

Sociodemographic, clinical and paraclinical characterization of infective endocarditis in a quaternary care hospital

JUAN PABLO CÁRDENAS-GUTIÉRREZ, MILCIADES IBÁÑEZ-PINILLA, DIEGO PINTO-PINZÓN, CRISTIAN LÓPEZ-OCAMPO, ANA MONROY-SIERRA • BOGOTÁ, D.C. (COLOMBIA)

DOI: <https://doi.org/10.36104/amc.2025.3586>

Abstract

Introduction: infective endocarditis (IE) is a disease with high morbidity and mortality, with clinical implications for hospital stay, treatment and prognosis. Identifying the associated variables is essential to guide treatment.

Objective: to determine the sociodemographic, clinical and paraclinical characteristics associated with endocarditis.

Methods: this was a retrospective case series that included patients diagnosed with IE from January 2021 to July 2024 at a quaternary care hospital in Bogotá. Clinical and paraclinical variables were collected and analyzed descriptively.

Results: the study included 68 patients with an average age of 59.6 ± 15.9 years who were predominantly male (70.6%). Hypertension was the most frequent comorbidity (54.4%). The main risk factors were the use of a vascular access for hemodialysis (20.6%) and a history of valve replacement (22.1%). The predominant clinical manifestation was fever (61.8%). *Staphylococcus aureus* was the most common causal germ (28%). The most frequent complications were embolic events (26.5%). Half of the patients required surgery, and the mortality rate was 16.2%.

Conclusions: infective endocarditis primarily affects men, with hypertension as the most frequent comorbidity and the use of vascular devices as a relevant risk factor. Fever was the cardinal clinical manifestation. Half required cardiovascular procedures for complex lesions, and embolic events were the predominant complication. The findings are consistent with prior national reports. (*Acta Med Colomb* 2025; 50. DOI: <https://doi.org/10.36104/amc.2025.3586>).

Keywords: *infective endocarditis, epidemiology, microbiology, echocardiography.*

Dr. Juan Pablo Cárdenas-Gutiérrez: Postgrado Medicina Interna; Dr. Milciades Ibáñez-Pinilla: Docente Investigador Epidemiología; Dr. Diego Pinto-Pinzón: Coordinador Postgrado Medicina Interna; Dr. Cristian López-Ocampo: Postgrado Medicina Interna; Dra. Ana Monroy-Sierra: Semillero Enfermedades Cardiovasculares. **Fundación Universitaria Sanitas – Clínica Universitaria Colombia. Bogotá, D.C. (Colombia).**

Correspondencia: Dr. Juan Pablo Cárdenas-Gutiérrez. Bogotá, D.C. (Colombia).

E-Mail: juanchocardenas83@hotmail.com

Received: 03/VIII/2024 Accepted: 14/VIII/2025

Introduction

Infective endocarditis (IE) is a disease historically associated with high morbidity and mortality. In the pre-antibiotic era, mortality was close to 100%. However, with the development of new diagnostic and therapeutic strategies, it has dropped significantly over time (1–10). Despite these advances, IE continues to represent a significant challenge for healthcare systems, due to the high percentage of patients who require prolonged antimicrobial treatment, complex surgical procedures, prolonged intensive care unit stays and a comprehensive interdisciplinary approach (1–5).

Those most at risk for IE include patients with valve replacements, those with prior episodes of endocarditis and people with cyanotic congenital heart disease (1–11). Dental procedures that involve gingival manipulation or perforation of the mucosa are also considered risk situations, and therefore antimicrobial prophylaxis is recommended for these cases (12).

From a clinical perspective, IE can present in three phases: acute (up to six weeks), subacute (between six weeks and three months) and chronic (more than three months). The most frequent symptoms include fever, diaphoresis and fatigue; some patients may have immunological and/or embolic phenomena (1–8). Laboratory tests generally show leukocytosis with neutrophilia, elevated C-reactive protein, and hematuria, among other findings (1, 4, 8).

The most frequently isolated microorganism is *Staphylococcus aureus* (1, 2, 13). Antimicrobial treatment is determined according to the isolated microbe; however, various scientific societies have proposed empirical treatment regimens (1, 2). A significant percentage of patients require surgery for valve repair or replacement, particularly emergency surgery in cases of cardiogenic shock, acute heart failure, or refractory pulmonary edema secondary to severe acute valve insufficiency, fistulas, or prosthetic obstruction (1, 2, 13).

The prognosis of IE depends on four main factors: the patient's cardiac history (such as heart failure), the presence

or absence of cardiac complications, the microorganism isolated, and the imaging findings. The combination of these factors determines the risk of mortality and morbidity (1–9, 11, 13).

Clínica Universitaria Colombia is a quaternary care facility and reference center that treats multiple cardiovascular diseases and receives both national and international patients, especially from the Caribbean islands (Curaçao and Saint Lucia, among others). Infective endocarditis holds a prominent place among these diseases; thus, we believe it is essential to provide descriptive and analytical data on this disease in patients treated at this facility. This will help strengthen research lines in this field and contribute to the development of new strategies for timely intervention and treatment, with a potential impact on morbidity and mortality as well as healthcare system costs.

Method

This was an observational, case series study of a retrospective cohort conducted at Clínica Universitaria Colombia, located in Bogotá (Colombia), using a retrospective analysis from January 2021 to July 2024.

Population

The study population was made up of patients over the age of 18, hospitalized for IE, who were jointly treated by internal medicine, cardiology and/or cardiovascular surgery. The following inclusion criteria were established: age over 18 and having a diagnosis of IE according to the modified Duke criteria and the assessment of the attending medical staff. Patients with an incomplete medical chart in Clínica Universitaria Colombia's medical records system (SOPHIA) were excluded.

Sampling frame

Consisted of a non-invasive cardiology service database of patients hospitalized for IE. In addition, data was obtained from patients filtered through the SOPHIA system using the corresponding ICD-10 code, as well as transesophageal echocardiograms with conclusive findings of infective endocarditis.

Variables

Fifty-five variables were included, grouped in four main categories: sociodemographic, pathological, treatment and complications.

Statistical analysis

Patients who met the proposed selection criteria were identified, corroborating the diagnosis, age and gender using the SOPHIA system. The electronic medical charts were reviewed to obtain the study variable data, which were verified and complemented by the research group. Following this, a database was constructed using Microsoft Excel version 1808, recording the complete information.

The data were cross-checked between subsets of the bases to ensure consistency, applying logical frequencies and validation during cleansing. Finally, the information was processed on Excel and SPSS version 15.0.

A descriptive analysis was done to characterize the sample. Quantitative variables were tested for normality using the Kolmogorov-Smirnov and Shapiro-Wilks tests, with a 5% level of significance ($p < 0.05$).

Bias control

To minimize potential bias, strict inclusion and exclusion criteria were defined, seeking to obtain a standard population that would be comparable to previous studies performed in Colombia. The data was collected and analyzed by trained staff, using specialized databases and programs. The statistical analysis was repeated to confirm the consistency of the results.

Ethical considerations

The study adhered to the international ethical principles for health established in the Declaration of Helsinki, Belmont Report, Nuremberg Code and CIOMS Guidelines. It also aligned with the stipulations of Resolution 008430 of October 4, 1993, in Colombia. The data collected is confidential and the privacy of the participants was protected, with data used only for this study. No additional interventions were performed, as this was a descriptive study based on retrospective data obtained from medical charts. The study was approved by the Unisanitas Ethics Committee, with study approval number 045-23 UNV.

Results

The cohort consisted of 68 patients with an IE diagnosis who met the study's inclusion criteria. All the patients' charts were able to be accessed, and all the variables were recorded.

Demographic and clinical characteristics

The minimum patient age was 19 years, and the maximum was 87 years, with an average of 59.6 ± 15.9 years and a median of 61 years. The sex distribution showed 70.6% male predominance ($n = 48$), while females accounted for 29.4% ($n = 20$). Most of the patients were Colombian citizens (86.8%; $n = 59$), while 13.2% ($n = 9$) came from other countries, specifically the Dutch Caribbean islands (Curaçao). The main characteristics of the study population are shown in Table 1.

Comorbidities and risk factors for infective endocarditis

Hypertension was the most prevalent comorbidity (54.4%; $n = 37$), followed by diabetes mellitus (30.8%; $n = 21$). Chronic heart failure (HF) was found in 30.8% ($n = 21$): 25% of the total population had a history of HF with preserved or mildly reduced left ventricular ejection fraction (LVEF), while 5.8% had HF with reduced LVEF.

Chronic kidney disease was found in 29.4% ($n = 20$) of the patients, and 20.6% ($n = 14$) had central

Table 1. Demographic characteristics, prevalence of comorbidities and risk factors in patients with infective endocarditis at Clínica Universitaria Colombia.

Variables	n=68
Demographic characteristics	
Male sex, n (%)	48 (70.6%)
Age, X (SD)	59.59 (15.89)
Foreigners, n (%)	9 (13.2%)
Comorbidities and risk factors, n (%)	
Hypertension	37 (54.4)
Diabetes	21 (30.8)
Heart failure	21 (30.8)
Chronic kidney disease	20 (29.4)
Prior valve disease	19 (27.9)
Biological valve replacement	11 (16.2)
Mechanical valve replacement	6 (8.8)
Coronary disease	13 (19.1)
Periodontal disease	13 (19.1)
Chronic obstructive pulmonary disease	2 (2.9)
SD: standard deviation X: average	

lines for renal replacement therapy. Periodontal disease confirmed by a dentist was found in 19.1% (n = 13). A total of 27.9% (n = 19) had a history of valve disease, 22.1% (n = 15) of whom had undergone a previous valve replacement. There was a 10.3% prevalence of intracardiac devices (n = 7). None of the patients reported using intravenous drugs (Figure 1).

Relevant clinical signs and symptoms

One hundred percent of the patients (n = 68) presented acute phase clinical signs and symptoms. Fever was the cardinal symptom, occurring in 61.8% (n = 42). A total of 23.5% (n = 16) reported chest pain. A new onset heart murmur was documented in 10.3% (n = 7), and splenomegaly was confirmed in 8.8% (n = 6). No manifestations like hematuria, Janeway lesions, Roth spots, Osler nodes or splinter hemorrhages were found in the evaluated cohort.

Inflammatory and infectious markers

White blood cell abnormalities were common: leukocytosis was found in 48.5% (n = 33), and leukopenia in 1.5% (n = 1). Anemia (according to the WHO criteria) was present in 61.8% (n = 42). C-reactive protein (CRP) was elevated in 79.4% (n = 54) and the erythrocyte sedimentation rate (ESR) was positive in 30.9% (n = 21). Hypoalbuminemia was confirmed in 38.2% (n = 26). Ultrasensitive T troponin

was elevated in 22.1% (n = 15), according to the institutional cut-off point.

Germ isolated and sensitivity profile

In 35.3% of the cases (n = 24), no microbe was isolated. *Staphylococcus aureus* was the most common micro-organism (28%; n = 19). *Enterococcus faecalis* and *Haemophilus spp.* were isolated in 4.4% (n = 3) each, and *Candida albicans* in 1.5% (n = 1). Among Gram-negative bacteria, *Klebsiella aerogenes* was isolated in 3% (n = 2). *Escherichia coli*, *Proteus mirabilis*, *Serratia marcescens*, *Morganella morganii*, *Granulicatella adiacens*, *Granulicatella elegans* and *Aggregatibacter actinomycetes* were each isolated in 1.5% (n = 1) of the cases. Other microbial isolates are shown in Figure 2. In 50% (n = 34) of the cases, the bacteria had the usual sensitivity profile, with no acquired resistance patterns (Figure 3).

The most frequently prescribed empiric antimicrobial was vancomycin, as monotherapy (11.8%; n = 8) or combination

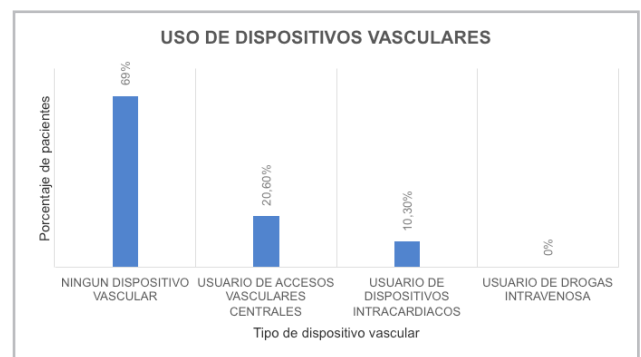


Figure 1. Percentage distribution out of 100% (n=68) of the use of vascular devices in patients with infective endocarditis at Clínica Universitaria Colombia.

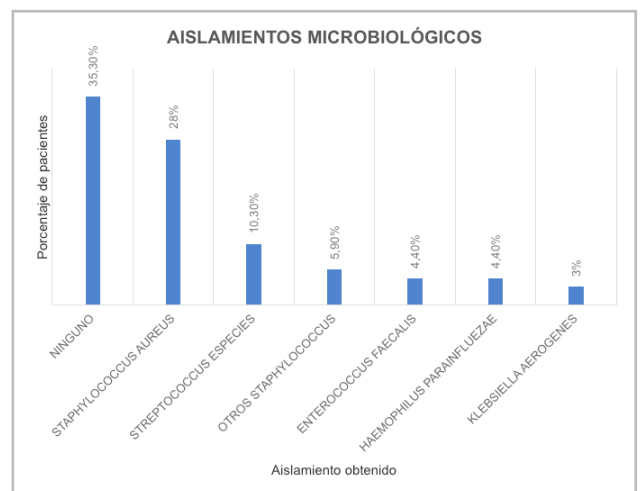


Figure 2. Percentage distribution out of 100% of patients (n=68) of germs isolated in patients with infective endocarditis at Clínica Universitaria Colombia.

therapy (32.3%; n = 22). Other monotherapy antibiotics included ceftriaxone, oxacillin and piperacillin-tazobactam (5.9%; n = 4), while cefepime was used as combination therapy or monotherapy in 19.1% (n = 13).

The minimum length of antimicrobial therapy was four days (due to the patient's death), and the maximum was 90 days (1 case; 1.5%). In 70.6% (n = 48) of the cases, the duration was 42 days, and in 7.4% (n = 5) it was 28 days, depending on the presence of vegetations on intracardiac devices. Durations of less than 28 days were related to mortality or refusal to continue treatment. The antimicrobial regimen was adjusted in 77.9% (n = 53) of the cases after obtaining the microbial isolates.

Echocardiographic findings

The aortic valve was the most frequently involved structure, with vegetations or lesions in 38.2% (n = 26). The pulmonary valve was least often affected (1.5%; n = 1). Concomitant aortic and mitral valve lesions were found in 8.8% (n = 6). Vegetations on intracardiac devices were documented in 14.7% (n = 10), and isolated endocardial wall involvement was found in 2.9% (n = 2) (Figure 4).

The average diameter of the vegetations was 12.4 mm, with a mode of 10 mm and a median of 11 mm. The minimum size was <1 mm, and the maximum was 45 mm. The average LVEF was 54%, with a mode of 63%, a median of 56%, a minimum of 14%, and a maximum of 70%.

In 73.5% (n = 50) of the cases, the vegetations were single lesions, while valve perforations were found in 11.8% (n = 8), abscesses in 10.3% (n = 7), fistulas in 1.5% (n = 1) and prosthetic dehiscence in 2.9% (n=2).

Complications

Embolic events were the most frequent complications, occurring in 26.5% (n = 18) of the cases. A total of 14.7% (n = 10) had septic or cardiogenic shock. Altogether, 7.4% (n = 5) did not have an adequate response to antimicrobial treatment, requiring treatment adjustment; this was the least frequent complication. Other complications are described in Figure 5.

A total of 44.1% (n = 30) of the patients had to be admitted to the intensive care unit (ICU). Fifty percent (n=34) required cardiovascular surgery, mainly valve replacement.

Mortality

The mortality rate in the study population was 16.2% (n=11). This mortality was directly related to septic and/or cardiogenic shock.

Discussion

In the cohort of 68 patients with IE at Clínica Universitaria Colombia, males were more prevalent, which is congruent with the data reported in the literature (11-29). Some studies in Colombia estimated an average age at presentation of 55 years (20-29), similar to the data analyzed in the described cohort. The foreign population referred from the

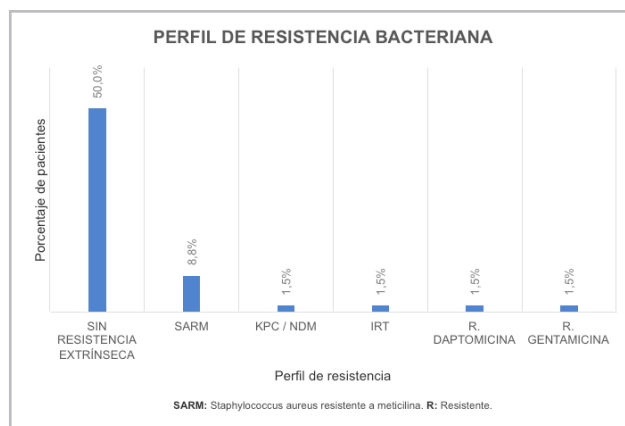


Figure 3. Percentage distribution out of 100% (n=68) of resistance profiles of isolated bacteria in patients with infective endocarditis at Clínica Universitaria Colombia.

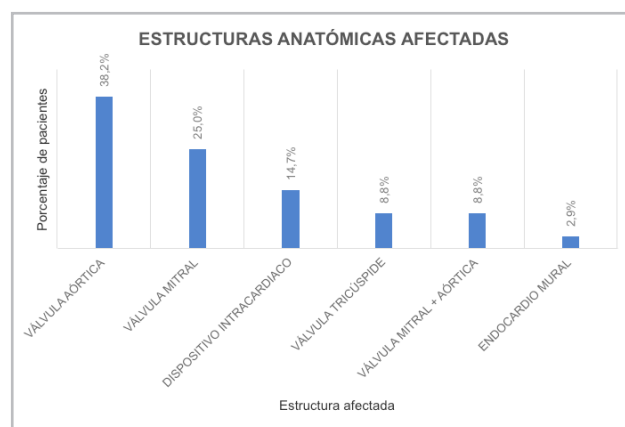


Figure 4. Percentage distribution out of 100% (n=68) of anatomical structures affected in patients with infective endocarditis at Clínica Universitaria Colombia.

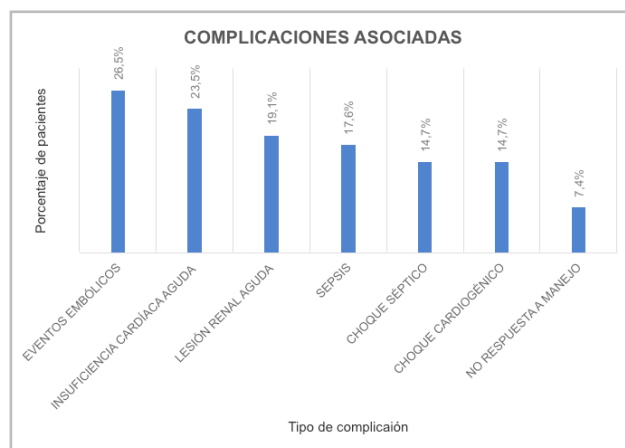


Figure 5. Percentage distribution out of 100% (n=68) of associated complications in patients with infective endocarditis at Clínica Universitaria Colombia.

Dutch Caribbean islands were significantly represented in the study (with more than 10%), generating questions and hypotheses that can be answered in future studies, proposing a direct comparison with the Colombian population.

Nine comorbidities were included among the evaluated pathological characteristics; hypertension, confirmed in over half the population, was the most prevalent prior condition in the cohort. However, due to the study design, a direct relationship cannot be established; this finding was concordant with what has been described in the rest of the Colombian studies (20-29). Risk factors, like the use of central lines for renal replacement therapy, were present in approximately 25% of the population, similar to findings of other Colombian studies (20, 21, 25, 26). Ten percent of the patients had intracardiac devices. None of the patients reported recreational intravenous drug use, similar to what other national studies have reported.

The patients' clinical signs and symptoms on the initial assessment are determinant factors for guiding the diagnosis and affect the timing of antimicrobial therapy and decision making. Fever is reported to be the most frequent sign in people with IE; this finding was replicated in the cohort described and the rest of the Colombian studies (20-29). Chest pain, new onset heart murmurs or splenomegaly were reported in less than 20% of the population. Other clinical signs related to embolic and/or immunological events like hematuria, Janeway lesions, Roth spots, Osler nodes or splinter hemorrhages were not found in any patients. These may have been underreported in the medical charts, as other studies, like the one conducted at Hospital Universitario San Vicente Fundación in Medellín, reported these signs in less than 5% of the patients (29).

In line with other studies in Colombia, leukocytosis and elevated C-reactive protein were documented in more than half the population, highlighting the importance of these inflammatory markers in the infectious process (20-29). In a study conducted at Fundación Cardioinfantil Instituto de Cardiología in Bogotá, more than 80% had a positive erythrocyte sedimentation rate (21), while a cohort studied at Clínica Colombia reported 30.9%, raising questions about the usefulness of this marker as a prognostic factor or its importance in disease follow-up. In the populations studied at Fundación Cardioinfantil and Clínica Foscal in Bucaramanga, hypoalbuminemia was prevalent, recorded in more than half the population (21- 26), and could be considered an inflammatory marker. In the study population at Clínica Colombia, 38.2% had hypoalbuminemia, which differs from what was previously reported.

Previous Colombian studies achieved microbiological isolation in most cases, reporting positive blood cultures in more than 70% of cases in most cohorts (20-29), similar to the described population. The most frequently isolated microbes were Gram positive, especially *Staphylococcus aureus*, similar to what is reported in the international literature (19-29). The presence of Gram-negative organisms

and fungi continues to be low. Bacterial resistance profiles typically differ among hospitals and clinics. Most of the isolated microbes at Clínica Colombia did not have a characteristic resistance profile or differ from the usual pattern, with oxacillin-resistant *S. aureus* being the most common resistant germ (less than 10%). Vancomycin, in combination therapy or monotherapy, followed by cefepime, were the antimicrobials of choice. This regimen differs from the international guidelines, although treatment was properly escalated upon germ isolation, with a favorable response in more than 90% of cases.

A case series from Hospital San José (Bogotá) reported that the mitral valve was the most commonly affected anatomical structure (27), a finding which coincides with most of the cohorts described. However, in this cohort, the aortic valve was most affected (38% of the cases), followed by the mitral valve and both the aortic and mitral valves. The average diameter of the lesions associated with endocarditis found on echocardiography was 12.4 mm, similar to what is reported in the literature. Lesions like valve perforation, abscesses, fistulas or valve prosthesis dehiscence were uncommon. It is important to point out that these findings may vary from one study to another, as echocardiography is operator dependent.

In a study at Hospital Cardiovascular del Niño in Cundinamarca, emboli associated with IE complications were infrequent, occurring in approximately 11% of the cohort studied (27), with a similar tally. In other studies, this finding is discordant, as it was the most frequent complication in the cohort described, occurring in 23.5% of the population. In addition, the frequency of other complications was lower than that of other cohorts described in Colombia (20-29). Due to the study methodology, the reason for the lower percentage of complications cannot be determined. The need for surgical intervention (valve repair or replacement) was higher, compared to other cohorts (20-29). The mortality rate was similar to what has been described in the international literature. It was under 20%, a figure which has been decreasing over the last decades.

This study's main limitation was the lack of an official database for patients with IE, which made it difficult to collect cases. However, a search of echocardiographic studies and other databases, along with clinical chart review, helped reduce patient loss. Since this was a descriptive study, causal relationships between variables could not be studied. The comparison with other Colombian studies opens the door to conducting comparative analyses between different cohorts in the future.

Conclusions

Infective endocarditis is a highly complex disease which occurs more frequently in males and those over the age of 55. The presence of vascular devices and periodontal disease continue to be relevant factors in its onset and evolution. The left-sided valves (aortic and mitral) are the most frequently involved anatomical structures. There are various

related complications, with embolic events being the most frequent in the cohort described. The need for surgery has an important impact on the clinical course; 50% of the study population required some type of cardiovascular procedure due to complex valve lesions. Interdisciplinary care is essential, highlighting the role of each clinical and surgical specialty in dealing with this disease. The rate of mortality and complications continues to be high compared to other diseases. More studies, especially comparative ones, are needed to evaluate direct associations with the impact and evolution of the disease.

Acknowledgements

Thanks to Orlando Cárdenas and the cardiac diagnostic imaging service at Clínica Universitaria Colombia.

References

1. **Delgado V, Ajmone Marsan N, de Waha S, Bonaros N, Brida M, et al.** ESC Scientific Document Group. 2023 ESC Guidelines for the management of endocarditis. *Eur Heart J*. 2023;44(39):3948–4042.
2. **López J, Olmos C, Fernández-Hidalgo N.** Novedades en la endocarditis infecciosa. *Revista Española de Cardiología*. 2024;77(9):779–87.
3. **Rajani R, Klein JL.** Infective endocarditis: A contemporary update. *Clin Med*. 2020;20(1):31–35
4. **Hubers SA, DeSimone DC, Gersh BJ, Anavekar NS.** Infective Endocarditis: A Contemporary Review. *Mayo Clin Proc*. 2020;95(5):982–997.
5. **Román AS.** Comments on the ESC 2015 Guidelines for the Management of Infective Endocarditis. *Revista Española de Cardiología*. 2016;69(1):7–10.
6. **Chamat-Hedemand S, Dahl A, Østergaard L, Arpi M, Fosbøl E, Boel J, et al.** Prevalence of Infective Endocarditis in Streptococcal Bloodstream Infections Is Dependent on Streptococcal Species. *Circulation*. 2020;142(8):720–30.
7. **Ursi MP, Durante Mangoni E, Rajani R, Hancock J, Chambers JB, Prendergast B.** Infective Endocarditis in the Elderly: Diagnostic and Treatment Options. *Drugs & Aging*. 2018;36(2):115–24.
8. **Lung B.** Infective endocarditis. Epidemiology, pathophysiology and histopathology. *Presse medicale*. 2019; 48(5):513–21.
9. **Rodríguez Jesús.** Estimulación cardíaca SEC, Cap 28. Dispositivos electrónicos cardíacos implantables e infecciones. *Editorial C*. 2017.
10. **Sanaïha Y, Lyons R, Benharash P.** Infective endocarditis in intravenous drug users. *Trends in Cardiovascular Medicine*. 2020;30(8):491–7.
11. **Di Filippo S.** Clinical outcomes for congenital heart disease patients presenting with infective endocarditis. *Expert Review of Cardiovascular Therapy*. 2020;18(6):331–42.
12. **Leong JW, Kunzel C, Cangialosi TJ.** Management of the American Heart Association's guidelines for orthodontic treatment of patients at risk for infective endocarditis. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2012;142(3):348–54.
13. **Li JS, Sexton DJ, Mick N, Nettles R, Fowler VG Jr, et al.** Proposed modifications to the Duke criteria for the diagnosis of infective endocarditis. *Clin Infect Dis*. 2000;30(4):633–8.
14. **Vandersluis YR, Suri S.** Infective endocarditis and orthodontic implications in children: A review of the literature. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2020;157(1):19–28.
15. **Yuan XC, Liu M, Hu J, Zeng X, Zhou AY, Chen L, et al.** Diagnosis of infective endocarditis using echocardiography. *Medicine*. 2019;98(38).
16. **Wang A, Gaca JG, Chu VH.** Management Considerations in Infective Endocarditis. *JAMA*. 2018;320(1):72.
17. **Selton-Suty C, Goehringer F, Venner C, Thivilier C, Huttin O, Hoen B.** Complications et pronostic de l'endocardite infectieuse. *La Presse Médicale*. 2019;48(5):532–8.
18. **Sénior JM, Lara F, Restrepo A.** Endocarditis infecciosa Descripción clínico-epidemiológica. 1995.
19. **Flores P, González N, Betancourt P, Berho J, Astudillo C, García C, et al.** Endocarditis Infecciosa: caracterización clínica de la enfermedad. Revisión de casos de los últimos 5 años. *Revista chilena de cardiología*. 2017; 36(1):34–40.
20. **Alkhwam H, Sogomonian R, Zaiem F, Vyas N, El-Hunjul M, Jolly J, et al.** Morbidity and mortality of infective endocarditis in a hospital system in New York City serving a diverse urban population. *J Investig Med*. 2016;64(6):1118–23.
21. **Sadeghi M, Behdad S, Shahsanaei F.** Infective Endocarditis and Its Short and Long-Term Prognosis in Hemodialysis Patients: A Systematic Review and Meta-analysis. *Current Problems in Cardiology*. 2021;46(3):100680.
22. **Enamorado Anaya AR, Yero García RO, Ruiz Manzanara A, Goro G, González Agüero M.** Caracterización de pacientes con endocarditis infecciosa en el periodo 2015 – 2020. *Rev Ciencias Médicas*. 2021;25(3):e4909.
23. **Ríos Olaya LS, Beltrán Barriga DS, Sayegh F, Infante-Rovaina G, García-González I, Sarmiento Acuña K.** Descripción y prevalencia de endocarditis en la población colombiana en el periodo 2015-2020. *Universitas Medica*. 2022;63(2).
24. **Noreña Calvo, Ivan Enrique.** Caracterización clínica, microbiológica y ecocardiográfica de pacientes con Endocarditis infecciosa en la Fundación Cardioinfantil 2002-2012. *Universidad del Rosario*; 2014.
25. **Jiménez Rocha H, Pinzón Cabrera, Poveda Castillo M, Rodríguez Gómez R.** Caracterización de la endocarditis infecciosa en el hospital cardiovascular del niño de Cundinamarca en el periodo 2013 – 2019-I. *Bogotá: Universidad de Ciencias Aplicadas y Ambientales*; 2021.
26. **Prada Serrano MA, Ochoa Vera ME.** Perfil de la endocarditis infecciosa en el complejo Foscal entre junio 2013 a junio 2017. Rasgos clínicos, microbiológicos y ecocardiográficos. *Bucaramanga: Universidad Autónoma de Bucaramanga*; 2019.
27. **Olaya A, Vargas D, Montes L, Ávila Y, Cárcamo M.** Descripción clínica, microbiológica y ecocardiográfica de la endocarditis infecciosa en un hospital de Bogotá durante los años 2013-2017. *Acta Médica Colombiana*. 2019;44(4).
28. **Dueñas-García F, Conta-López JA, Quintero-Farías RA, Ospina-Díaz JM, Vargas-Rodríguez LJ.** Caracterización de la endocarditis infecciosa. *Revista Colombiana de Cardiología*. 2023;30(2).
29. **Ariza EJ, Suárez EU, Giraldo S, Jaimes FA, Muñoz E, Senior JM.** Características epidemiológicas de la endocarditis infecciosa. Experiencia de seis años. *Rev Colomb Cardiol*. 2022;50:102990.

