SCIENTIFIC JOURNAL
CEREM-GO

DOI 10.37951/2675-5009.2025v6i18.189
ISSN 2675-5009
e26189
SCIENTIFIC ARTICLE - REVISION

DESCRIPTION OF CLINICAL CHARACTERISTICS, DIAGNOSTIC CRITERIA AND MANAGEMENT OF INFECTIOUS ENDOCARDITIS IN A TERTIARY HOSPITAL IN GOIÁS: AN 11-MONTH RETROSPECTIVE STUDY

GABRIELLA TORRANO CARVALHO PIMENTEL[1], LUCIANA FERNANDES BALESTRA[1,2], GIULLIANO GARDENGHI[3,4]

1. Hospital de Urgências de Goiás Dr. Valdemiro Cruz – Goiânia/GO, Brasil.
2. Hospital do Coração Anis Rassi – Goiânia/GO, Brasil.
3. Centro de Ensino e Treinamento da Clínica de Anestesia – Goiânia/GO, Brasil.
4. Hospital ENCORE – Aparecida de Goiânia/GO, Brasil.

ABSTRACT

Introduction: Infective endocarditis (IE) is a severe condition characterized by infection of the inner layer of the heart, particularly the heart valves, by microorganisms such as bacteria or fungi. It is essential to highlight the importance of preventing infective endocarditis, especially in at-risk patients. Objective: To analyze risk factors, diagnosis, and therapeutic approaches adopted in patients with IE admitted to a tertiary hospital in Goiás over a 11-month period. Methods: This was an observational, retrospective, and descriptive study conducted at a tertiary hospital in Goiás, reviewing medical records of patients hospitalized with infective endocarditis between May 2024 and March 2025, diagnosed according to the Modified Duke Criteria. Clinical, laboratory, electrocardiographic, radiographic, and echocardiographic data were analyzed, including vegetation characteristics and associated complications. Times to diagnosis, length of hospital stay, and, when applicable, surgery were recorded, as well as antimicrobial regimens and cardiac surgical interventions. Outcomes included hospital discharge, outpatient follow-up, or death, ensuring patient anonymity and adherence to ethical standards. Results: Among the nine patients evaluated with infective endocarditis, eight required the use of a central venous catheter during hospitalization. Transthoracic echocardiography identified vegetations in six cases, while transesophageal echocardiography was necessary in three. Most patients (7/9) were discharged, with two deaths recorded. Six presented positive blood cultures, predominantly caused by multidrug-resistant microorganisms, while three remained negative. Seven patients had vegetations larger than 10 mm, associated with higher risk of complications, and three fulfilled definitive Duke criteria. Conclusion: The study analyzed nine cases of infective endocarditis, highlighting the importance of the modified Duke criteria and complementary tests, such as echocardiography and blood cultures, for diagnostic confirmation. Prolonged antimicrobial therapy, guided by susceptibility testing, resulted in favorable clinical

outcomes in most patients, although limited access to cardiac surgery delayed the correction of severe lesions in some cases. Early detection, a multidisciplinary approach, and prompt outpatient follow-up proved essential to reducing complications and recurrences.

Keywords: Endocarditis Bacterial, Risk factors, Diagnosis, Treatment, Therapeutics, Echocardiography, Cardiovascular infections.

INTRODUCTION

Infective endocarditis (IE) is a severe condition characterized by infection of the inner lining of the heart, particularly the cardiac valves, caused by microorganisms such as bacteria or fungi. The disease develops through the colonization of damaged endothelial surfaces, where pathogens adhere and form vegetations composed of platelets, fibrin, inflammatory cells, and microbial colonies. IE may affect individuals with native valves as well as those with prosthetic valves, presenting distinct clinical features depending on the valve involved or the presence of intracardiac devices.[1]

The diagnosis of IE is challenging and requires the integration of clinical, laboratory, and imaging findings. The primary diagnostic tool is the modified Duke criteria[1], which are based on major criteria (such as positive blood cultures and evidence of endocardial involvement on echocardiography) and minor criteria (including fever, predisposing factors, and vascular phenomena). Transthoracic or transesophageal echocardiography is an essential modality for detecting vegetations, abscesses, or prosthetic valve dehiscence, and plays a crucial role in diagnostic confirmation.[2]

Risk factors for the development of IE include the presence of prosthetic heart valves, congenital heart disease, a history of prior endocarditis, use of intracardiac devices, hemodialysis, and intravenous drug use. Immunosuppressed patients or those with comorbidities such as cancer are also at increased risk. In addition, dental procedures in patients with pre-existing valvular disease may act as precipitating factors due to procedure-induced transient bacteremia.[3]

The therapeutic management of IE is complex and should be conducted by a multidisciplinary team. Empirical antibiotic therapy should be initiated promptly after blood cultures are obtained, with subsequent adjustment according to the identified etiologic agent and its antimicrobial susceptibility profile. Treatment duration typically ranges from four to six weeks, with the intravenous route preferred in most cases. Surgical intervention is indicated in situations such as heart failure, failure of medical therapy, infections caused by resistant microorganisms, or complications including embolic events and cardiac abscesses.[4]

Finally, the importance of IE prevention must be emphasized, particularly in high-risk patients. Antibiotic prophylaxis for dental procedures is recommended for selected high-risk groups in accordance with international guidelines. Careful follow-up, treatment adherence, infection control, and patient education regarding early signs and symptoms are essential measures to reduce the morbidity and mortality associated with IE.[5,6]

Therefore, the primary objective of this study was to describe the clinical characteristics, diagnostic criteria, and therapeutic management of patients with infective endocarditis admitted to a tertiary hospital in Goiás over an 11-month period. The specific objectives were to: identify the main clinical characteristics of patients diagnosed with IE; describe

the diagnostic methods used (laboratory tests, imaging studies, and clinical criteria); and evaluate the therapeutic approaches employed (antibiotic therapy, surgery, and clinical support) and their outcomes.

METHODS

Patients admitted to the Hospital de Urgências do Estado de Goiás (HUGO) between May 2024 and March 2025 (11 months) with a diagnosis of infective endocarditis (IE) were evaluated. This was an observational, retrospective, and descriptive study, conducted at a tertiary referral hospital in the state of Goiás, with data collected through medical record review of patients diagnosed with infective endocarditis.

Patients hospitalized between May 2024 and March 2025 who met clinical, laboratory, and echocardiographic criteria compatible with infective endocarditis according to the Modified Duke Criteria were included. Medical records of patients diagnosed with IE were reviewed with attention to clinical presentation, laboratory findings—including blood cultures—and transthoracic and/or transesophageal echocardiography, the latter used to characterize vegetations (size and site of attachment), associated valvular dysfunction, and ventricular function impairment.

Selected patients underwent clinical evaluation and routine complementary examinations, including a detailed medical history, complete physical examination, and laboratory tests such as complete blood count, renal function, electrolytes (sodium, potassium, magnesium), C-reactive protein, and serial blood cultures. In addition, a 12-lead electrocardiogram (ECG), chest radiography, and transthoracic and/or transesophageal echocardiography were performed to assess vegetation characteristics, valvular function, and associated complications.

The time to diagnosis of infective endocarditis was defined as the interval from hospital admission to clinical, laboratory, or imaging confirmation of the diagnosis. Length of hospital stay was calculated in days from admission to hospital discharge or death. In patients who underwent surgical treatment, the time between admission and surgery was recorded, as well as early postoperative complications, when available.

Therapeutic strategies were analyzed, including the antimicrobial regimen used, guided by culture results and antimicrobial susceptibility, and the indication for or performance of cardiac surgery. The outcomes evaluated were hospital discharge, outpatient follow-up, or death.

All information was obtained and organized from medical notes, diagnostic test results, and discharge summaries, with confidentiality and anonymity ensured in accordance with the ethical principles of clinical research.

The project complied with all ethical guidelines established by Resolution No. 466/2012 of the Brazilian National Health Council, ensuring data protection and research integrity. The study was approved by the Research Ethics Committee (CEP) under CAAE No. 92916525.6.0000.5075 (Appendix 1).

RESULTS

Of the nine patients analyzed, five were female and four were male. Regarding age, six patients were younger than 60 years and three were aged 60 years or older. Most patients were admitted for non-cardiological causes; only one patient was hospitalized due to initial

cardiological symptoms (dyspnea on minimal exertion, orthopnea, and lower-limb edema). The baseline characteristics of the sample are presented in Table 1.

The main reasons for hospital admission were neurological conditions, including subarachnoid hemorrhage, stroke, and brain abscess (3/9). Other causes included renal conditions (dialysis urgency and rupture of an arteriovenous fistula, in two patients), gastrointestinal bleeding (melena and hematochezia, in two patients), and polytrauma (one patient).

Among previous risk factors, the most notable were the use of a central venous catheter (CVC) or double-lumen catheter (DLC), skin infection (erysipelas), and a history of dental infection. Regarding underlying heart disease, heart failure with reduced ejection fraction (HFrEF), patent foramen ovale (PFO), and rheumatic valvular disease were identified.

Five patients had risk factors, three had pre-existing heart disease, and two presented both conditions. The most frequent risk factor was CVC use (5/9): two patients were on chronic hemodialysis, one had a DLC in the internal jugular vein prior to admission, and another underwent right internal jugular vein catheterization on the first day of hospitalization. Only one patient had a history of skin infection and one had a dental infection. Among the three patients with heart disease, each had a distinct condition (HFrEF, PFO, and mitral valve disease). Two patients had both risk factors and heart disease: one female patient with HFrEF, DLC use, and illicit drug use, and another with PFO, previous endocarditis, and dental infection. Only one patient had no identifiable risk factors or known heart disease.

Microbiological analysis identified five main bacterial pathogens: methicillin-resistant Staphylococcus aureus (MRSA), carbapenemase-producing Klebsiella pneumoniae (KPC), Acinetobacter baumannii, Enterococcus faecalis, and Staphylococcus epidermidis. Surgical samples from a brain abscess also yielded Aggregatibacter aphrophilus and Actinomyces georgiae.

Six patients had positive blood cultures, frequently involving multidrug-resistant organisms. Three patients had cultures positive for KPC, two for MRSA, one for Enterococcus faecalis, and one for Staphylococcus epidermidis (considered probable contamination). The patient with a brain abscess had negative blood cultures, but positive surgical cultures for Aggregatibacter aphrophilus and Actinomyces georgiae. Overall, three patients had persistently negative blood cultures, a situation commonly observed in a subset of infective endocarditis cases and one that complicates etiological diagnosis.

The first imaging modality suggestive of vegetation was transthoracic echocardiography (TTE) in seven patients, whereas in two patients, the initial diagnosis was established by transesophageal echocardiography (TEE). The mitral valve was the most frequently affected, followed by the aortic valve and the right atrium, with one case of multivalvular involvement. The tricuspid valve was affected in only one patient.

Seven patients had vegetations with an initial size greater than 10 mm, ranging from 13.1 mm to 33 × 6 mm, with a mean size of 20.5 mm. In two cases, the initial vegetation size was not described. During treatment, only one patient showed complete resolution of the vegetation; three exhibited partial reduction, without reaching sizes below 10 mm; one patient showed increase in vegetation size (comparison between TTE and TEE); and in two patients, no follow-up echocardiographic studies were performed, both of whom progressed to death.

According to the Modified Duke Criteria, six patients were classified as having definite infective endocarditis and three as possible infective endocarditis. All patients met a major

criterion due to imaging evidence of vegetation. Two patients fulfilled major criteria based on typical positive blood cultures and compatible imaging findings. The most frequent minor criteria were the presence of a cardiovascular device (CVC), positive blood cultures not meeting major criteria, fever, and valvular disease. Less frequent criteria included illicit drug use, previous endocarditis, congenital heart disease (PFO), brain abscess, and embolic stroke.

All patients initiated empirical antibiotic therapy during the period of clinical suspicion. After microbiological results became available, six patients received targeted therapy, while three remained on empirical therapy, one of whom had treatment guided by surgical culture results. A total of 11 different antibiotics were used, with ceftriaxone and ampicillin being the most common, as well as broad-spectrum agents such as vancomycin, linezolid, meropenem, and tigecycline.

Three patients had an indication for cardiac surgery due to vegetation size and valvular complications; however, only one patient (case 7) underwent surgery during hospitalization, with replacement of the mitral and aortic valves using biological prostheses. The remaining patients awaited elective surgery. One patient (case 6), with pulmonary arteriovenous malformation (AVM) and PFO, was referred for embolization after clinical treatment.

Regarding outcomes, three patients were discharged with cured endocarditis, two were discharged while awaiting elective cardiac surgery, and one was discharged for treatment of a non-cardiac condition. Two patients died (cases 8 and 9), both classified as possible infective endocarditis according to the Duke criteria.

Length of hospital stay exceeded four weeks in most cases (8/9), reflecting the complexity of clinical management, the need for prolonged antibiotic therapy, and multidisciplinary care. Only one patient had a hospital stay shorter than four weeks due to rapid progression to death.

In summary, the patient profile was predominantly women under 60 years of age, admitted for non-cardiological causes, with neurological manifestations being the most common. The primary risk factor was CVC use, and structural heart disease was present in three cases. Most patients had positive blood cultures, frequently involving KPC. TTE was the most commonly used diagnostic modality, with predominant involvement of the mitral valve and vegetations larger than 10 mm. Despite disease severity, most patients were discharged, although two patients died. The collected data are presented in Tables 2 and 3.

Table 1. Baseline characteristics of the study population

Patient	Sex*	Age	Date of Admission	Reason for Admission*	Risk Factor / Pre-existing Heart Disease	Blood Culture
1	F	< 60 years	05/13/2024	Subarachnoid hemorrhage	Risk factor present	Positive
2	M	≥ 60 years	08/23/2024	Embolic stroke	Risk factor present	Positive
3	M	< 60 years	07/09/2024	Polytrauma	Risk factor present	Positive

4	F	< 60 years	08/26/2024	Dialysis urgency	Risk factor present	Positive
5	F	< 60 years	10/31/2024	Rupture of arteriovenous fistula	Risk factor present + Pre-existing heart disease	Positive
6	M	< 60 years	09/25/2024	Brain abscess Nonspecific symptoms + gastrointestinal bleeding + persistent fever	Risk factor present + Pre-existing heart disease	Negative
7	F	< 60 years	03/01/2025		Absent	Negative
8	M	≥ 60 years	11/06/2024	Gastrointestinal bleedingI + acute kidney injury (AKI) + anemia + erysipelas + pulmonary infection	Risk factor present	Positive (suggestive of contamination)
9	F	< 60 years	jun/25	Cardiac decompensation	Pre-existing heart disease	Negative

*Sex (F – Female; M – Male); Reason for admission (GI – Gastrointestinal tract; AKI – Acute Kidney Injury).
Source: Authors, 2026

Table 2: Echocardiographic characteristics, Duke criteria, and time to diagnosis in patients with suspected or confirmed infective endocarditis

Patient	First examination showing an image suggestive of vegetation	Affected valve	Vegetation size	Duke criterion	Diagnosis	Time to diagnosis
1	ECOTE	Aortic	≥ 10 mm	Definite	Definite infective endocarditis	58 days

2	ECOTT	Mitral	≥ 10 mm	Definite	Definite infective endocarditis with embolic stroke and leaflet perforation	5 days
3	ECOTT	Right atrium	< 10 mm	Definite	Definite infective endocarditis	19 days
4	ECOTT	Aortic	≥ 10 mm	Definite	Definite infective endocarditis	46 days
5	ECOTT	Tricuspid	≥ 10 mm	Definite	Definite infective endocarditis with embolic stroke and leaflet perforation	7 days
6	ECOTE	Right atrium	≥ 10 mm	Definite	Definite infective endocarditis with brain abscess (embolization)	26 days
7	ECOTT	More than one valve involved	≥ 10 mm	Possible	Possible infective endocarditis with bivalvular regurgitation	7 days
8	ECOTT	Mitral	≥ 10 mm	Possible	Possible infective endocarditis	5 days
9	ECOTT	Mitral	< 10 mm	Possible	Possible infective endocarditis involving a prosthetic valve	4 days

Legend: TTE: transthoracic echocardiography; TEE: transesophageal echocardiography.
Source: Authors, 2026

Table 3: Therapeutic management, surgical indication, clinical outcomes, and length of hospital stay in patients with infective endocarditis

Patient	Antibiotic treatment	Surgery indicated	Outcome	Length of hospital stay
1	Culture-guided therapy	Not indicated	Hospital discharge / cured	> 28 days
2	Culture-guided therapy	Cardiac	Hospital discharge while awaiting cardiac surgery	> 28 days
3	Culture-guided therapy	Not indicated	Hospital discharge / cured	> 28 days
4	Guided by culture from other sites – surgical specimen collected from a brain abscess	Non-cardiac, such as embolization of pulmonary arteriovenous malformation (AVM)	Discharged while awaiting non-cardiac surgery	> 28 days
5	Not guided by blood culture	Cardiac	Discharged after cardiac surgery	> 28 days
6	Culture-guided therapy	Not indicated	Death	> 28 days
7	Culture-guided therapy	Cardíaca	Discharged after cardiac surgery	> 28 days
8	Culture-guided therapy	Not indicated	Death	> 28 days
9	Not guided by blood culture	Not indicated	Death	< 28 days

Source: Authors, 2026

DISCUSSION

The diagnosis of infective endocarditis (IE) in the analyzed cases was established through the integration of clinical, microbiological, and imaging findings, in accordance with the Modified Duke Criteria, which include positive blood cultures and echocardiographic evidence of vegetations. Consistent with the literature, initial suspicion frequently arose in the setting of persistent fever associated with a history of invasive procedures or embolic events. In some patients, the simultaneous presence of positive blood cultures and vegetations detected on transesophageal echocardiography (TEE) allowed diagnostic confirmation, reinforcing the central role of the multimodal approach recommended by current guidelines.[1]

In this context, the identified risk factors corroborate previously described findings[1,2,3], particularly the presence of pre-existing structural heart disease, such as valvular insufficiency and patent foramen ovale, as well as the use of intravascular devices, immunosuppression, recent surgical procedures, and poor dental conditions. Patients undergoing dialysis therapy exhibited a particularly high risk, in agreement with studies[1,2,3,4] that associate frequent manipulation of vascular access with an increased incidence of IE. Additionally, a history of severe trauma and polytrauma emerged as a contributory factor, possibly related to prolonged hospital exposure and intensive use of invasive devices.

Echocardiography, both transthoracic and transesophageal, proved fundamental for the identification of vegetations, assessment of valvular function, and detection of structural complications such as leaflet perforations and significant valvular regurgitation. In some cases, vegetations were located at unusual sites, such as the junction of the superior vena cava and the right atrium, a pattern predominantly described in catheter-related endocarditis. Serial blood cultures played a crucial role not only in diagnosis but also in guiding antimicrobial therapy and monitoring therapeutic response. Complementary imaging studies, including computed tomography and magnetic resonance imaging, were useful in the investigation of neurological and pulmonary complications, in line with international recommendations.[1]

With regard to treatment, prolonged, culture-guided antibiotic therapy predominated, with treatment durations ranging from four to six weeks, as recommended by guidelines. Combination regimens were employed, including ceftriaxone, ampicillin, vancomycin, linezolid, gentamicin, and meropenem, adjusted according to the susceptibility profile of isolated microorganisms. In infections caused by multidrug-resistant pathogens, such as Klebsiella pneumoniae and Acinetobacter baumannii, the use of polymyxin B and combination therapies was required, a scenario more frequently described in healthcare-associated infective endocarditis.

Despite adequate clinical therapy, some patients had a formal indication for cardiac surgery due to structural complications such as leaflet perforation and severe valvular regurgitation. However, similarly to what is observed in other public healthcare settings, surgical intervention was limited by logistical constraints and limited availability, resulting in hospital discharge with outpatient referral for elective surgical evaluation.

Observed complications included neurological events, such as ischemic stroke due to septic embolization and brain abscesses, as well as heart failure, valvular perforations,

and pulmonary complications, including hemopneumothorax and ventilator-associated pneumonia. In cases of right-sided or catheter-related endocarditis, a higher risk of septic pulmonary embolization was observed, a finding widely reported in the literature.[6,7] Mechanical ventilation was required in critically ill patients, particularly in the presence of neurological or respiratory instability or during surgical procedures, with subsequent intensive care unit admission and one episode of self-extubation. In other patients, less invasive ventilatory support strategies were adopted, consistent with approaches aimed at preventing complications related to prolonged mechanical ventilation.

Clinical evolution was favorable in most cases following completion of antibiotic therapy, with resolution of fever, hemodynamic stabilization, and blood culture sterilization. Some patients were discharged with residual vegetations, a finding consistent with the literature, which describes aseptic persistence of these structures due to fibrin deposition, without necessarily indicating therapeutic failure.[1,5] From a complementary diagnostic standpoint, all patients underwent electrocardiography, which, as expected, demonstrated low diagnostic specificity. Its primary value lies in the detection of potential complications, such as perivalvular abscesses, suggested by new conduction abnormalities, particularly PR interval prolongation, a finding not observed in this series. Similarly, chest radiography provided limited information for the direct diagnosis of IE, with its use being more related to global clinical assessment, as recommended by European guidelines.[6,7]

Regarding nosocomial risk factors, there was a high frequency of prior exposure to central venous catheters, identified in at least five patients, in addition to three patients undergoing dialysis therapy. The association between CVC use, hemodialysis, and comorbidities such as chronic kidney disease and diabetes mellitus reinforces the profile of healthcare-associated infective endocarditis, which predominated in this series.[1]

From an echocardiographic perspective, vegetations were identified by transthoracic echocardiography in 7 of 9 cases, whereas in 2 cases the diagnosis relied exclusively on TEE, particularly in catheter-related endocarditis and atypical locations. In one case, both modalities were concordant. These findings reflect the higher diagnostic yield of TEE in specific clinical scenarios, as highlighted in current guidelines.[7]

The mitral valve was the most frequently affected (3/9), followed by the aortic valve (2/9), with a predominance of large vegetations (≥10 mm) in 8 of 9 cases. During treatment, reduction or disappearance of vegetations was observed in at least three patients, without evidence of progressive growth, in agreement with data indicating that morphological evolution alone is not an isolated marker of therapeutic success.[8]

From a microbiological standpoint, blood culture positivity was observed in 7 of 9 cases, with a predominance of Gram-negative bacilli in nosocomial settings, partially contrasting with international series in which Staphylococcus aureus is the most frequently isolated pathogen. The rate of culture-negative endocarditis (22%) was within the range reported in the literature, often associated with prior antibiotic use or fastidious microorganisms.[9,10] According to the Modified Duke Criteria, three patients met criteria for definite infective endocarditis and six for possible infective endocarditis, reflecting the predominance of major criteria related to imaging and microbiology and minor criteria associated with predisposition and fever, a pattern similar to that observed in hospital-based series.[1,11]

Regarding outcomes, seven patients were discharged and two died, both with infections caused by multidrug-resistant Gram-negative bacilli. Neither had documented surgical indication, and in one case death occurred only a few days after echocardiographic confirmation, highlighting the severity of IE in nosocomial infection contexts.

Finally, three patients were referred for elective cardiac surgery evaluation, following classical surgical indication criteria described in current guidelines[1]. In summary, this case series reflects a profile of predominantly healthcare-associated infective endocarditis, characterized by high exposure to central venous catheters and dialysis, large vegetations, complex microbiology, and management aligned with contemporary recommendations.

As study limitations, the small sample size restricts generalizability of the findings. Additionally, the lack of transesophageal echocardiography availability for all cases may have limited diagnostic accuracy, particularly in the detection of smaller vegetations and intracardiac complications, potentially leading to underestimation of disease severity in part of the sample.[10,11]

CONCLUSION

The analysis of the nine cases of infective endocarditis highlighted the complexity of diagnosis and management, particularly in patients with multiple comorbidities and a history of invasive procedures. Diagnostic confirmation was based on the rigorous application of the Modified Duke Criteria, supported by echocardiography and serial blood cultures, revealing a wide diversity of clinical presentations and etiologic agents, which reinforces the need for an individualized and multidisciplinary approach. Prolonged antibiotic therapy proved effective in most cases; however, limited timely access to cardiac surgery resulted in some patients being discharged while awaiting valvular correction, underscoring structural vulnerabilities within the healthcare system. These findings emphasize the importance of early diagnosis, particularly in high-risk populations, combined with appropriate antimicrobial therapy, continuous monitoring, and careful surgical indication, as well as early outpatient follow-up and patient education—essential measures to reduce complications, mortality, and recurrence.

REFERENCES

1. Delgado V, Ajmone Marsan N, de Waha S, Bonaros N, Brida M, Burri H, Caselli S, Doenst T, Ederhy S, Erba PA, Foldager D, Fosbøl EL, Kovac J, Mestres CA, Miller OI, Miro JM, Pazdernik M, Pizzi MN, Quintana E, Rasmussen TB, Ristić AD, Rodés-Cabau J, Sionis A, Zühlke LJ, Borger MA; ESC Scientific Document Group. 2023 ESC Guidelines for the management of endocarditis. Eur Heart J. 2023 Oct 14;44(39):3948-4042. Erratum in: Eur Heart J. 2023 Dec 1;44(45):4780. Erratum in: Eur Heart J. 2024 Jan 1;45(1):56.Erratum in: Eur Heart J. 2025 Mar 13;46(11):1082.

2. Habib G, Erba PA, Iung B, Donal E, Cosyns B, Laroche C, Popescu BA, Prendergast B, Tornos P, Sadeghpour A, Oliver L, Vaskelyte JJ, Sow R, Axler O, Maggioni AP, Lancellotti P; EURO-ENDO Investigators. Clinical presentation, aetiology and outcome of infective endocarditis. Results of the ESC-EORP EURO-ENDO (European infective endocarditis) registry: a prospective cohort study. Eur Heart J. 2019 Oct 14;40(39):3222-3232. Erratum in: Eur Heart J. 2020 Jun 7;41(22):2091.

3. Chen H, Zhan Y, Zhang K, Gao Y, Chen L, Zhan J, Chen Z, Zeng Z. The Global, Regional, and National Burden and Trends of Infective Endocarditis From 1990 to 2019: Results From the Global Burden of Disease Study 2019. Front Med (Lausanne). 2022 Mar 9;9:774224.

4. Pericàs JM, Llopis J, Jiménez-Exposito MJ, Kourany WM, Almirante B, Carosi G, Durante-Mangoni E, Fortes CQ, Giannitsioti E, Lerakis S, Montagna-Mella R, Ambrosioni J, Tan RS, Mestres CA, Wray D, Pachirat O, Moreno A, Chu VH, de Lazzari E, Fowler VG Jr, Miró JM; ICE Investigators. Infective Endocarditis in Patients on Chronic Hemodialysis. J Am Coll Cardiol. 2021 Apr 6;77(13):1629-1640.

5. Barbieri A, Cecchi E, Bursi F, Mantovani F. Is Infectious Endocarditis Evolving into a Time-Dependent Diagnosis in the Contemporary Epidemiological Era? Emphasis on the Role of Echocardiography as a First-Line Diagnostic Approach. Rev Cardiovasc Med. 2023 Oct 8;24(10):283.

6. Naber CK, Erbel R. Infective endocarditis with negative blood cultures. Int J Antimicrob Agents. 2007 Nov;30 Suppl 1:S32-6.

7. Freling SR, Richie I, Norwitz D, Canamar CP, Banerjee J, Davar K, Clark D, Spellberg B. Interpreting Blood Culture Results as Early Guidance for Infective Endocarditis. JAMA Netw Open. 2025 May 1;8(5):e258079.

8. Mihos CG, Nappi F. A narrative review of echocardiography in infective endocarditis of the right heart. Ann Transl Med. 2020 Dec;8(23):1622.

9. Imran A, Quarrell A, Edhem L, Eni G, Ahmed A, Solano J. Prosthetic Valve Endocarditis and Aortic Root Abscess: A Case of High-Risk Infection. Cureus. 2025 Apr 11;17(4):e82063.

10. Horgan SJ, Mediratta A, Gillam LD. Cardiovascular Imaging in Infective Endocarditis: A Multimodality Approach. Circ Cardiovasc Imaging. 2020 Jul;13(7):e008956.

11. Fowler VG, Durack DT, Selton-Suty C, Athan E, Bayer AS, Chamis AL, Dahl A, DiBernardo L, Durante-Mangoni E, Duval X, Fortes CQ, Fosbøl E, Hannan MM, Hasse B, Hoen B, Karchmer AW, Mestres CA, Petti CA, Pizzi MN, Preston SD, Roque A, Vandenesch F, van der Meer JTM, van der Vaart TW, Miro JM. The 2023 Duke-International Society for Cardiovascular Infectious Diseases Criteria for Infective Endocarditis: Updating the Modified Duke Criteria. Clin Infect Dis. 2023 Aug 22;77(4):518-526. Erratum in: Clin Infect Dis. 2023 Oct 13;77(8):1222.

MAILING ADDRESS

GIULLIANO GARDENGHI
CET – CLIANEST, R. T-32, 279 - St. Bueno, Goiânia-Goiás- Brazil.
E-mail: coordenacao.cientifica@ceafi.edu.br

EDITORIAL AND REVIEW

Authors:
Gabriella Torrano Carvalho Pimentel - http://lattes.cnpq.br/9259082959498289 - https://orcid.org/0009-0002-2399-360X

Luciana Fernandes Balestra - http://lattes.cnpq.br/2947425938390393 - https://orcid.org/0009-0006-0123-357X

Giulliano Gardenghi - http://lattes.cnpq.br/1292197954351954 - https://orcid.org/0000-0002-8763-561X

Library Review: Izabella Goulart
Spell Check: Dario Alvares
Received: 02/05/2026. Accepted: 05/02/26. Published in: 23/02/2026.