis is that the disease's demographic trends, both in terms of patient profile and microbiology, are changing. The evolution of IE diagnosis and management over the last five decades has revealed consistent modifications in the clinical spectral range, etiological organism profiles, as well as diagnosis, as well as substantial regional different versions in risk variables. And over 50 % of patients with IE occurrences in advanced nations have a normal heart control valve, whereas rheumatic cardiac illness affects only 10% of the overall people with IE [14]. RHD, on the other hand, is still the most prevalent genetically predisposed situation in India.

Separation of pathogenic microorganisms from serum samples is essential for treatment planning and diagnosis but blood cultures in India only yield up to 40% positivity. When compared to Western countries, this figure is 80% [14]. In recent times, there has been a rise in the prevalence of IV drug addiction, better as well as earlier identification of congenital heart defects, debilitating cardiovascular disease, technical progress in echocardiograms such as Trans Esophageal Echo [TEE], and a rise in the prevalence of health care-associated infections, all of which may change the medical and microbiological portfolio. Many studies in Western countries have unveiled as well as disclosed the major shift of IE in their respective areas, but these research findings on IE in India, especially in South India, are rare [13].

Information on the microbiological and clinical characteristics of IE is still scarce in India. The presence of new adverse outcomes including hospital treatment as well as

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device implantation must have altered the prevalence and incidence of the illness in the Western countries, whereas the scenario seems to be more complex and difficult in India and other developing countries due to such concurrent liability of rheumatic heart disease as well as congenital abnormalities [12-14].

Just several types of research have been carried out in India to try to define the clinical features of IE; the goal of this study was to characterize the clinical features of IE in a solitary institute in India as well as to recognize hazards connected including in-hospital mortality.

MATERIALS AND METHODS

Study Design

A retrospective study was conducted on patients with infective endocarditis (IE) who came to the outpatient department of Karpagam faculty of Medical Sciences and Research,Coimbatore,Tamil Nadu from October 2021 to October 2022. For the classification of IE, the modified Duke criteria were applied. The study considered 100 patients. By reviewing charts, the following data regarding demographic information, clinical features, risk factors, and history of heart disease, as well as laboratory and microbiological results, echocardiographic results, medicinal or surgical treatments, side effects, and outcomes, were collected.

Along with valve involvement (mitral, aortic, tricuspid, or many), side of involvement (left, right, or bilateral), and if native valve endocarditis (NVE) or prosthetic valve endocarditis (PVE) was present, cases were also categorized. PVE was classified as either early or late depending on whether the infection was discovered within a year of the valve replacement or afterwards.

The existence of valvular insufficiency, transthoracic or transesophageal inclusion of the oesophageal orifice, presence, location, mobility of vegetation, and electrocardiographic findings were all noted.

Inclusion and Exclusion criteria

Patients who came to the outpatient department of our hospital who follow the study protocol and give informed consent for the study are included. Patients who provide informed consent for the study are included in the study.

Patients who did not follow the study protocol did not finish it, or did not provide consent were not included in the study. Patients with other chronic conditions like

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kidney disorders or chronic pancreatitis were excluded.

After applying inclusion and exclusion criteria, the study considered 100 patients.

Statistical analysis

All category variables were examined using numeric coefficients (percentage). All continuous variables were expressed as a single mean standard deviation. A continuous variable comparison was carried out using an independent "t" test. For comparing categorical variables, the Fisher exact test or the Chi-square test was used. Statistical significance was defined as p 0.05. Microsoft Excel was used to collect data and enter it into a database. Version 16.0 of SPSS for Windows was used for the statistical analysis.

Ethical approval

The patients were given a thorough explanation of the study by the authors. The patients' permissions were obtained. The concerned hospital's ethical committee has accepted the study's methodology.

RESULTS

100 confirmed case of IE was examined in all. The demographic information for patients with NVE and PVE is summarized in Table 1. There were 27 women and 73 men, and their combined ages ranged from 54 to 14 years. There was a significant difference between the way of infection contact.

Table 1: Demographic characteristics of patients with definite IE based on NVE and PVE and also on the whole sample

Parameters	**Total = 100**	**NVE =85**	**PVE = 15**	***p*-value**
Age (years)				
Mean	54 ± 14	53 ± 14	58 ± 14	0.257
Median	56	55	61	
Mode	61	49	67	
Range (years)	17-78	17-78	31-76	
Gender distribution				

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Male	73 (73%)	60 (70.5%)	12 (80%)	0.391
Female	27 (27%)	25 (29.4%)	3 (20%)	
Male: Female	2.7: 1	2.4: 1	4: 1	
Infection presence				
Prior IE	6 (6%)	2 (2.3%)	4 (26.6%)	0.002
Type of infection based on place of contact				
Community-acquired	72 (72%)	58 (68.2%)	15 (100%)	0.03
Hospital-acquired	28 (28%)	28 (32.9%)	0	0.02

Table 2 shows that the most prevalent symptom was fever, which was present in 89 (89%) of the patients but absent in 11 (11%) of them. Before hospital admission, fevers lasted between 30 and 90 days in 31 (31%), over 90 days in 47 (47%) patients, and over 90 days in 11 (11%) patients. 34 (34%) patients reported weight loss and 19 (19%) patients with neurological problems (focal deficits and headache). A total of 56% of patients had anaemia (Hb 10 g/dL; mean Hb 9.8 1.9), and 47% of patients exhibited leucocytosis (mean TLC 12.4 6.7). 19 patients (19%) experienced cerebral vascular embolic symptoms, while 21 (21%) experienced another organ or peripheral embolism. Congestive cardiac failure (CCF) was detected in 13 (13%) patients, while multi-organ dysfunction syndrome was found in 6 (6%) patients (MODS).

In 72 (72%) cases, IE was categorized as community-acquired, and in 28 (28%) cases, it was associated with healthcare. Hemodialysis, which contributed to 8% of cases, recent surgery, which involved urological instrumentation with urosepsis, and gastrointestinal operations, which contributed to 6% of cases, were predisposing factors. In 2% of patients, postpartum IE (observed within 1 month of delivery) was seen. In 12% of patients, who presented with IE, there was evidence of a distant abscess, past bacteremia, or septic foci, and 4% of patients had undergone a previous dental operation. Diabetes mellitus (14%), chronic renal disease (11%), decompensated chronic liver disease (4%), and exposure to steroids or other cytotoxic drugs (6%), among other co-morbidities, were all significant ($p<0.05$).

Sixteen (16%) of the patients had bicuspid aortic valve, 11 (11%) had mitral valve prolapse, and 16 (16%) had rheumatic heart disease (RHD). 13 (13%) patients with no valvular abnormalities experienced IE. Six patients (2 with NVE and four with PVE)

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had prior IE.

The study has shown that 85 people had NVE, while 15 patients had PVE. There were 91 (91%) cases of left-sided IE, 6 (6%) cases of right-sided IE, and 3 (3%) cases of bilateral involvement. 40 (40%) of the instances involved the aortic valve, 42 (42%), the mitral, 6 (6%) the tricuspid, and 14 (14%), numerous valves. Three PVE patients showed signs of valvular dehiscence. PVE had a higher rate of paravalvular abscess than NVE [2/13 (15%) vs. 3/92 (3%)]. 18 (18%) NVE had valve perforations that were discovered.

Table 2: Features and findings in the whole sample of this study

Variables	**No: of patients (%)**
Clinical features and lab findings	
Fever	
≤30 days	47 (47%)
>30 and ≤90 days	31 (31%)
> 90 days	11 (11%)
Anaemia (Hb ≤10 gm/dl)	56 (56%)
Weight loss	34 (34%)
Leucocytosis (WBC ≥11,000/cmm)	47 (47%)
Neurological symptoms	19 (19%)
Underlying cardiac condition	
Congenital heart disease	8 (8%)
Rheumatic heart disease	16 (16%)
Ventricular septal defect	3 (3%)
Mitral valve prolapse with mitral regurgitation	11 (11%)
Bicuspid aortic valve	6 (6%)
Degenerative aortic valve disease	4 (4%)
Other valvular abnormalities	9 (9%)

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Prior innfective endocarditis	6 (6%)
Prosthetic valve	14 (14%)
Predisposing conditions	
Postpartum	2 (2%)
Dialysis	8 (8%)
Dental procedure	4 (4%)
abscess/ septic foci/ bacteremia	12 (12%)
Recent surgical intervention	6 (6%)
Co-morbidities	
Chronic kidney disease (CKD)	11 (11%)
Diabetes mellitus	14 (14%)
Immunosuooressed (non-HIV)	6 (6%)
Chronic liver disease (CLD)	4 (4%)
Complications	
Multi-organ dysfunction syndrome	6 (6%)
Congestive cardiac failure	13 (13%)
Embolic manifestations	
Splenic infarct	6 (6%)
CNS emboli/ intracranial haemorrhage	19 (19%)
peripheral/ septic	9 (9%)
renal/ glomerulonephritis	6 (6%)
Echocardiography findings	
Side of cardiac valve involvement	
Right	6 (6%)
Left	91 (91%)

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Both	3 (3%)
Valve involvement	
Mitral valve (MV)	42 (42%)
Tricuspid valve (TV)	6 (6%)
Aortic valve (AV)	40 (40%)
Multiple (more than 1)	14 (14%)
MV + TV	1 (1%)
MV + AV	9 (9%)
MV + pulmonary valve (PV)	1 (1%)
AV + TV	2 (2%)
MV + AV + PV	1 (1%)
Number of vegetations	
Multiple	41 (41%)
Single	59 (59%)

Table 3 shows that the total number of patients with culture-positive is 60 and culture negative 40. NVE shows high culture-positive cases (88.3%) than PVE (11.7%). Dead cases are 13.3% in culture-positive and 15% in culture-negative. 2 patients have prior IE in NVE and 4 in PVE. congestive cardiac failure is seen higher (10) in NVE. 78% underwent medical therapy alone in NVE and 53% in PVE.

Table 3: Comparison of culture positive and negative; comparison of NVE and PVE

Findings of the cultures			
Parameters	**Culture Positive N= 58 (%)**	**Culture Negative N= 30 (%)**	**p-value**
Total number of patients	60 (60%)	40 (40%)	
Native valve IE	53 (88.3%)	33 (82.5%)	0.308
Prosthetic valve IE	7 (11.7%)	8 (20%)	

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Prior antibiotics	17 (28.3%)	24 (60%)	0.0002
Improved	52 (86.7%)	32 (80%)	0.553
Dead	8 (13.3%)	6 (15%)	
Comparison between Native Valve Endocarditis (NVE) and Prosthetic Valve Endocarditis (PVE)			
Parameters	**Native N=85**	**Prosthetic N=15**	**p-value**
Mean age (years)	52 ± 14	58 ± 14	
Male: female	2.4: 1	4: 1	
Prior IE	2	4	
Embolisms	35	5	**0.98**
Congestive cardiac failure	10	3	**1.001**
Culture negative	33	8	**0.045**
Culture positive	53	7	
Prior antibiotics	37	4	
Medical therapy alone	78 (78%)	53 (53%)	
Valve surgery	26 (26%)	23 (23%)	**0.41**
Dead	9	5	**0.045**
Improved	70	14	
Hospital-acquired	28 (32.9%)	0	**0.02**
Community-acquired	58 (68.2%)	15 (100%)	**0.03**

In 40 (40%) of the cases, 60% of which had taken antibiotics previous to admission, blood cultures were negative. *E. coli* makes up 5% of the culture, and other gram-positive bacteria make up 7% (Fig. 1).

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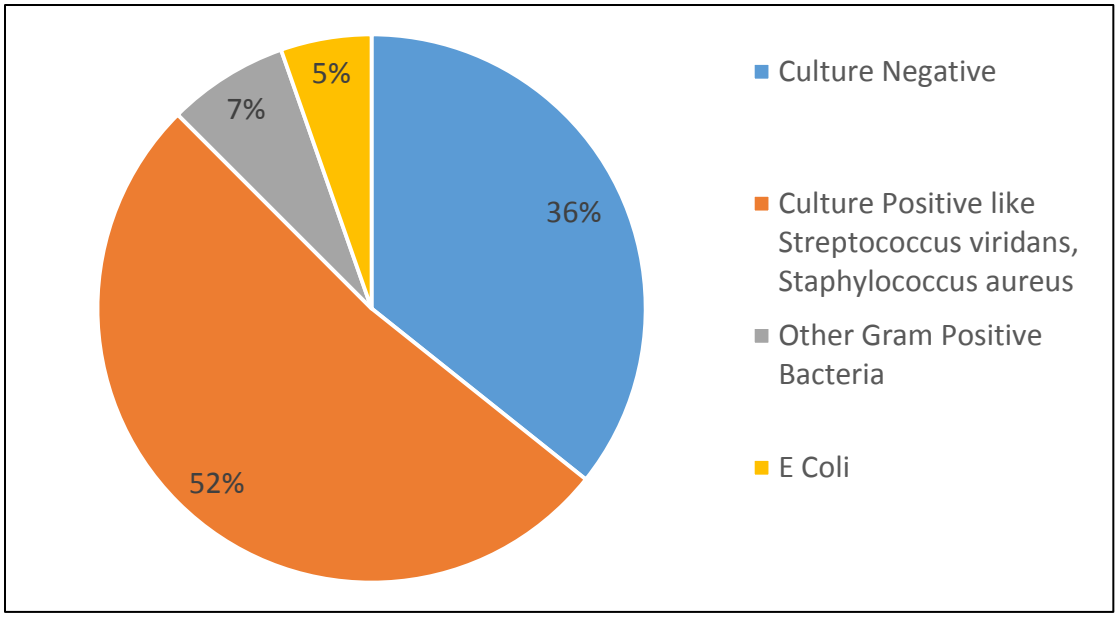

Figure 1: Distribution of microbiological findings among the whole sample

75% of the patients underwent medical therapy, 26% underwent surgical intervention, and a total of 11% are dead. 13.3% of all deaths occurred in hospitals. Compared to NVE, PVE had a higher mortality rate (Fig. 2).

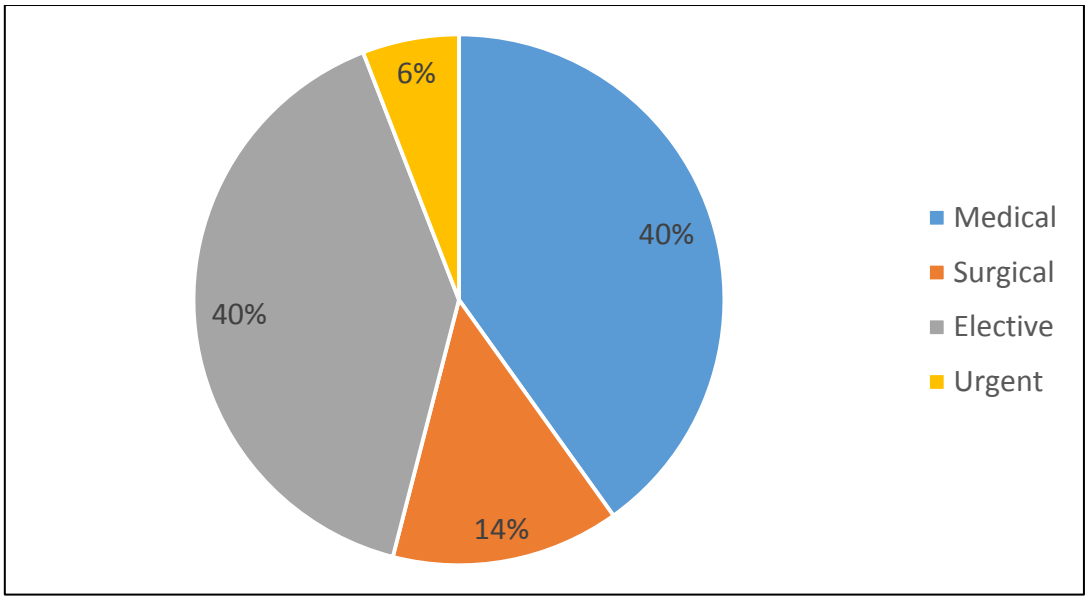

Figure 2: Distribution of Treatments (Interventions) as received by the study sample

96% of the time, transthoracic echo TEE found vegetation. TEE was found to be more cost-effective than TTE in individuals with high pre-test probabilities of IE, according to a study by Heidenreich19 et al. Due to a high index of suspicion of IE in our study,

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7 patients received solely TEE without TTE, and all of them displayed vegetation. All patients with a poor transthoracic window and those with negative TTE but a strong suspicion of IE should have TEE. A TEE that is initially non-diagnostic does not rule out the possibility of IE, and if the clinical index of suspicion is still high after 3 to 5 days, a repeat study is advised. After one week, three patients had a second TEE, which confirmed the presence of vegetation.

DISCUSSION

To determine health risks for in-hospital death rates, Ma et al. (2020) reported and researched clinical characteristics and outcomes of infective endocarditis once at a public hospital in China. The study would include 381 patients in total. The patients were 46 years old on average, with 66.9% being male. Community-acquired infective endocarditis emerged as the most commonly used type, and the most common pathogen was still Viridians Group Streptococci (37.5%). The bacteriological etiology of infective endocarditis differed depending on where it was acquired. Infective endocarditis was culture-negative in 97 (25.5%) of the patients. Vegetation was found in 85% of the patients, with the mitral valve being the furthermost commonly complicated valve. Surgery was executed on 72.7% of patient populations; in addition to the in-hospital death, the frequency was 8.4%. In-hospital risk of death was associated with age over 70, cardiac fault, stroke, as well as treatment. Related to age, cardiovascular disease, stroke, as well as treatment were all linked to an increase in in-hospital mortality. In China, infective endocarditis was primarily instigated through Viridians Group Streptococci, with young patients in addition to a subordinate death frequency [15].

Damasco et al. (2019) investigated and reported epidemiological as well as scientific statistics from 73 IE cases in Rio de Janeiro, Brazil. Information from the eight-year investigation as well as 73 IE occurrences (70 patients) indicated an average age of 46 years and a male patient population of 65.7%. CAIE and HAIE were found in 32.9% and 67.1% of people, respectively. The most common microorganisms were *Staphylococcus aureus* (30.1%), and *Enterococcus spp.* (19.1%), in addition to *Streptococcus spp.* (15.0%). Fever (97.2%; mean 38.6 + 0.05°C) besides heart murmur (87.6%) were the relevant signals and symptoms. Plants were found in the mitral (41.1%) plus aortic (27.4%) valves. The cases had a 47.9% mortality rate. In conclusion, *S. aureus, Enterococcus spp.,* in addition to *Streptococcus spp.* were the

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foremost reasons for contamination in 73 cases of IE reported in our hospital in the Rio de Janeiro cosmopolitan range over the last eight years. In our country, *Enterococcus spp.* has also been acknowledged as a developing etiology agent of HAIE [16].

Madhumitha et al. (2018) investigated and reported on the evolving epidemiological data of the illness in a cohort of definite IE patients who were admitted to a tertiary care center. 145 cases of IE were identified between January 2010 and December 2015, with 120 certain cases of IE identified using the modified Dukes' standards [15,16].

In another study, the average age was 53 years; 15 years (range 18 to 79 years), with a 72% high prevalence rate. There have been 103 native valve disease cases as well as 17 prosthetic valve infections. IE has been categorized as community procured in 87 (72.5%) cases, while healthcare connected in 33 (27.5%). Current surgical treatment, and included urological measuring instruments for urosepsis as well as gastrointestinal processes in 5.8% of case scenarios, was a risk factor for 8.3% of healthcare-related events. In 1.7% of cases, postpartum IE occurred. Within the previous 3 months of presenting an IE, 8.3% of patients had a remote abscess, prior bacteraemia, or septic foci, and 3.3% had a prior dental procedure [13-16].

The preceding structural cardiovascular disease seems to have been prevalent in 47.5% of cases, with Rheumatic heart disease present in 15% (RHD). 29.4% of PVE patients had a previous story of infective endocarditis, compared to 1.9% of NVE patients. Blood cultures were negative in 50 (41.7%) of the cases, with antibiotics administered in 60% of the cases before admission. The culture was negative in nine of seventeen PVE patients (52.9%). Streptococcus sp was separated in 15.8% of the 70 (58.3% among all patient populations) cases with positive blood cultures, with Viridans group Streptococci (VGS) seen in the largest number of cases (13.3%), Staphylococcus sp (14.2%), methicillin-resistant staphylococcus in 3.3%, as well as Enterococcus sp in 13.3% [2,7,11].

8.3% of the patients had Gram-negative bacteraemia. Furthermore, ESBL E. coli accounted for 4% of with us culture confirmed samples, suggesting that this prevalent neighbourhood accumulated bacteraemia is complicated by improved resistance in E. coli. Tissue/valve cultures were positive in four patients who had undergone surgical procedures, three of whom had negative blood cultures. PVE had a 33% mortality rate compared to 10% for NVE. The far more typical cause of death in IE was chronic

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heart failure. But while rheumatic heart disease remains the most frequent cause of IE, degenerative heart disease and healthcare-associated IE is also on the rise [2-4, 15]. It is challenging to provide surgical outpatient care since many patients who are referred have significant complications from pathogenic pathogens. Many patients are frequently declared unfit for surgery due to additional comorbidities. The overall result is better if surgery is performed early, before cardiac tissue loss and the formation of CCF [11,13]. Although the mortality rate in individuals with prosthetic valve endocarditis was much higher, our mortality rates for IE were low and comparable to western data. Thought The most frequent predisposing factor is still rheumatic heart disease, degenerative heart illnesses and healthcare-related IE are also gradually rising. Antibiotic use before shipping blood cultures is still a major contributor to negative culture results. Even though ESBL E. coli made up a sizable minority, it could shed light on the evolving epidemiology and risk factors for Gram-negative endocarditis [14-16].

CONCLUSION

While the male predominance has not changed, the average age of patients with IE in India has. Although less frequently than in prior research, rheumatic heart disease is still the main risk factor, although degenerative heart illnesses and IE related to healthcare are also gradually rising. We discovered that TEE is a crucial diagnostic technique with exceptional sensitivity for finding vegetation. The rates of culture positivity were higher in our studies as compared to other past studies, although the administration of antibiotics before shipping blood cultures continues to be a key factor in culture negativity. The most prevalent pathogen is still viridans streptococci, although staphylococci are not far behind, and ESBL E. coli made up a sizeable portion of that group. Especially for patients with culture-negative conditions, the excised native or artificial valve should be transferred to the microbiology laboratory in saline for rapid culture.

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