A case of a huge aortic pseudo-aneurysm following aortic bioprosthetic endocarditis: the key role of 3D echocardiography

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Abstract

Infective endocarditis (IE) is a life-threatening condition with high morbidity and mortality rates, making early diagnosis and intervention crucial. This report details the case of a male with a history of mechanical prosthetic aortic valve replacement, presenting with pyrexia and diagnosed with aortic bioprosthetic endocarditis leading to a massive aortic pseudoaneurysm. This shows that 3D transesophageal echocardiography is much more useful than regular 2D imaging for finding problems with IE, which makes surgical planning and intervention more precise.

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Introduction

Infective endocarditis (IE) is a complex cardiovascular condition characterized by microbial infection of the endocardial surface of the heart, primarily affecting heart valves. It is associated with severe complications, including heart failure, systemic embolisms, and the formation of intracardiac abscesses and pseudoaneurysms. Despite advancements in medical and surgical treatments, IE continues to pose significant challenges due to its diverse presentations and the critical need for timely diagnosis and intervention. Traditionally, 2D-transesophageal echocardiography (TEE) has been the cornerstone for the diagnosis and management of IE, offering detailed images of valvular structures and their function [1]. However, the advent of 3D-TEE has markedly enhanced our diagnostic capabilities, enabling more precise visualization of cardiac structures and pathologies. 3D-TEE provides comprehensive views of the heart valves and associated complications, facilitating a better understanding of the disease's extent and complexity. This imaging modality has become invaluable in the planning and guidance of surgical interventions, particularly in patients with complicated IE, where precise anatomical details are crucial for successful outcomes. The role of 3D-echocardiography in IE management has evolved rapidly, supported by a growing body of literature that underscores its advantages over traditional 2D imaging techniques. This introduction seeks to explore the impact of 3D-TEE on the diagnosis and treatment of IE, emphasizing its role in the management of this infectious disease [2].

Case Report

A man presented to the Cardiology Infectious Department for 11 days of recurrent, relapsing fevers with night sweats and generalized weakness. His past medical history was significant for previous biologic prosthetic aortic valve replacement and for history of ischemic heart disease with previous angioplasty, arterial hypertension, and type II diabetes mellitus. Additional pertinent history was negative for recent surgeries, recent travel, previous intravenous drug use, and recent dental infection or treatment. On physical examination, the patient had a temperature of 38.3°C, a heart rate of

105 beats/min, blood pressure of 115/70 mmHg, and a respiratory rate of 22 breaths/min. On cardiovascular examination, a 2/6 blowing systolic murmur was heard best at the right and left upper sternal borders. There was no evidence of cardiac failure, and there were no peripheral stigmata of IE.

His respiratory, abdominal, musculoskeletal, and neurologic examinations were normal. Urinalysis revealed large amounts of blood but was otherwise negative. Laboratory tests showed an elevated white blood cell count (12.7×10^9; reference range 4.8-10.8×109 K/uL), elevated erythrocyte sedimentation rate, elevated C-reactive protein, and elevated procalcitonin. He was additionally found to have low hemoglobin of 9.7 g/dL. A chest X-ray performed at that time was unremarkable. The patient was admitted for severe sepsis with concern for possible endocarditis of his biologic aortic valve. Two blood cultures were drawn on admission, and empiric antibiotic therapy with daptomycin was started. Both blood cultures from admission returned 2 days later, growing *Staphylococcus epidermidis*, and a specific antibiotic therapy was started. A transthoracic echocardiogram (TTE) showed an ejection fraction of 60% to 65% and mild left ventricular hypertrophy with grade II diastolic dysfunction. It also showed thickening of the biocusps with a periprosthetic anechoic image without aortic insufficiency. Owing to continued high clinical suspicion for IE, a TEE was then performed, showing only a pulsatile perivalvular echo-free space with color Doppler flow inside suggestive of an aortic pseudoaneurysm (Figure 1). For a better evaluation of morphological characteristics, we carried out volumetric reconstructions with 3D. 3D-TEE imaging provides better morphological assessment of aortic pseudoaneurysm. 3D-TEE clearly demarcates an irregularly shaped perivalvular cavity and, through multiplanar reconstruction, allows a correct evaluation of the area and circumference (Figures 2 and 3). Cardiac computed tomography (CT) was performed, confirming our diagnosis. Possible alternate sources of *S. epidermidis* bacteremia were subsequently ruled out by CT of the abdomen and pelvis and a whole-body white blood cell scan. The patient underwent cardiac surgery to replace the aortic valve with a new biological prosthesis with excellent results. To date, 3 and a half months after the completion of antibiotics, the patient remains afebrile and is doing well clinically, with no evidence of infection recurrence.

Discussion

The field of 3D-echocardiography has seen substantial progress over the past decade, with significant implications for the management of IE. Scientific literature increasingly supports the superiority of 3D-TEE over 2D-TEE, particularly in its ability to offer detailed and accurate assessments of valvular anatomy, vegetations, abscesses, and pseudoaneurysms associated with IE. One of the primary advantages of 3D-TEE is its ability to provide *en face* views of the heart valves, which are not possible with 2D imaging [2]. This perspective is crucial for evaluating the extent of valve involvement and for assessing the size and morphology of vegetations, thereby aiding in risk stratification and therapeutic decision-making. Studies have shown that 3D-TEE has a higher sensitivity and specificity in detecting valvular lesions and perivalvular complications, such as abscesses and pseudoaneurysms, which are pivotal factors influencing the surgical approach and timing. Furthermore, 3D-TEE plays a vital role in preoperative planning and intraoperative guidance [3,4].

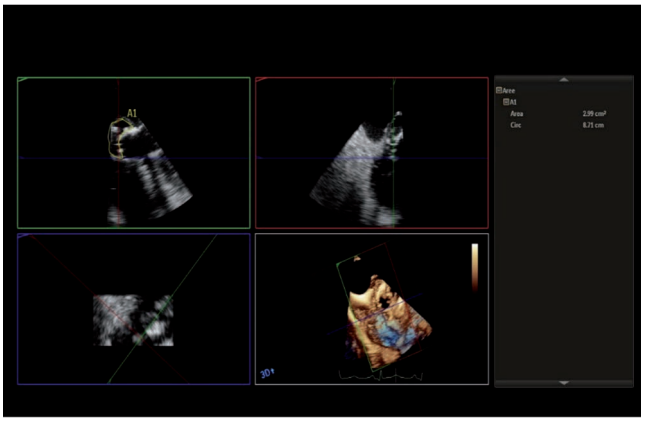

Figure 2. 3D transesophageal echocardiography. Multiplane reconstruction for evaluation of pseudoaneurysm area and circumference.

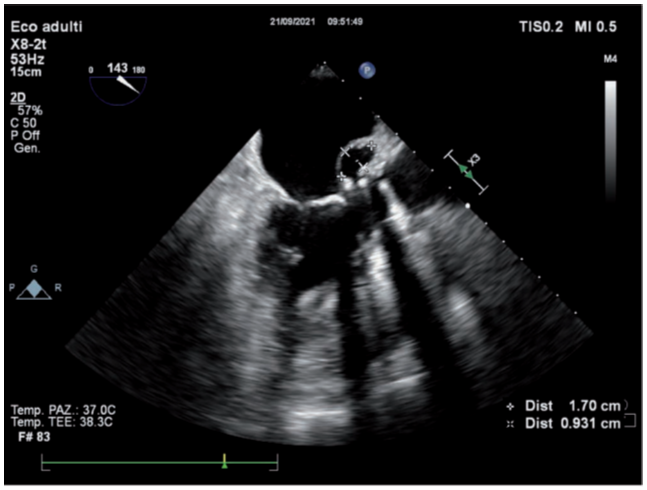

Figure 1. 2D transesophageal echocardiography images of an aortic pseudoaneurysm.

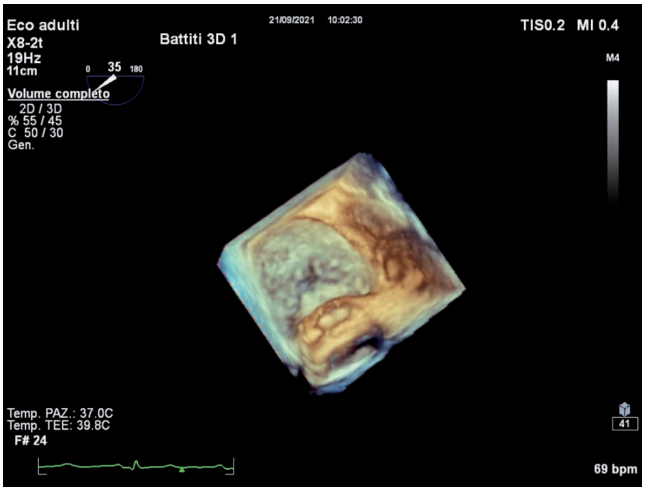

Figure 3. Real-time 3D transesophageal echocardiography. Aortic pseudoaneurysm.

By providing a realistic assessment of the cardiac anatomy, 3D imaging enables surgeons to tailor their surgical approach, potentially reducing operative times and improving surgical outcomes. The ability to visualize complex spatial relationships and the extent of disease involvement helps in predicting the feasibility of valve repair *vs.* replacement, which is a critical consideration in managing IE patients [5,6]. Despite these advantages, the integration of 3D-TEE into routine clinical practice requires specialized training and experience. The interpretation of 3D images is more complex and time-consuming than traditional 2D echocardiography. However, the potential benefits for patient management and outcomes justify the investment in training and infrastructure to support the widespread adoption of this technology [7]. It should be underlined anyway that cardiac CT is also accurate for diagnosing perivalvular and periprosthetic complications of IE (abscesses, pseudoaneurysms, and fistulae) and is recommended in both native valve endocarditis and prosthetic valve endocarditis if TEE is not conclusive or not feasible. In addition, cardiac CT is a valuable alternative for non-invasive assessment of coronary artery disease before cardiac surgery in patients with IE and can significantly influence subsequent surgical decision-making. In conclusion, 3D-echocardiography represents a significant advancement in the diagnostic and therapeutic landscape of IE. Its ability to provide unparalleled insights into cardiac anatomy and pathology has the potential to revolutionize the management of this challenging condition. As the technology continues to evolve and become more accessible, it is poised to become an indispensable tool in the armamentarium against IE.

Conclusions

Decision-making in IE is complex. The most common indications for early surgery are the development of heart failure, uncontrolled infection, or risk of embolism. In particular, uncontrolled infection is commonly due to perivalvular abscess formation. 3D-transoesophageal echocardiography (TOE) allows rapid, accurate, unique assessment of IE complications through unlimited multiplanar reconstructions, volume-rendered real-time imaging, and color full-volume regurgitation assessment, which may not always possible on 2D-TTE or 2D-TOE. This case demonstrates how traditional 2D TEE may provide incomplete anatomical information. 3D imaging improved the identification and characterization of the complications of IE. The complementary data provided aids in decision-making with regard to both requirements for timing and planning of surgery.

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