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Infective Endocarditis in Children: Challenges and Evolving Profile in Portugal

Endocardite Infecciosa em Crianças: Desafios e Perfil em Mudança em Portugal

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INTRODUCTION

Infective endocarditis (IE) is a rare but severe infectious and systemic clinical condition affecting the cardiac endocardium and implanted devices, associated with significant morbidity and mortality. Epidemiological data on IE show considerable variability and limited reproducibility, due to heterogeneity in case definitions, study populations, and geographical and sociodemographic factors, as well as the absence of large multicentric registries.

Recent population-based studies[1,2] have reported an increasing trend in the incidence of IE, a rise in complications, persistently high all-cause mortality, and lower-than-expected rates of surgical intervention. In Portugal, the incidence of IE in the pediatric population was quite low (0.3 - 0.6/100 000 inhabitants), revealing a non-significant rising trend between 2010 and 2018.[1] Nevertheless, data on pediatric IE remains limited, highlighting the need for further investigation in this subgroup.

The landscape of infective endocarditis in children in recent years and its lessons

The study conducted by Dias *et al*[3] provides an updated overview of the current epidemiological profile of IE in the pediatric population. This was a retrospective, single-center analysis carried out at a tertiary care hospital, encompassing all pediatric cases diagnosed with IE between 2008 and 2022. A total of 27 patients were included, with a mean age of 9.2 years. The majority (88.9%) had underlying structural heart disease, predominantly of congenital origin. Cardiac prosthetic material was present in 58.9% of the cohort, although only a minority of cases (25.9%) were attributable to healthcare-associated infections. Transthoracic echocardiography revealed identifiable vegetations in only one-third of the patients, underscoring the diagnostic challenges in this population. Curiously, transesophageal echocardiogram was only performed in 33% of patients. Nevertheless, computed tomography (CT) was performed in 44.4% of patients and PET-CT in 25.9%. This likely reflects a growing adoption of a multimodality imaging strategy, particularly given the inclusion of several patients diagnosed following the release of the 2015 European Society of Cardiology (ESC) guidelines on infective endocarditis. These guidelines emphasized the importance of integrating multiple imaging modalities and introduced updated diagnostic criteria to enhance the sensitivity and specificity of IE detection.

Interestingly, the surgical treatment rate for IE reported in this study is non inferior compared to the more recent single-center retrospective observational studies from adult cohorts in Portugal.[4]

Notably, the study reports a discernible upward trend in the annual incidence of IE from 2018 to 2022, suggesting an evolving clinical landscape. These findings are largely attributable to technical advances in surgical approaches and medical management of congenital heart disease (CHD), which have markedly improved survival rates. However, they have also contributed to a growing population of children at increased risk for IE and its associated complications, including significant morbidity and long-term functional impairment. This observation aligns with the existing literature, which estimates that only 8% - 10% of pediatric IE cases occur in children without CHD. Furthermore, the 25-year cumulative incidence of IE in patients with surgically corrected CHD is reported to range from 1.3% to 13%.

Given the well-established risk that CHD confers for the development of IE, preventive strategies should be increasingly emphasized and prioritized in this patient population. Key measures include appropriate use of antibiotic prophylaxis in high-risk scenarios, rigorous maintenance of oral health, and strict adherence to aseptic techniques during invasive procedures. These findings also underscore the need for standardized clinical protocols and well-established multidisciplinary referral networks to ensure timely diagnosis and management of a condition that appears to be increasing in incidence within this population.

In terms of microbiological profile, *Staphylococcus*

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aureus emerged as the most frequently isolated pathogen, followed by streptococcal species. This profile mirrors recent trends observed in adult IE registries,[5] in which *Staphylococci* have become the predominant causative agents. This shift is likely related to the increased use of intravascular devices and cardiac prostheses, including prosthetic valves and endovascular catheters, commonly employed in the management of congenital heart anomalies.

Limitations and external validity of findings

The study by Dias *et al*[3] presents several methodological and analytical limitations. Drawing population-level inferences from a single-center cohort comprising only 27 diagnosed cases inherently limits both the statistical power and external validity of the findings. Although the study was conducted at a national referral center for both infective endocarditis and congenital heart disease – thereby enabling the inclusion of a relatively higher number of cases and reflecting considerable clinical expertise – this setting introduces a notable selection bias.

From a methodological standpoint, one of the principal limitations of this study pertains to the case definition and the consistency in establishing a definitive diagnosis of IE. Notably, the authors acknowledge that the modified Duke criteria were not systematically applied, primarily due to logistical constraints. Furthermore, the use of imaging modalities lacked standardization, with no uniform diagnostic protocol in place. This variability introduces potential for diagnostic inconsistencies, including both underdiagnosis and overdiagnosis of IE cases.

It is also important to highlight the absence of data regarding patients' ethnic background, geographical origin, and migration status. This is particularly relevant in the context of ongoing demographic shifts in increasingly globalized societies. In Portugal, for instance, there has been a notable rise in migrant populations, many of whom originate from other Portuguese-speaking countries, particularly in Africa, sometimes with established healthcare protocols. As such, future epidemiological studies should incorporate sociodemographic variables to better characterize the affected populations and to inform tailored public health strategies.

A changing profile in Portugal for infective endocarditis in children

In the last 30 years, this is the fourth (retrospective) published analysis derived from pediatric single centers in Portugal (Table 1).

The first three series were published between 1996 and 2001.[6-8] This, once again, reflects the paucity of data in this field.

The recent work by Dias *et al* reveals a higher number of patients/year, a significant higher percentage of positive blood cultures and a significant lower all-cause mortality. Congenital heart disease constitutes a significant risk factor for IE in this specific subpopulation.

The rate of cardiac surgery was significantly higher in the study by Dias *et al*[3] when compared to the same institution in the series from Lira *et al*[8] in 2001.

Table 1 – Population characteristics of the pediatric cohorts of patients with infective endocarditis hospitalized in Portugal

Studies	Cunha *et al*,[6] 1996	Teixeira *et al*,[7] 1997	Lira *et al*,[8] 2001	Dias *et al*,[3] 2025
City	Coimbra	Porto	Porto	Porto
Period	1985 - 1995	1993 - 1997	1991 - 1998	2008 - 2022
Number of years	11	5	8	15
Sample size (n)	17	7	7	27
Patients/year	1.55	1.40	0.88	1.80
Mean age (years)	(range 10 days - 11 years old)	9	(range 4 months - 11 years old)	9.2
Male sex (%)	NA	43	43	40
Predominant sign (%)	Fever (88%), heart murmur (74%)	Fever (71.4%), heart murmur (57%)	Fever (100%)	Fever (88.9%)
Congenital heart disease (%)	65	86	86	85
Positive blood culture (%)	59	29	57	96
Heart failure (%)	53	NA	NA	NA
Uncontrolled infection (%)	0	NA	NA	NA
Embolization (%)	41	57	NA	44.4
Cardiac surgery (%)	0	43	0	29.6
Intrahospital mortality (%)	23.5	14	14	7.4

NA: not available

CONCLUSION

High-quality, evidence-based, and prospective data in infective endocarditis remain limited, especially in a pediatric population, with a notable absence of large-scale, multicentric studies capable of providing robust and generalizable conclusions. Nevertheless, investigations of this nature remain extremely valuable, particularly given the rarity of pediatric infective endocarditis. In such contexts, small-scale, single-center studies can provide crucial insights, especially within specific subpopulations. The profile of IE in this specific population is also evolving.

This highlights the need for IE registries that include the pediatric population that can capture the full picture.

AUTHOR CONTRIBUTIONS

JFP: Writing – original draft.

CS: Contents review as expert in the topic. Draft of the table comparing the results of this study with those of previous articles. Data curation.

PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association updated in October 2024.

DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

COMPETING INTERESTS

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