

## Original Research Article

## Echocardiographic Assessment of Perivalvular Extension in Infective Endocarditis

Hanaa Amchaarou (MD)<sup>1\*</sup>, Mehdi Berrajaa (MD)<sup>1</sup>, Wassim Beladel (MD)<sup>1</sup>, Khalil Abderrahmane Elbaz (MD)<sup>1</sup>, Mohamed El Minaoui (MD)<sup>1</sup>

<sup>1</sup>Cardiology Department, University Hospital Agadir, Medical School of Medicine & Pharmacy Ibn Zohr University, Agadir, Morocco

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**Abstract:** Infective endocarditis (IE) is a severe, life-threatening disease of the endocardial surface, most often caused by bacterial infection. Despite advances in diagnostic and therapeutic strategies, IE continues to be associated with high morbidity and mortality, largely due to its heterogeneous clinical presentation and the destructive cardiac complications it may cause. Echocardiography, whether transthoracic (TTE) or transesophageal (TEE), remains the cornerstone imaging modality for diagnosis, guiding therapeutic decisions, and monitoring disease progression. It is particularly crucial for the detection of perivalvular and valvular complications, which significantly influence prognosis. In this context, we conducted a clinical study at the University Hospital Souss Massa in Agadir. The primary objective of this study was to characterize the echocardiographic perivalvular involvement in infective endocarditis, with particular emphasis on the frequency of destructive complications—including abscesses, pseudoaneurysms, new partial prosthetic valve dehiscence, and fistulas—and to assess their detection using transthoracic (TTE) and transesophageal echocardiography (TEE). Secondary objectives included comparing our local data with those in the international literature, in order to place our experience in the global context and draw clinical implications.

**Keywords:** Echocardiography, Perivalvular, Infective Endocarditis, Abscesses, Pseudoaneurysms, Prosthetic Valve Dehiscence, Fistulas, Diagnostic, Prognosis.

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## INTRODUCTION

Infective endocarditis (IE) is a severe infection of the endocardial surface, most often caused by bacteria, and remains a condition associated with considerable morbidity and mortality despite advances in diagnostic and therapeutic strategies. The estimated annual incidence ranges from 3 to 10 cases per 100,000 inhabitants in industrialized countries, and the mortality rate remains between 15–30% even with optimal care [1, 2]. The clinical presentation is heterogeneous, often delaying diagnosis, and the disease is frequently complicated by destructive valvular or perivalvular lesions.

Perivalvular extension represents one of the most severe complications of IE, encompassing abscess formation, pseudoaneurysms, fistulas, and new prosthetic valve dehiscence. These lesions significantly worsen prognosis, being associated with higher rates of heart failure, conduction disturbances, and urgent surgical indication [3, 4]. Early detection is therefore crucial for management and surgical planning.

Echocardiography plays a central role in the diagnosis and management of IE. Transthoracic echocardiography (TTE) is the first-line imaging modality, widely available, non-invasive, and essential for the initial assessment of suspected cases. Transesophageal echocardiography (TEE), with its higher resolution and proximity to cardiac structures, is a complementary technique that provides additional accuracy in complex situations, such as the perivalvular extension, or inconclusive TTE findings. Together, TTE and TEE represent the cornerstones of diagnostic imaging, guiding therapeutic decisions and monitoring disease progression [4, 5].

In this context, the present study was conducted at the University Hospital Souss Massa in Agadir, Morocco. Its primary aim was to characterize echocardiographic perivalvular involvement in patients with IE, with a particular focus on the prevalence of destructive lesions such as abscesses, pseudoaneurysms, new prosthetic valve dehiscence, and fistulas, and to evaluate their detection by TTE and TEE. Secondary objectives included comparing these findings with the

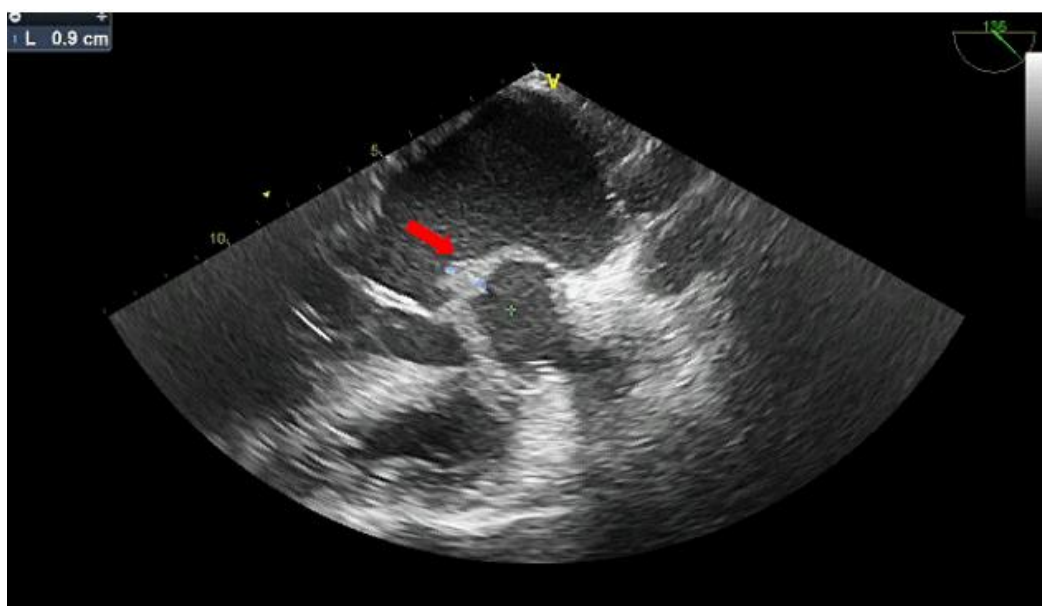
international literature to situate our experience within the global context.

## MATERIALS AND METHODS

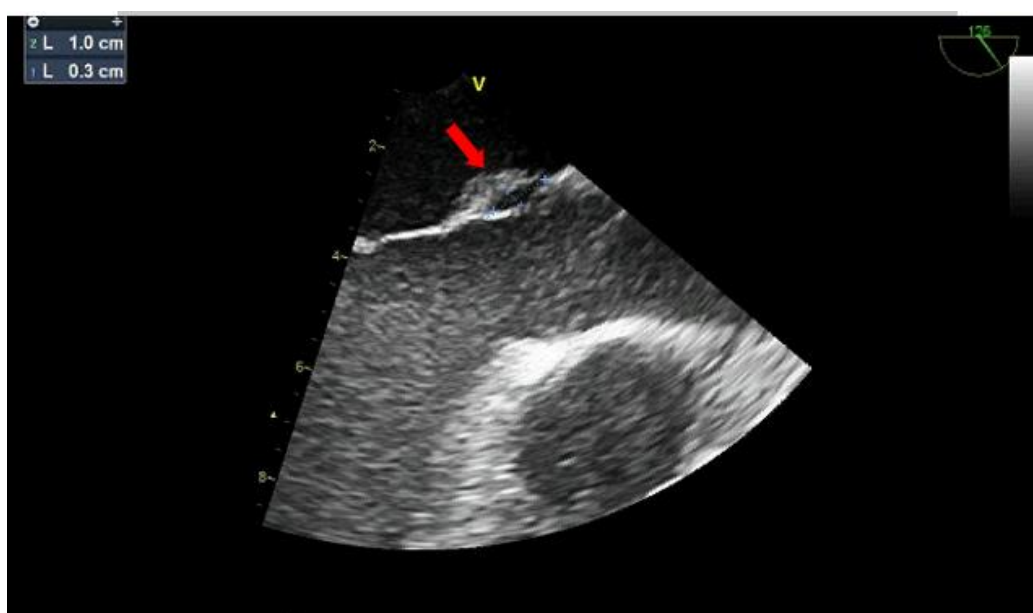
We included 26 patients aged 16 years or older with a definite or possible diagnosis of infective endocarditis (IE) according to the modified Duke criteria, who had undergone transthoracic and/or transesophageal echocardiography during their management. Exclusion criteria comprised patients younger than 16 years, those for whom the diagnosis was excluded based on the same criteria, and cases with incomplete medical records that prevented reliable data collection.

## RESULTS

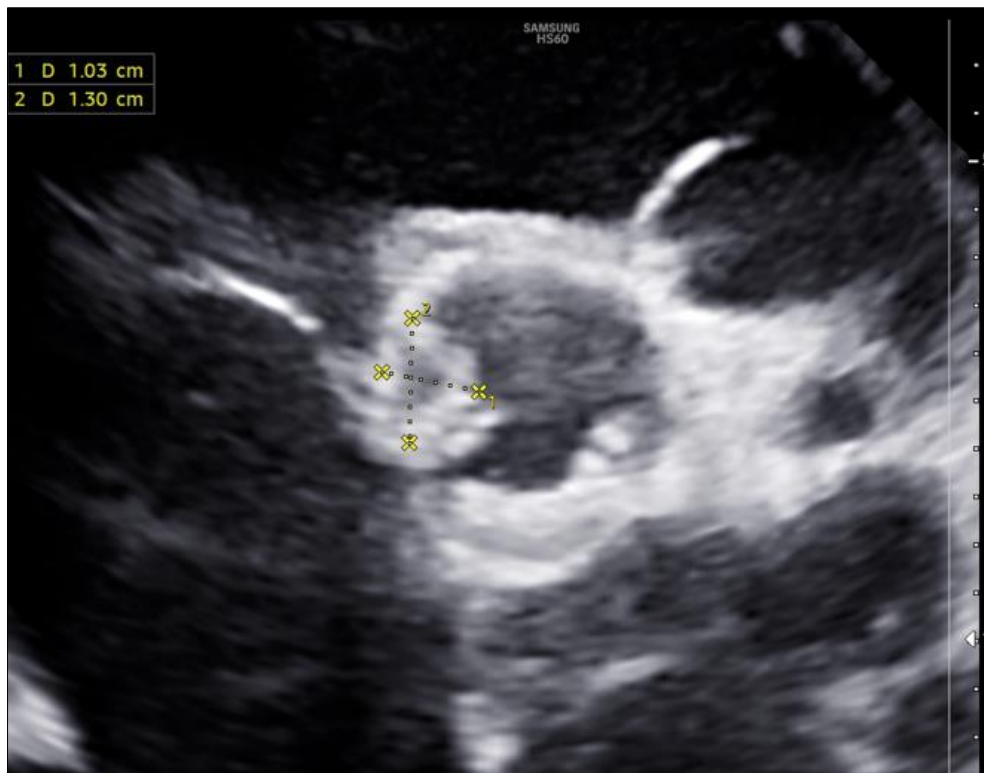
Among the 26 patients included in the study, echocardiographic evaluation, performed systematically with transthoracic and, when necessary, transesophageal imaging, demonstrated evidence of perivalvular extension in several cases. The most frequently encountered lesions consisted of perivalvular abscesses, which were identified in two patients, representing 7.7% of the study population. In addition, a periprosthetic abscess was observed in one patient (3.8%). All of these abscesses were located predominantly at the level of the aortic annulus, which was the main site of extension in our series.



**Figure 1: Mid-esophageal long-axis view showing a circumferential peri-aortic abscess in a patient with a bileaflet mechanical prosthesis in the aortic position (TEE)**

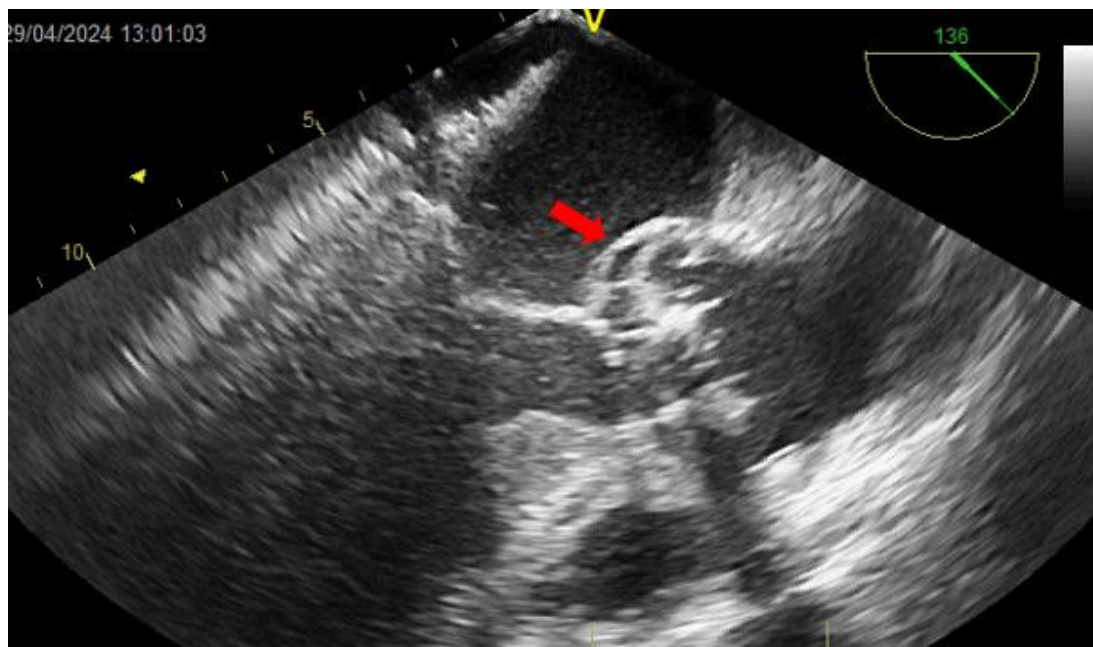


**Figure 2: Mid-esophageal long-axis view focused on the native aortic valve, demonstrating an aortic annular abscess adjacent to the left coronary cusp (TEE)**



**Figure 3: Parasternal short-axis view at the aortic valve level, demonstrating an aortic periprosthetic abscess measuring 10.3 × 13 mm (TTE)**

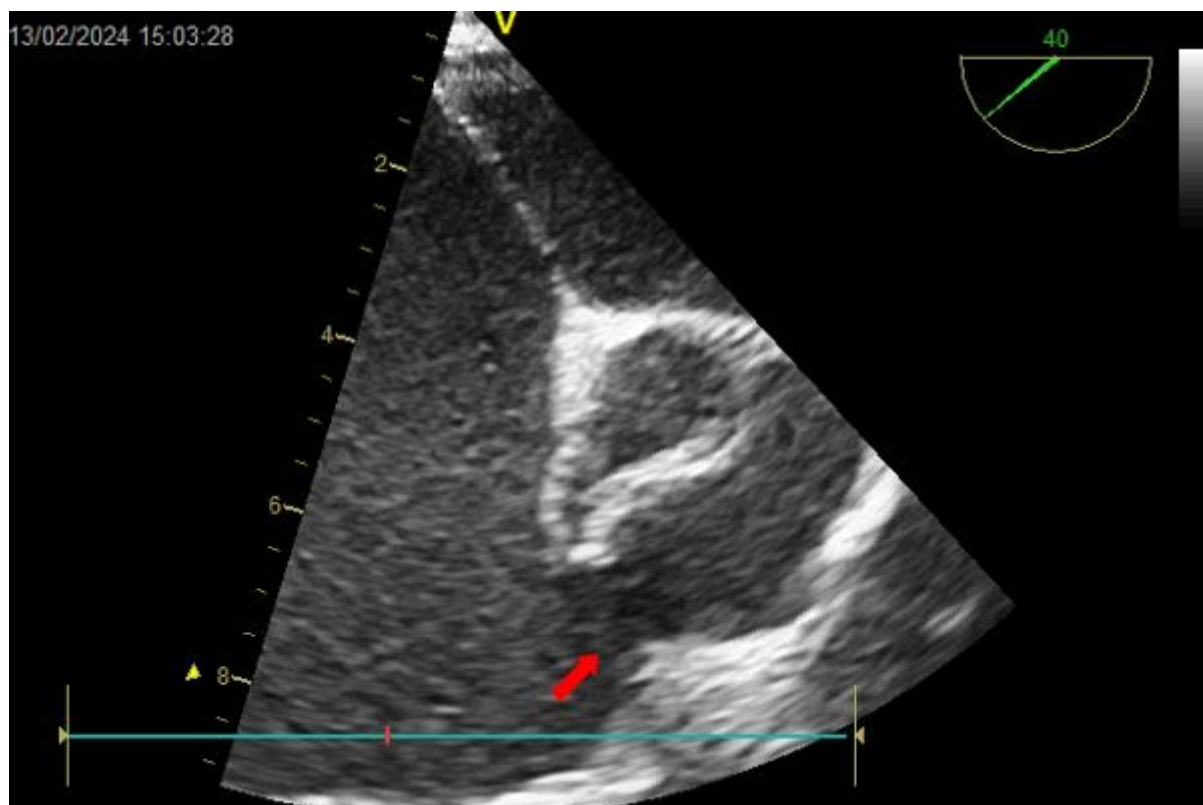
In addition, prosthetic valve dehiscence was documented in one patient, highlighting the destructive potential of infective endocarditis on prosthetic material.



**Figure 4: Mid-esophageal long-axis view focused on the aortic valve, showing dehiscence of a bileaflet mechanical prosthesis in the aortic position (TEE).**

Rare but severe complications were also detected. One patient developed an aorto–right atrial fistula, while another presented with an aortic root pseudoaneurysm involving the sinus portion of the

ascending aorta, revealed in the context of severe aortic regurgitation during infective endocarditis of the aortic valve.



**Figure 5: Mid-esophageal aortic valve short axis view, demonstrating an aorto–right atrial fistula secondary to infective endocarditis (TEE).**

Overall, perivalvular extension was documented in 6 out of 26 patients (23%), underscoring the major role of echocardiography—particularly

transesophageal echocardiography—in detecting these life-threatening complications. These findings are summarized in **Table 1**.

**Table 1: Perivalvular Extension in Infective Endocarditis**

Type of Perivalvular Complication	Number of Cases
Perivalvular abscess	2
Periprosthetic abscess	1
Prosthetic valve dehiscence	1
Aorto-right atrial fistula	1
Aortic root pseudoaneurysm	1

## DISCUSSION

Perivalvular extension of infection (PVEI) is a serious complication of bacterial endocarditis and is well recognized to cast a shadow over prognosis [6]. It reflects locally uncontrolled infection and should be suspected in patients with persistent bacteremia, recurrent emboli, new conduction abnormalities, or hemodynamic compromise despite appropriate antimicrobial therapy [7]. The main manifestations are abscesses, pseudoaneurysms, prosthetic valve dehiscence, and intracardiac fistulas [8].

Echocardiography remains the cornerstone of diagnosis. Since the introduction of transesophageal echocardiography (TEE), recognition of periannular complications has improved considerably [6]. Compared with transthoracic echocardiography (TTE), TEE has superior sensitivity and is particularly valuable in

prosthetic valve endocarditis where artifacts compromise TTE assessment [8, 9]. Abscesses typically appear as nonhomogeneous perivalvular thickening, pseudoaneurysms as pulsatile echo-free cavities communicating with the lumen, and fistulas as abnormal color Doppler connections between adjacent cavities [8–10]. These echocardiographic features are crucial for timely surgical referral.

In our study, perivalvular extension was documented in 23% of patients. The most frequent lesions were perivalvular abscesses, identified in two patients (7.7%), and one periprosthetic abscess (3.8%), all located predominantly at the level of the aortic annulus. Prosthetic valve dehiscence was observed in one patient and also involved the aortic valve, highlighting the destructive potential of infective endocarditis on prosthetic material. In addition, one patient developed an aorto–right atrial fistula, and



another presented with an aortic root pseudoaneurysm of the sinus portion of the ascending aorta. Taken together, these findings demonstrate that all perivalvular lesions in our study affected the aortic valve, supporting the well-established observation that aortic valve endocarditis is most frequently associated with periannular complications.

These results are consistent with the literature. The incidence of perivalvular extension ranges from 10% to 30% in native valve endocarditis, with higher incidences in prosthetic valve cases [11]. Perivalvular complications and abscesses occur more frequently in the aortic than in the mitral position and are particularly common in bicuspid aortic valves compared with tricuspid ones [12]. In aortic valve endocarditis, extension most often involves the mitral-aortic intervalvular fibrosa [13], whereas in mitral IE, abscesses tend to be posterior or lateral. Our findings also mirror Moroccan experiences: Harrak *et al.*, at CHU Ibn Sina, Rabat, reported periannular abscesses mainly at the aortic annulus, and at CHU Tangier, the frequency was 11.3% [14, 15]. On a larger scale, the EURO-ENDO registry reported abscesses and pseudoaneurysms in 13.9% of cases, and the ICE-PCS study confirmed 14.4%, both noting a higher mortality in this subgroup [16-2].

Prosthetic valve involvement deserves particular attention. In our study, one case of prosthetic dehiscence was observed in the aortic position. This is consistent with Tangier data reporting 4.9%, and with international registries showing that prosthetic valve endocarditis accounted for 30.1% of EURO-ENDO cases, while ICE-PCS found dehiscence or new paravalvular regurgitation in 34.1% [15-2]. These complications are strongly associated with poor outcomes and often mandate urgent surgery.

Finally, although echocardiography remains the first-line modality, complementary imaging may be required. TOE is recommended in a wide range of scenarios due to the limitations of TTE in detecting periannular complications, small vegetations, and prosthetic valve involvement [4]. Cardiac CT is more accurate than TEE for diagnosing perivalvular and periprosthetic complications such as abscesses, pseudoaneurysms, and fistulas, and is recommended in both NVE and PVE if TOE is inconclusive or not feasible [4]. PET/CT may also provide additional value in PVE. In cases of uncontrolled infection with evidence of progression on follow-up imaging, urgent surgery within 3–5 days is indicated [17-20], while conservative management may be considered only in exceptional cases with stable clinical status.

## CONCLUSION

Perivalvular extension is a severe and prognostically unfavorable complication of infective endocarditis, most often associated with aortic valve

involvement. In our series, all perivalvular lesions—including abscesses, prosthetic dehiscence, pseudoaneurysm, and fistula—were located at the aortic annulus, confirming its particular vulnerability. Echocardiography, and especially transesophageal echocardiography, proved indispensable for the early detection of these life-threatening complications and for guiding timely surgical decisions. Our findings highlight the critical role of echocardiography in the management of infective endocarditis and underscore the importance of integrating advanced imaging modalities when the diagnosis remains uncertain.

## REFERENCES

1. Mostaghim AS, Lo HYA and Khardori N. A retrospective epidemiologic study to define risk factors, microbiology, and clinical outcomes of infective endocarditis in a large tertiary-care teaching hospital. *SAGE Open Med* 2017;5:2050312117741772.
2. Murdoch DR, Corey GR, Hoen B et al. Clinical presentation, etiology, and outcome of infective endocarditis in the 21st century: the International Collaboration on Endocarditis-Pro prospective Cohort Study. *Arch Intern Med* 2009;169:463–73.
3. Anguera I, Miro JM, Cabell CH, Abrutyn E, Fowler VG Jr, Hoen B, et al. Clinical characteristics and outcome of aortic endocarditis with periannular abscess in the International Collaboration on Endocarditis Merged Database. *Am J Cardiol*. 2005;96(7):976-81. doi:10.1016/j.amjcard.2005.05.060.
4. Habib G, Lancellotti P, Iung B, et al. 2023 ESC Guidelines for the management of endocarditis. *Eur Heart J*. 2023;44(39):3948-4045. doi:10.1093/eurheartj/ehad411.
5. Daniel WG, Mügge A, Martin RP, Lindert O, Hausmann D, Nonnast-Daniel B, et al. Improvement in the diagnosis of abscesses associated with endocarditis by transesophageal echocardiography. *N Engl J Med*. 1991;324(12):795-800. doi:10.1056/NEJM199103213241203.
6. Graupner C, Vilacosta I, San Román JA, Ronderos R, Sarriá C, Fernández C, Mújica R, Sanz O, Sanmartín JV, González Pinto A. Periannular extension of infective endocarditis. *Journal of the American College of Cardiology*, 2002;39(7):1204-1211. doi:10.1016/S0735-1097(02)01747-3
7. Carpenter JL. Perivalvular extension of infection in patients with infectious endocarditis. *Clin Infect Dis*. 1991;13(1):127-38. doi:10.1093/clinids/13.1.127.
8. Sordelli C, Liguori C, Fele N, Weisz SH, Verde R, Guarino A, De Crescenzo N, Perrella A, Di Lorenzo E. Perivalvular complication in infective endocarditis: an integrated imaging approach in the diagnostic workup. *Diagnostics (Basel)*. 2025;15(3):345. PMID: 40950367; PMCID: PMC12425274.
9. Daniel WG, Mügge A, Martin RP, Lindert O, Hausmann D, Nonnast-Daniel B, Laas J, Lichtlen

- PR. Improvement in the diagnosis of abscesses associated with endocarditis by transesophageal echocardiography. *N Engl J Med*. 1991;324(12):795-800. doi:10.1056/NEJM199103213241201.
10. Horgan SJ, Mediratta A, Gillam LD. Cardiovascular imaging in infective endocarditis: a multimodality approach. *Circ Cardiovasc Imaging*. 2020;13(7):e008956. doi:10.1161/CIRCIMAGING.120.008956.
11. Ramanathan A, Witten JC, Gordon SM, Griffin BP, Pettersson GB, Shrestha NK. Factors associated with local invasion in infective endocarditis: a nested case-control study. *Clin Microbiol Infect*. 2021;27(7):1011-1014. doi:10.1016/j.cmi.2020.09.003.
12. Kiyota Y, Della Corte A, Montiero Vieira V, Habchi K, Huang CC, Della Ratta EE, et al. Risk and outcomes of aortic valve endocarditis among patients with bicuspid and tricuspid aortic valves. *Open Heart*. 2017;4(1):e000545. doi:10.1136/openhrt-2016-000545.
13. Forteza A, Centeno J, Ospina V, Lunar IG, Sanchez V, Perez E, et al. Outcomes in aortic and mitral valve replacement with intervalvular fibrous body reconstruction. *Ann Thorac Surg*. 2015;99(3):838-845. doi:10.1016/j.athoracsur.2014.09.052.
14. Harrak S, Doghmi N, Fellat B, Zarzur J, Cherti M. L'endocardite infectieuse au Maroc à travers l'expérience d'un service hospitalier. *Ann Cardiol Angeiol (Paris)*. 2019;68(2):87-93. doi:10.1016/j.ancard.2018.10.014
15. Boussaadani BE, Soussan I, Bendoudouch H, Hara L, Ech-chenbouli A, Raissuni Z. Epidemiology, outcomes and prognosis of infective endocarditis in Northern Morocco. *BMC Infect Dis*. 2024; 24:698. doi:10.1186/s12879-024-09436-4
16. Habib G, Erba PA, Iung B, Donal E, Cosyns B, Laroche C, et al; 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;40(39):3222-32. doi:10.1093/eurheartj/ehz620
17. Kiefer T, Park L, Tribouilloy C, Cortes C, Casillo R, Chu V, et al. Association between valvular surgery and mortality among patients with infective endocarditis complicated by heart failure. *JAMA*. 2011;306(20):2239-2247. doi:10.1001/jama.2011.1701.
18. Lalani T, Chu VH, Park LP, Cecchi E, Corey GR, Durante-Mangoni E, et al. In-hospital and 1-year mortality in patients undergoing early surgery for prosthetic valve endocarditis. *JAMA Intern Med*. 2013;173(16):1495-1504. doi:10.1001/jamainternmed.2013.820.
19. Anguera I, Miro JM, Vilacosta I, Almirante B, Anguita M, Munoz P, et al. Aorto-cavitary fistulous tract formation in infective endocarditis: clinical and echocardiographic features of 76 cases and risk factors for mortality. *Eur Heart J*. 2005;26(3):288-297. doi:10.1093/eurheartj/ehi034.
20. Knosalla C, Weng Y, Yankah AC, Siniawski H, Hofmeister J, Hammerschmidt R, et al. Surgical treatment of active infective aortic valve endocarditis with associated periannular abscess: 11-year results. *Eur Heart J*. 2000;21(6):490-497. doi:10.1053/euhj.1999.1861.

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