Original Research Article

THE BACTERIAL PROFILE OF AORTIC INFECTIOUS ENDOCARDS: Experience of the Cardiology Department, Mohammed VI University Hospital of Marrakech.

ABSTRACT:

Introduction : Infective endocarditis is defined as infection of a native or prosthetic heart valve, endocardial surface, or cardiac device. The causes and epidemiology, as well as the microbiology of the disease have evolved over the last few decades with the doubling of the average age of patients and an increased prevalence in patients with indwelling cardiac devices.

Patients and methods : This is a retrospective study, including all subjects over 20 years of age who presented with infective endocarditis of the aortic valve, hospitalized between January 2019 and December 2022, in the Department of Cardiology and Vascular Diseases at ERRAZI Hospital-Mohammed VI University Hospital in Marrakech. Clinical, paraclinical and therapeutic data were collected for each case using an exploitation form. **Result :** Over the study period, 46 patients had presented with aortic positional AR, with a sex ratio that was equal to 1.8. The mean age of the patients was 43±12.5 years. Endocarditis on aortic prosthesis was found in 15%. The valves were rheumatic in 85%. The presumed portal of entry was cutaneous in 45%, oral and ENT in 33%, urinary in 15%, and digestive in 7%. In our series, 21 out of 26 patients presented a biological inflammatory syndrome. At least one or more blood cultures were positive in 38% of cases. Coagulase-negative Staphylococcus was the most common germ in aortic infective endocarditis, found in 40% of positive blood cultures. All the patients in our series had received a combination of broad-spectrum intravenous antibiotic therapy, initially probabilistic, taking into consideration the portal of entry. Adapted after antibiogram results. The evolution during the hospitalization, was marked by an improvement of the clinical state in only 12%, a perioperative death in 38%, and a worsening of the clinical state in 50%, with an average duration of hospitalization of 14 days. In our series, 60% of the patients with positive blood cultures died, whereas there was 75% survival in the group with negative blood cultures.

Conclusion : Infective endocarditis is a serious disease because of its high morbidity and mortality. Despite improvements in diagnostic testing, antimicrobial therapy, and surgical intervention, changes in the epidemiology of IE, including the increase in healthcare-associated infections and the virulence of staphylococcus aureus as the causative organism, increase the risk of complications and death in the acute phase of IE. Action must be taken to prevent infective endocarditis, especially in this rheumatically endemic area.

Keywords : Aortic endocarditis, Bacterial transplantation, Blood culture, Resistance, Antibiotic therapy

INTRODUCTION :

Infective endocarditis is defined as infection of a native or prosthetic heart valve, endocardial surface, or cardiac device. The causes and epidemiology of the disease have evolved over the past few decades with a doubling of the average age of patients and an increased prevalence in patients with indwelling cardiac devices.

The microbiology of the disease has also changed, and staphylococci, most commonly associated with healthcare provider contact and invasive procedures, have surpassed streptococci as the most common cause of the disease. Although new diagnostic and therapeutic strategies have

emerged, one-year mortality has not improved and remains 30%, which is worse than for many cancers [1].

Our objective was therefore to describe the bacteriological profile of aortic infective endocarditis in adults through a series of 26 cases in the Department of Cardiology, CHU Mohammed VI of Marrakech, with a review of the literature.

PATIENTS AND METHODS:

This is a retrospective study, including all adolescent and adult patients over 20 years of age with aortic valve infective endocarditis, hospitalized between January 2019 and December 2022, in the Department of Cardiology and Vascular Diseases at ERRAZI Hospital - Mohammed VI University Hospital in Marrakech.

Patients hospitalized with the diagnosis of aortic infective endocarditis were collected from the registers and complete files of the service. We excluded incomplete records.
The data studied concerned the epidemiological profile, IE, age, sex, FDRCVX, medical history, and the bacteriological profile of aortic infective endocarditis.

A descriptive analysis of the study population was performed. Quantitative variables were presented as medians and extremes and qualitative variables as numbers and percentages.

RESULTS :

1. Hospital prevalence:

The hospital prevalence of infective endocarditis over the duration of our study was 1.5%.
In our series, 26 patients out of 47 had infective endocarditis in the aortic position, IE 55%.

2. Epidemiological data:

a. Age :

We collected 26 patients with aortic infective endocarditis hospitalized in our facility over a 3-year period. The mean age of our patients was 43▪12.5 years, with extremes ranging from 17 to 63 years. The most predominant age range was 31 to 40 years with 30%. The distribution of patients according to age range is shown in Figure 1.

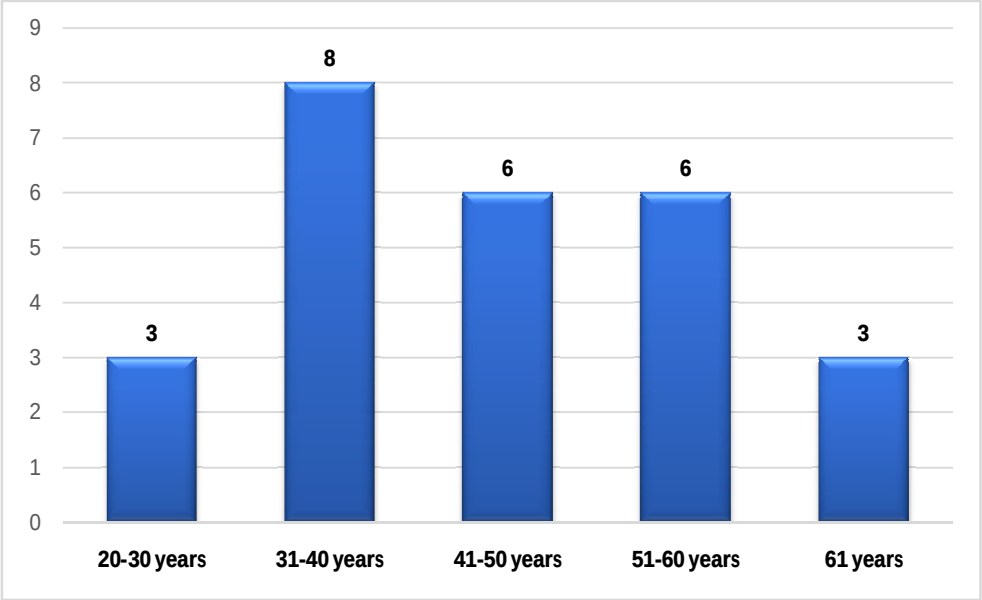

Figure 1: Distribution of patients by age group.

b. Gender :

There was a male predominance with 65%, and a sex ratio that was equal to 1.8.

c. History :

A history of infective endocarditis was found in 3 patients on native valve, with a variable delay of the new episode, the first being 20 years, the second was 4 months and the third was 1 month, after which the patient was hospitalized in our training for suspicion of infective endocarditis not treated following a discharge against medical advice.

A known and treated history of rheumatic fever was found in 2 patients (7% of cases). Tuberculous pericarditis was confirmed by biopsy and under anti-bacillary treatment, thus developing tuberculous endocarditis after 3 months of treatment (figure 2).

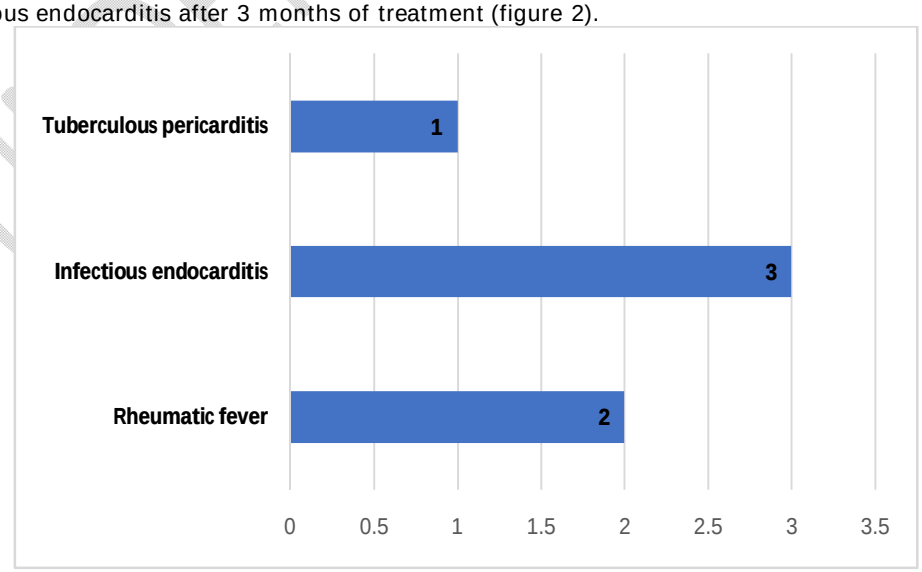

Figure 2 : Distribution according to the history of the patients in our series

A known history of valvulopathy was found in 57% of the cases, distributed as follows (figure 3).

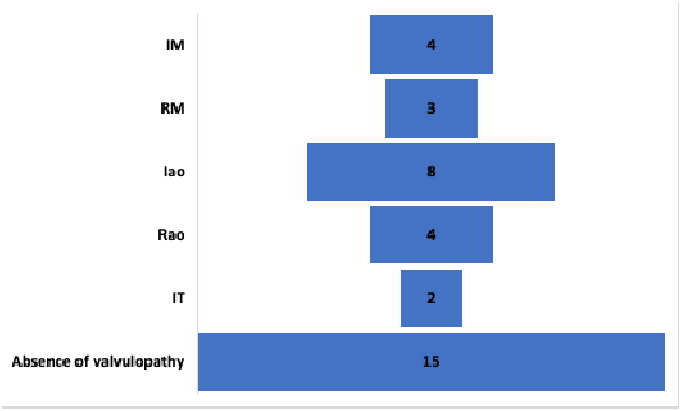

Figure 3 : Distribution according to known history of valvulopathy.

In our series, four patients had endocarditis on aortic prosthesis, i.e. 15% of the cases (3 mechanical prosthesis and 1 biological), while the rest of the cases (85%) had endocarditis on native valve. The valves were rheumatic in 85% (Figure 4).

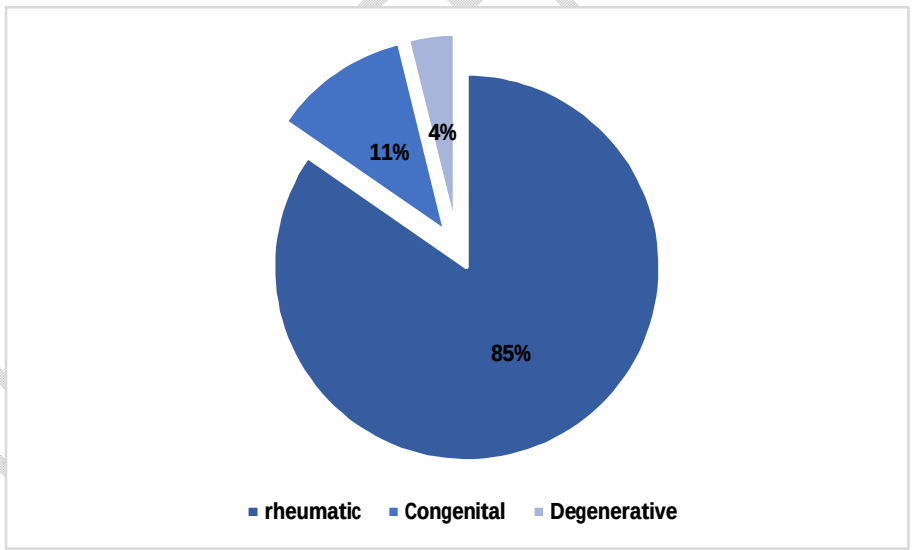

Figure 4 : The distribution of patients according to the nature of the valvulopathy.

The congenital heart diseases found in our series were: one case of persistent ductus arteriosus, one case of IVC, one case of IAo on sub-aortic membrane and three cases of bicuspidia.

3. Bacteriological data:

a. Infectious entry point :

The presumed portal of entry was cutaneous in 45%, oral and ENT in 33%, urinary in 15%, and digestive in 7%.

b. Inflammatory assessment:

In our series, 21 out of 26 patients presented a biological inflammatory syndrome.

C-reactive protein (CRP) was performed in all our patients and was positive in 73% of cases.

Procalcitonin was requested in only 10 patients of our series, coming back positive in 80%. Whereas the SV was requested in 20 patients, coming back positive in 65% of the cases (figure 5).

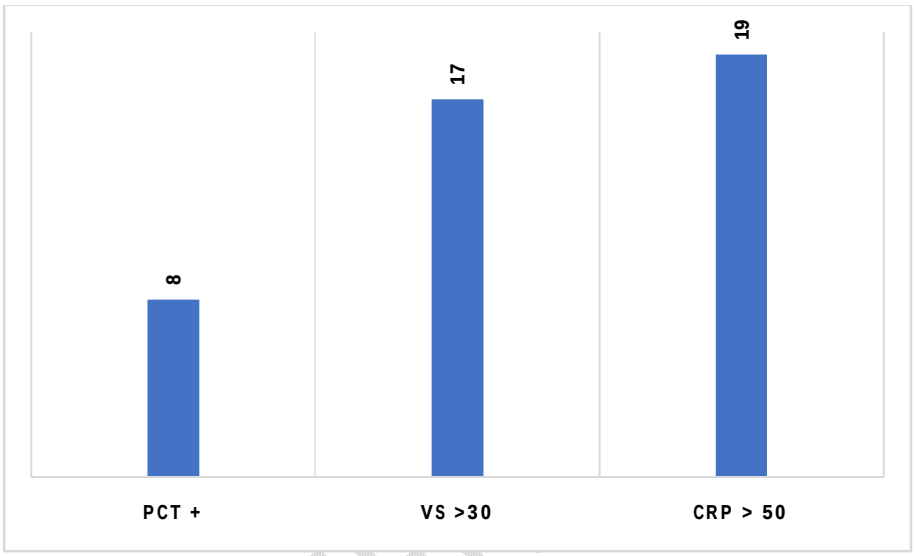

Figure 5 : Distribution of inflammatory findings in our series.

c. Blood culture :

Blood cultures were performed for all patients in our series, with a mean number of 4 (extremes ranged from 2 to 6).

At least one or more blood cultures were positive in 38% of cases (Figure 6).

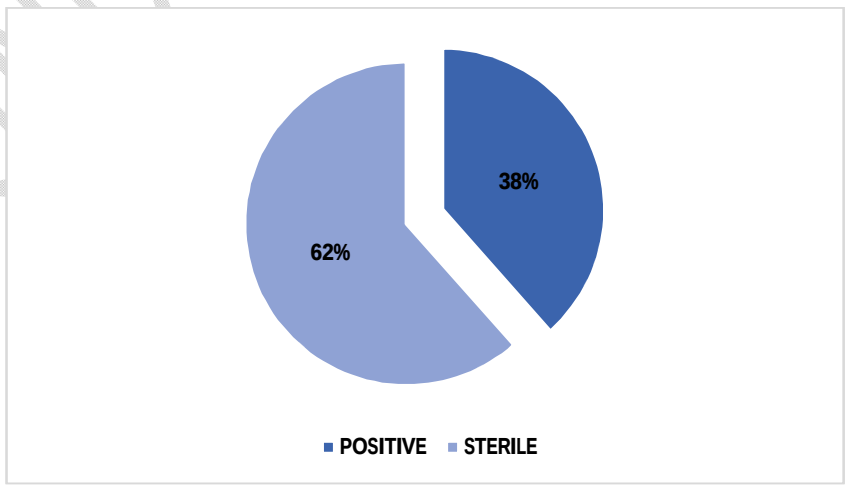

Figure 6 : Distribution of patients according to blood culture results.

Coagulase-negative Staphylococcus was the most common germ in aortic infective endocarditis, found in 40% of positive blood cultures (Figure 7).

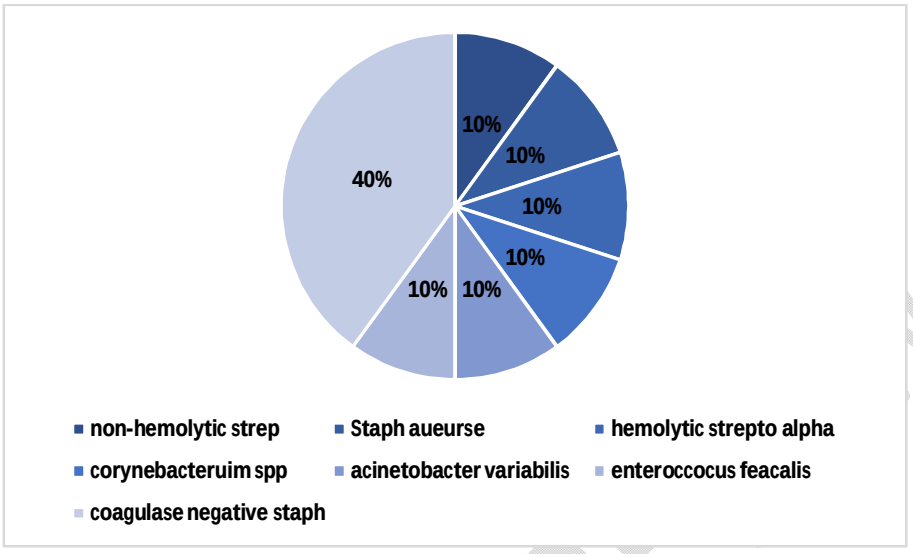

Figure 7 : The distribution of patients according to the incriminated germ.

1. Therapeutic management:

All patients in our series had received a combination of broad-spectrum intravenous antibiotic therapy. A probabilistic antibiotic therapy had been prescribed initially; taking into consideration the cases where the entrance door was found or suspected.

In 92% of cases, third generation cephalosporins (C3G) at a dose of 2g/d for 6 weeks + Gentamycin at a dose of 5mg/kg/d for 2 weeks were prescribed (figure 8).

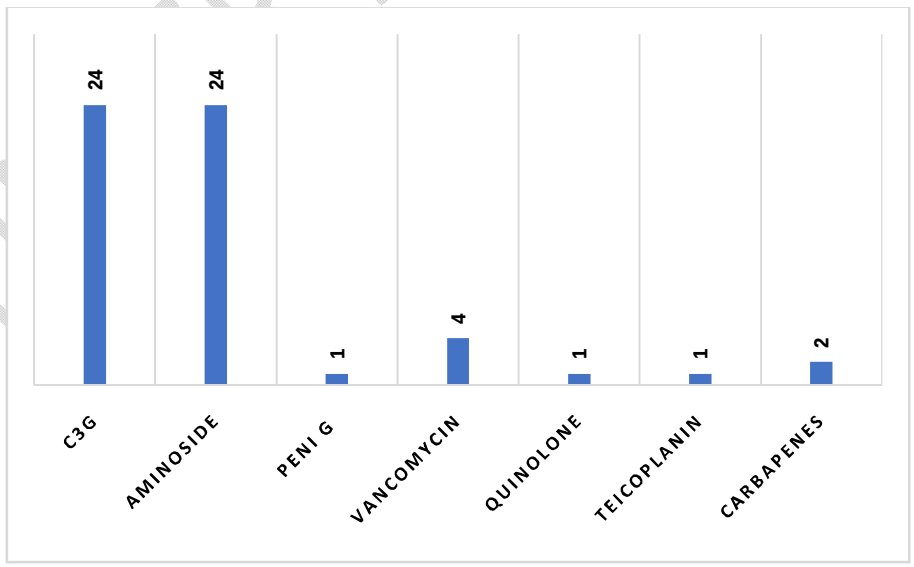

figure 8: The therapeutic classes of antibiotic therapy prescribed in our series.

In each case, after obtaining the results of blood cultures, the curative antibiotic therapy was adapted to the germs.

The distribution of patients according to the duration of antibiotic therapy was presented in figure 9.

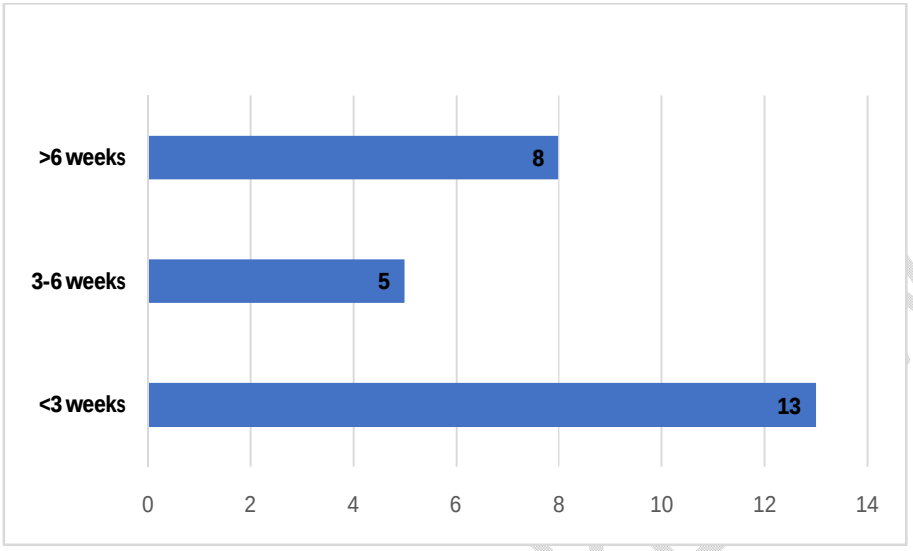

Figure 9: The distribution of patients by duration of treatment.

2. <u>Evolution :</u>

The evolution during the hospitalization, preoperatively, was marked by an improvement of the clinical state in only 12%, a perioperative death in 38%, and a worsening of the clinical state in 50%, with an average duration of hospitalization of 14 days (figure 10).

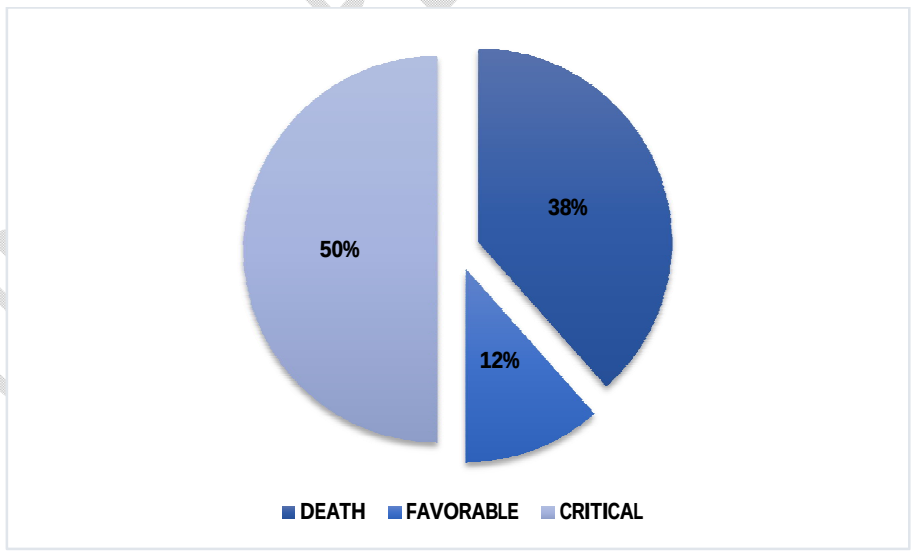

Figure 10: Distribution of patients by infective endocarditis course.

Emergency surgery was indicated in 77% of the cases due to the deterioration of the clinical condition of the patients, and due to the worsening of the lesions, whereas in 23% of the cases valve replacement surgery was indicated after cooling of the lesions, depending on the severity of the CAI as well as the associated valvulopathies.

3. Correlation between death and blood culture positivity in Aortic IE:

In our series, 60% of patients with positive blood cultures died, whereas there was 75% survival in the group with negative blood cultures with a p-value of 0.1 (Table 1).

Table 1: Correlation between death and blood culture positivity.

	Deaths	Survival
Blood culture +	6	4
Blood culture -	4	12

DISCUSSION :

Infective endocarditis is an infrequent but still serious disease, the incidence of which seems to be stable over the last decades [1]. It affects the young population because of the predominance of endocarditis over rheumatic valve disease in our regions.

IE is a serious condition, associated with high mortality and a high risk of complications [2]. It is a rare condition with an incidence of 3-10 cases/100,000 population/year [3]. The underlying valvulopathy is mostly of rheumatic origin in developing countries [4], while in developed countries it is mostly of degenerative origin [1].

The slight male predominance found in our series is consistent with Western series [5]. The importance of these rheumatic valve diseases in the history confirms the persistence of these conditions in Africa, contrary to the new trends concerning endocarditis on pacemaker, prosthetic valves particularly [6].

The percentage of entry points found in our study is high compared to those observed in most African series [1]. However, it is almost similar to that of Western series [7]. The usual predominance of the oral and ENT portal of entry was found in our study as in some authors [8]. The other presumed routes of entry are pulmonary, digestive, urinary and cutaneous. This corroborates the data in the literature.

Concerning the previous cardiac status, infective endocarditis occurs preferentially in a previously damaged heart. Indeed, the prevalence of acquired valvulopathy varies between 70% and 93.4% in the different African series, which is in line with our data (89%), 85% of which are of rheumatic origin [8]. This finding is also related to the rheumatic endemic in our regions.

Clinically, fever and alteration of general condition were important symptoms of infective endocarditis, and any unexplained fever lasting more than 10 days in a patient with a heart murmur should raise the diagnosis of infective endocarditis [10-11].

The percentage of entry points found in our study is high compared to those observed in most African series [1]. However, it is almost similar to that of Western series [7]. The usual predominance of the oral and ENT portal of entry was found in our study as in some authors [8]. The other presumed routes of entry are pulmonary, digestive, urinary and cutaneous. This corroborates the data in the literature.

Streptococci and staphylococci are the germs most often found [3]. In our series, blood cultures were positive in 54% of cases, with a predominance of staphylococci and streptococci (42%).

The incidence of aortic infective endocarditis with negative blood cultures was high in our series (64%) as in the literature in Africa [1]. On the other hand, these blood culture negative infective endocarditis are relatively rare in Western countries in 5 to 10% of cases [12]. As far as positive blood cultures are concerned, the germ most frequently encountered was Staphylococcus Aureus, as was the case for some authors [9].

The management of patients with infective endocarditis requires a multidisciplinary approach involving cardiologists, cardiothoracic surgeons, and infectious disease specialists.

Recent guidelines from an international valve task force specifically emphasize the role of a hospital endocarditis team. Randomized clinical trials to guide management decisions are almost nonexistent, and none of the recommendations in international guidelines on infective endocarditis are supported by Level A evidence (IE., multiple randomized controlled trials). On an empiric basis, antibiotics should be started as soon as blood cultures have been acquired, but clinicians can also wait for culture results if the patient is clinically stable.

Empirical antibiotic regimens for native valve endocarditis and prosthetic valve endocarditis are based on definitive guidelines produced by the British Society for Antimicrobial Chemotherapy (Table 2).

Table 2:Empirical antibiotic regimens for native valve endocarditis and valve endocarditis prothétique [13].

Antibiotic	Dosage and route	Duration, weeks	Class[g]	Level[h]	Ref.[i]	Comments
Beta-lactam and gentamicin-susceptible strains (for resistant isolates see [a,b,c])						
Amoxicillin* with Gentamicin[d]	200 mg/kg/day i.v. in 4–6 doses	4–6	I	B	6,8, 129, 135, 136, 186	6-week therapy recommended for patients with >3 months symptoms or PVE
	3 mg/kg/day i.v. or i.m. in 1 dose	2–6**	I	B		
	Paediatric doses:[e] Ampicillin 300 mg/kg/day i.v. in 4–6 equally divided doses Gentamicin 3 mg/kg/day i.v. or i.m. in 3 equally divided doses					
Ampicillin with Ceftriaxone	200 mg/kg/day i.v. in 4–6 doses	6	I	B	183–185	This combination is active against *Enterococcus faecalis* strains with and without HLAR, being the combination of choice in patients with HLAR *E. faecalis* endocarditis.
	4 g/day i.v. or i.m. in 2 doses	6	I	B		
	Paediatric doses:[e] Amoxicillin as above Ceftriaxone 100 mg/kg/12 h i.v. or i.m.					This combination is not active against *E. faecium*
Vancomycin[f] with Gentamicin[d]	30 mg/kg/day i.v. in 2 doses	6	I	C		
	3 mg/kg/day i.v. or i.m. in 1 dose	6	I	C		

Involvement of local microbiology experts is strongly recommended. The antimicrobial regimen may be modified based on culture results, resistance patterns, severity of infection, and the presence or absence of prosthetic hardware.

In general, combined intravenous therapy is preferred over monotherapy to reduce the emergence of resistance and provide synergistic antimicrobial activity. The exception is meticillin-susceptible S aureus, for which Flucloxacillin monotherapy is sufficient and the addition of gentamicin increases nephrotoxicity [11].

Treatment for at least 4 to 6 weeks is usually required, and much longer in some cases. Patients with uncomplicated native valve endocarditis due to highly susceptible streptococci may be suitable for a short 2-week course of intravenous Benzylpenicillin or Ceftriaxone in combination with gentamicin. Other selected patients who respond to treatment and have appropriate home living conditions might be eligible for home or outpatient antibiotic therapy after the first 2-week period during which the frequency of complications is highest [7].

Reducing bacteremia is the intuitive upstream approach to preventing infective endocarditis. Optimizing the use and maintenance of central venous catheters, including aseptic techniques, early catheter removal, and avoidance of femoral access, reduces rates of catheter-associated bacteremia [14]. Poor oral hygiene is associated with bacteremia after tooth brushing and has long been recognized as an easily modifiable risk factor for infective endocarditis. For patients undergoing cardiac device implantation, antibiotic prophylaxis reduces the risk of subsequent infection. For more than 50 years, oral antibiotic prophylaxis has been used to reduce bacteremia in patients at risk for infective endocarditis undergoing invasive procedures (including dental procedures).

In 2008, the National Institute for Health and Clinical Excellence in the United Kingdom advised that this practice be discontinued, citing the lack of strong evidence, the low overall risk of infective endocarditis from dental procedures, and the potential dangers of indiscriminate antibiotic use ·15]. In contrast, the European Society of Cardiology, the American College of Cardiology, and the American Heart Association have recommended the continued use of antibiotic prophylaxis for patients at highest risk: those with a history of infective endocarditis, prosthetic valve disease, and cyanotic congenital heart disease. Since 2008, several observational studies have examined the effect of full (in the United Kingdom) or partial (in the United States and the rest of Europe) discontinuation of antibiotic prophylaxis [16].

Although previous studies have shown no change in the incidence of infective endocarditis, Dayer and colleagues reported in 2015 a small but statistically significant increase in infective endocarditis cases in the United Kingdom since 2008. The temporal correlation between the decrease in antibiotic prophylaxis use and the increase in the incidence of infective endocarditis clearly raises concerns about current prophylaxis policy in the UK, although causality has not been established. The apparent link could be confounded by an increase in bacteremia rates or the number of people at risk, or by factors related to diagnostic coding. Given this ongoing uncertainty, many UK cardiologists rely on European and US society guidelines and continue to prescribe prophylactic antibiotics to patients at highest risk [17].

CONCLUSION :

Infective endocarditis is a serious disease because of its high morbidity and mortality. Despite improvements in diagnostic testing, antimicrobial therapy, and surgical intervention, changes in the epidemiology of IE, including the increase in healthcare-associated infections and the virulence of staphylococcus aureus as the causative organism increase the risk of complications and death in the acute phase of IE. S. aureus has become both the leading cause and the most important prognostic factor in IE.

Action must be taken to prevent infective endocarditis, especially in this rheumatically endemic area.

REFERENCES:

1. Ndiaye MB, Diao M, Kane A, Bodian M, Mbaye A, Dia MM, et al. Infectious endocarditis in Dakar cardiological environment: descriptive study about 39 cases. Pan Africa Med J 2010;7:12.

2. Diagnosis and management of infective endocarditis and its complications - PubMed
3. Murdoch DR, Corey GR, Hoen B, Miró JM, Fowler VG, Bayer AS, et al. Clinical presentation, etiology, and outcome of infective endocarditis in the 21st century: the International Collaboration on Endocarditis-Prospective Cohort Study. Arch Intern Med 2009;169(5):463 73.
4. Takayama Y, Okamoto R, Sunakawa K. Definite Infective Endocarditis: Clinical and Microbiological Features of 155 Episodes in a Japanese University Hospital. Journal of the Formosan Medical Association 2010; 109(11):788 99.
5. Murdoch DR, Corey GR, Hoen B, Miró JM, Fowler VG, Bayer AS, et al. Clinical Presentation, Etiology and Outcome of Infective Endocarditis in the 21st Century: The International Collaboration on Endocarditis-Prospective Cohort Study. Arch Intern Med 2009; 169(5):463 73.
6. Hogevik H, Olaison L, Andersson R, Lindberg J, Alestig K. Epidemiologic aspects of infective endocarditis in an urban population. A 5-year prospective study. Medicine (Baltimore) 1995;74(6):324 39.
7. Masson E. Infectious endocarditis [Internet]. EM-Consult.
8. El Bekkali Y, Boulahya A, Wahid F, Aouifi A, Amehzoune B, Salkane C, et al. Surgery for infective endocarditis in the active phase: about 13 cases. Annals of Cardiology and Angiology. 2001;50 (5):269 73.
9. Bouramoue C, Nkoua JL, Kimbally G. et al. Infectious endocarditis: Experience of a Brazzaville department: about 47 cases. Cardiol Too 1992; 18:134.
10. Ndiaye M, Diao M, Kane A, Bodian M, Mbaye A, Dia M, et al. [Infectious endocarditis in a cardiac setting in Dakar: descriptive study of 39 cases]. The Pan African medical journal 2010; 7:12.
11. Ferrieri P, Gewitz MH, Gerber MA, Newburger JW, Dajani AS, Shulman ST, et al. Unique features of infective endocarditis in childhood. Traffic 2002; 105(17): 2115 26.
12. Barnes PD, Crook DW. Culture negative endocarditis. J Infected. 1997;35(3):209 13.
13. Cahill TJ, Prendergast BD. infective endocarditis. The Lancet; 2015 ; s0140-6736(15):00067-7
14. Miller SE, Maragakis LL. Central line-associated bloodstream infection prevention. Curr Opin Infect Dis. 2012; 25(4):412 22.
15. Lockhart PB, Brennan MT, Thornhill M, Michalowicz BS, Noll J, Bahrani-Mougeot FK, et al. Poor oral hygiene as a risk factor for infective endocarditis-related bacteremia. J Am Dent Assoc. 2009; 140(10):1238 44.
16. Pasquali SK, He X, Mohamad Z, McCrindle BW, Newburger JW, Li JS, et al. Trends in endocarditis hospitalizations at US children's hospitals: impact of the 2007 American Heart Association Antibiotic Prophylaxis Guidelines. Am Heart J. 2012; 163(5):894 9.
17. Dayer MJ, Jones S, Prendergast B, Baddour LM, Lockhart PB, Thornhill MH. Incidence of infective endocarditis in England, 2000-13: a secular trend, interrupted time-series analysis. Lancet 2015; 385(9974):1219 28.
18. Selton-Suty C, Célard M, Le Moing V, Doco-Lecompte T, Chirouze C, Iung B, et al. Preeminence of Staphylococcus aureus in infective endocarditis: a 1-year population-based survey. Clin Infect Dis 2012; 54(9):1230 9.