Predictors of Mortality in Infective Endocarditis: A Retrospective Study

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Introduction: Infective endocarditis (IE) remains a major health problem with significant morbidity and mortality rates. Despite its serious implications, data on prognostic factors remain scarce.
Aim: We aim to determine predictive factors of mortality during infective endocarditis.
Methods: We performed a retrospective study including patients admitted to university hospital Mohammed 6 of Marrakech between September 2019 and January 2024 for a confirmed IE based on Dukes modified criteria.
Results: Of 43 patients included, 30 were males (69%) and 13 were females (30%). The mean age was 47.4 for men and 49.30 for women. 44.1% of our patients were admitted in heart failure, and 37% presented themselves late to our facility for management. Only 25.58% suffered from kidney failure and 55.8% presented an LV dysfunction. Complications were noted at a rate of 48%. Male's group had less complication rate with 10% vs 38% in females' group (p=0.042). And an overall mortality rate was at 34% and there were no significant sex related differences in terms of mortality between the two groups (33% in males vs 38% in females, p = 0.742).

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The analytical study concluded that heart failure at admission(p<0.001), neurological complications(p=0.024), anemia (p=0.049), kidney failure (p=0.002), prolonged antibiotics (p=0.016), LV dysfunction (p=0.027) and an emergency surgery (p<0.001) were independent risk factors for mortality.

Conclusion: Our study underscores the urgent need to identify predictive factors of mortality in infective endocarditis (IE), and to adopt a multidisciplinary approach to enhance the care and management of patients, ultimately aiming to improve their survival rates.

1. INTRODUCTION

Despite the major interest shown by scientific societies and the frequent update of guidelines in the management of infective endocarditis (IE), it stubbornly maintains its rank among the most lethal infectious diseases, casting a shadow of uncertainty over patient outcomes. In a landscape where research is scarce, we sought to determine prognostic factors in IE patients for a better understanding and an improved care.

2. STUDY METHODS

2.1 Study Design

We conducted a retrospective, descriptive study spanning from September 2019 to January 2024, focusing on hospitalized patients diagnosed with infective endocarditis involving native valves, prosthetic valves, or endocavitary devices such as pacemakers.

2.2 Data Collection

Data collection encompassed a comprehensive range of parameters, including patients' demographic characteristics, clinical presentations, laboratory findings, bacteriological profiles, detailed echocardiographic evaluations and surgical management. Initial and late outcomes were meticulously documented.

2.3 Statistical Analysis

Statistical analysis of the collected data was performed using SPSS version 26.0 software. Risk factors for mortality were identified through univariate analyses. The significance level for all statistical tests was set at 0.05.

By following these methodological steps, we aimed to provide a robust analysis of prognostic factors in infective endocarditis patients, shedding light on critical determinants of outcomes in this challenging clinical scenario.

3. RESULTS

In this study of 43 patients with infective endocarditis, the demographic distribution revealed 69% males and 30% females with a sex ratio of 2.3, with mean age of 48.02 +/- 15.13, with extremes varying between 14 and 75 years old.

All of our patients were on synergistic bactericidal antibiotics according to guidelines. The average duration of antibiotherapy was 21.04 days+/-13.04 with a minimum of 5 days and a maximum of 56 days. Their administration was probabilistic in 32 patients (40.5%) and adapted to blood culture once the results are out in 17 patients (39.5%). The staphylococcus aureus was isolated in nine cases; streptococcus pneumoniae in seven cases; and acinetobacter in one case.

Our patients presented with more than 2 comorbidities (renal failure, diabetes mellitus, substance abuse) in 70.45%. Notably, infective endocarditis on prosthetic valves was observed in 13.95% of cases.

Renal function was monitored strictly on a twice-weekly basis, however, 16 patients in our series had an altered GFR following AKI in 12 patients (27.9%), while four patients were already known to have chronic renal failure at the haemodialysis stage. 27.3% of these patients had moderate to severe renal failure due to renal arterial emboli in two cases, in six cases following vasculitis glomerulonephritis, two cases following gentamycin-induced nephrotoxicity, and in two cases following low-flow hypoperfusion due to cardiogenic shock.

The outcome was favourable in 22 patients (51.16%) with numerous complications in 48% of the cases with a lower rate within males (10%) compared to females (38%). Overall, we found 35 vascular lesions due to embolization that were neurological in 38.6%, with arterial limbs occlusion in 9.09%, 6.81% in splenic infarcts, and 4.54% septic pulmonary embolisms and renal infracts respectively.

Table 1. Predictive factors of mortality in the univariate study

Prognostic factors of mortality	Dead n=15	Survivors n=28	P
Male	10	20	0.504
Subacute installation	10	21	0.561
Diagnosis delay >1month	5	11	0.700
Valvular abscess	3	6	0.913
Neurological complications	6	3	0.024
Embolic complication	8	10	0.264
Heart failure symptoms	10	9	0.030
Urgent surgery	15	9	<0.001
Duration of ATB>21 days before surgery	5	20	0.016
Blood culture	7	10	0.484
Anemia	13	16	0.049
WB	13	18	0.119
Renal failure	8	3	0.002
CRP>128	8	9	0.176
RV dysfunction	3	5	0.863
HF with reduced EF	5	2	0.027

A surgical treatment was offered in 88.37% of the cases. An urgent surgery was indicated in 55.8% of the cases. The indications were for four cases of distal embolization; four cases for uncontrolled infection and four cases for hemodynamic instability and ten cases for hemodynamic instability associated to uncontrolled infection. An elective surgery was indicated in 32.55% of the cases for a persistent valvular disease after a complete cure of antibiotics. Plasty of the tricuspid valve was associated in 48.8% of the cases in the surgical approach of valve replacement. A double prosthetic replacement was done in 39.5% of the cases, a mitral replacement in 13.9% of the cases; an aortic replacement in 16.2% of the cases; and the cure of the underlying congenital heart disease in 6.9% of the cases. We noted by the same occasion only one case of mitral plasty.

Univariate analysis enabled us to determine several factors predictive of mortality with an overall mortality rate at 34% and there were no significant sex related differences in terms of mortality between the two groups (33% in males vs 38% in females, p = 0.742).

Significant predictive factors were the neurological complications, admission with heart failure symptoms, an urgent surgical indication, a short duration of ATB<21 days before surgery, anemia, a reduced heart fraction ejection and mostly renal failure. Other factors predictive of mortality were studied but the statistical correlation was not significant namely gender, CRP, isolated germ and others reported in the table (Table 1).

4. DISCUSSION

Infective endocarditis (IE) will always be a major public health challenge. First, the population at risk of IE has increased and new data on IE in different clinical scenarios have arisen. Furthermore, the emerging and increasing antibiotic resistance among oral streptococci is of concern [1].

The pattern of IE varies worldwide, especially related to patient characteristics and predisposing conditions. In low-income countries, rheumatic heart disease remains the most common underlying valvular condition, whereas degenerative valve disease is the most frequent native valve predisposing factor in high- income countries [2].

The poor prognosis of IE is mainly related to complications occurring during the in-hospital stay, including embolic events, periannular extension of the infection, and valve dysfunction causing heart failure. These complications are the cause of the high morbidity and mortality during hospitalization. Previous studies addressing the prognosis of IE have highlighted important predictors of in-hospital mortality. However, many risk factors will only be identified during treatment and not at the time of hospital admission. Heart failure and periannular complications are well- established predictors of an unfavorable outcome, but these are not usually assessed at the diagnosis of IE [3].

Most of our patients were males (69%) and the majority of the cases were from native valves (86.1%), a similar pattern was reported in studies conducted in developing countries. IE has a well-recognized and consistent male predominance, with a reported male to female ratio of 1.2 to 2.7. This might be related to the male predominance in congenital cardiac conditions, such as a bicuspid aortic valve that

also has a male predominance [4]. Notably, infective endocarditis on prosthetic valves was observed in 13.9% of cases. in the range described in literature (10–30%) [5,6,7].

The staphylococcus aureus was isolated in nine cases; streptococcus pneumoniae in seven cases; and acinetobacter in one case. These findings are in accordance with the international literature, which demonstrates a significant increase in S. aureus prevalence (21%-30% in the last five decades), currently representing the most frequent microbiological agent in high-income health systems [8]. The transition in pathogen pattern, from viridans streptococcus to S. aureus, has been associated with population-aging, decrease in rheumatic heart disease burden, and advanced device management in various cardiac pathology [9].

Mortality due to infective endocarditis declined during its evolution in two periods: after the advent of penicillin in 1945, and more recently with the development of cardiac surgery and improved diagnosis using cardiac ultrasound and new bacteriological techniques.

The overall mortality rate in our series is estimated at 34.8%. This rate varies considerably depending on the series; in the HENTALI series, the mortality rate was estimated at 24% [10]. In the PEREIRA NUNES series, it was estimated at 32% [11]. This higher mortality rate may be justified by differences in patients' profile, with a high prevalence of multiple comorbidities, and a delay in reaching medical assistance. In our study, the long delay time between symptoms onset and hospital admission was a major determinant in the mortality.

The factors associated to increased risk of in-hospital mortality in our study were: neurological complications; heart failure symptoms at admission; the need of an urgent surgical interferation; a short duration of ATB before surgery [10], anemia; reduced heart fraction ejection; and renal failure [12].

The major limitation of our study is its retrospective and single- center design, enrolling patients from a tertiary-care center, which could not represent the profile of the entire Moroccan health system. It is also important to highlight that the description of temporal trends and associations does not provide evidence of causality. Despite a long-term enrollment period, this study focuses on short-term results [13].

5. CONCLUSION

In conclusion, the dynamic landscape of infective endocarditis involves complex factors, including changing patient demographics, pathogen patterns, and treatment hurdles. While advancements in cardiac surgery, antibiotics, and diagnostics have enhanced outcomes, high mortality rates and diverse risk factors highlight the persistent public health challenge posed by IE. Further research, particularly long-term prospective studies, is crucial to deepen understanding, refine treatments, and ultimately improve management. By addressing the multifaceted aspects of infective endocarditis, we aim for better outcomes and a promising future for affected patients.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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