Fistulous Periprosthetic Aortic Abscess to the Left Ventricle Viewed on Three-Dimensional Transesophageal Echocardiography

Debora Tabosa de Almeida, Leticia Braga Paciello da Silva, Vanessa G Esmanhoto Andrioli, Marcos Valerio de Resende, Marcelo Luiz Campos Vieira

Hospital TotalCor, São Paulo, SP; Hospital Santa Paula, São Paulo, SP; Instituto do Coração, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP; Hospital Israelita Albert Einstein, São Paulo, SP – Brazil

Introduction

Infectious Endocarditis (IE) is an inflammatory process of the endocardium, especially that one located in the heart valves,[1] and it is still a major cause of mortality and morbidity.[2] Its incidence ranges from 3 to 9 cases per 100,000 people.[2] The main causes of death are cardiac complications, such as perivalvarial abscess, fistula formation, systemic embolism, ventricular pseudoaneurysm and heart failure.[2] Early detection of these disorders is of paramount importance for prognosis. We report the case of periprosthetic aortic abscess diagnosed after 4 months of mitral aortic valve replacement surgery. Diagnosis was confirmed by Transesophageal Echocardiography Three-dimensional (3D ETE).

Case Report

A 35-year-old male patient with a history of rheumatic carditis had an aortic bioprosthesis implanted 15 years before and, 4 years prior, underwent biological aortic valve repair and biological mitral valve replacement due to IE.

He was transferred to our service to investigate fever using empiric antibiotic therapy (ceftriaxone, vancomycin and gentamicin). The patient reported intermittent fever of 38.5 to 39ºC, dyspnea on unusual exertion, inappetence and weight loss of 2 kg in 15 days.

On physical examination, he was flushed, eupneic in the horizontal dorsal decubitus position, blood pressure of 115 × 78 mmHg, heart rate of 80 bpm and axillary temperature of 36.8ºC. Cardiovascular examination: regular heart rhythm with two sounds, systolic murmur in the mitral area (+2/+6) and diastolic murmur in the aortic area (+2/+6). Examination of the respiratory tract, abdomen and lower limbs revealed no abnormalities. Electrocardiogram with sinus rhythm and normopositive axis, normal PR and no ventricular repolarization disorders. Hemoculture from the hospital of origin identified Gram-positive bacteria: *Streptococcus sanguinis* sensitive to penicillin.

Keywords

Endocarditis; Abscess; Echocardiography.

Mailing Address: Debora Tabosa de Almeida •
E-mail: deborat.almeida@cardiol.br

DOI: 10.5935/2318-8219.20190028

TEE revealed normally functioning biological prosthesis in the aortic position and periprosthetic aortic neocavity extending to the mitroaortic junction, with thick walls and evidence of internal flow with externalisation to the left ventricular outflow tract, compatible with periprosthetic abscess (Figures 1 to 3). Biological prosthesis in mitral position, thickened, preserved aperture, mean transprosthetic gradient of 7 mmHg and mitral prosthesis area of 1.9 cm^2. Two-dimensional images were complemented by 3D echo for better analysis of the mitral valve junction and mitral valve apparatus (Figure 4).

Aortic prosthesis was replaced with 25 mm porcine prosthesis and closure of the abscess area with sequential points and reinforcement with bovine pericardium.

The patient progressed well, was discharged after treatment with ceftriaxone for 6 weeks and maintained outpatient follow-up with the cardiology, infectiology and cardiac surgery team and in the rehabilitation group.

Discussion

EI can affect the endothelial surface of the heart and the most susceptible structures are the atrioventricular valves. It may also occur in the endocardium of the atria, ventricles and large vessels.[3] Most (80%) EI cases occur in patients with risk factors that include structural heart disease, cardiac valve prosthesis, intravenous drug use, HIV/AIDS and history of EI. Currently, more cases have been observed in the elderly (institutionalized/hospitalized and handled with invasive procedures).[4]

There are geographic differences in the epidemiology of IE.[3] In developing countries, such as Brazil, the subacute form of the disease is still frequently encountered.[3] In developed countries, nosocomial endocarditis is more common. In Brazil, we are in a transition period and we observed a pattern of endocardial infection in countries with greater economic development in large private hospitals and, at the same time, patients with classic streptococcal endocarditis underserved populations. On a global level, IE is also associated with invasive procedures.[3]

IE is caused by a variety of bacteria and fungi. The most incident ones include *Streptococcus viridans*, *Enterococcus sp.* (20,8%) and *Staphylococcus aureus* (about 80%).[5] Other less common microorganisms such as -negative *Gram* bacteria from the HACEK group (*Haemophilus aphrophilus*, *Actinobacillus actinomycetemcomitans, Cardiobacterium hominis,*

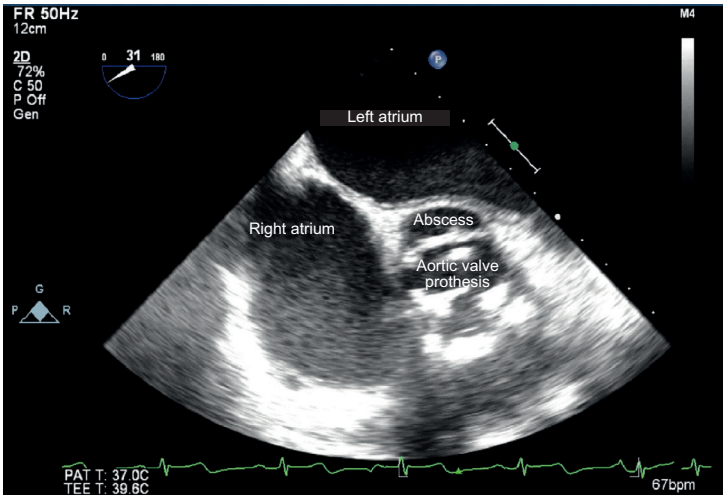

Figure 1 – *Two-dimensional transesophageal echocardiogram showing aortic prosthesis with abscess at the mitroaortic junction.*

Figure 2 – *Three-dimensional echocardiogram showing periprosthetic neocavity flow.*

Eikenella corrodens and *Kingella kingae*) and fungi affect the other patients.[3]

While streptococci predominate in South America, India and Southeast Asia, *S. aureus* is the most common cause in better developed countries.[3] The importance of this pathogen as a potentially lethal infection is a source of concern, given its increasing antimicrobial resistance, including vancomycin.[4]

Population aging has also resulted in a higher prevalence of endocarditis associated with *Streptococcus bovis*, mainly in Europe. Reports have found an increased incidence of the HACEK group in Europe, in addition to cases of *Coxiella burnetti* and *Bartonella*. Changes in the etiological and epidemiological profile of IE with increased nosocomial cases suggest that rigorous measures to prevent bloodstream infections should be applied in hospitals. Hospitalized elderly should be carefully investigated if they present any fever or bacteremia. IE is still a disease with high morbidity (37%) and lethality despite progress in therapy and diagnosis.[7]

Diagnosis of IE is based both on medical history, detailed physical examination, laboratory tests and imaging scans. Clinical, pathological, echocardiographic and microbiological parameters must be considered for definitive diagnosis of the disease. To diagnose IE, the modified Duke criteria for diagnosis are used. These are divided into major criteria and minor criteria.[6] The presence of two major criteria, a major one associated with three minor ones, or five minor ones alone, is considered sufficient to define the diagnosis.[3]

Echocardiography is recommended as the first-line imaging modality for IE diagnosis. Diagnostic echocardiographic

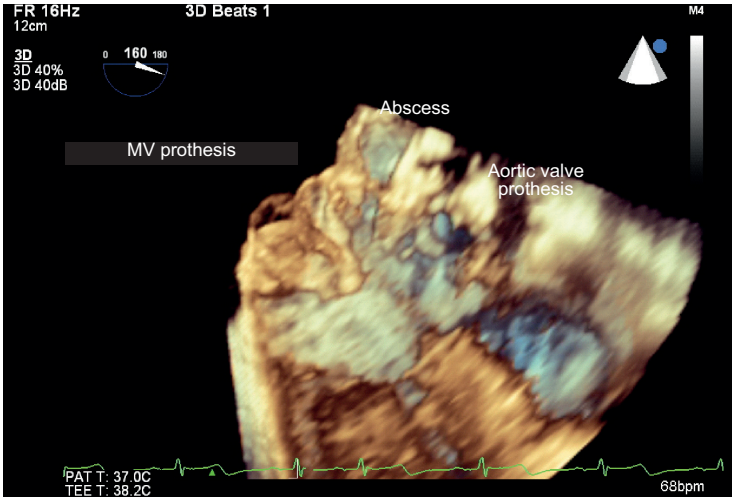

Figure 3 – *Three-dimensional transesophageal echocardiogram showing aortic periprosthesis neocavity extending to the mitroaortic junction.*

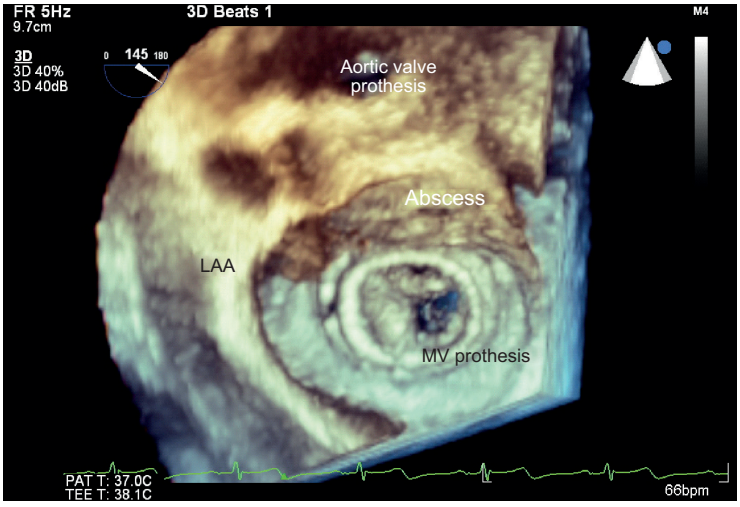

Figure 4 – *Three-dimensional transesophageal echocardiogram images showing aortic periprosthesis neocavity extending to the mitroaortic junction.*

criteria include the identification of images compatible with vegetation, perivalvular abscess or new dehiscence of a prosthetic valve. Cardiac computed tomography allows the detection of abscesses, pseudoaneurysms, fistulas and prosthetic valve dehiscence. Additional methods, such as Positron Emission Tomography-Computed Tomography (PET-CT), may be useful to identify inflammatory activity, suggesting a local inflammatory or infectious process, especially in patients with cardiac valve prostheses or periprosthetic abscesses.

Major care should occur in the differential diagnosis of situations of inflammatory yet not infectious processes, considering the use of PET-CT for the diagnostic investigation of patients with suspected IE.

Transthoracic echocardiography (TTE) is a rapid and noninvasive diagnostic modality, with excellent specificity for the diagnosis of native valve endocarditis (98%), but with general sensitivity of only 40-60%, whereas TEE has high sensitivity (75% to 95%) and specificity (98%).[9] However, in prosthetic valve endocarditis, the amount of prosthetic material in the supra and infravalvular regions, and the occurrence of acoustic shade resulting from prosthetic structures reduce the sensitivity and specificity for the diagnosis of IE. Progress in 3D allowed better spatial resolution and viewing of cardiac structures, allowing the identification of any valvular vegetations (above 2 mm), abscess or nodules.[10]

The use of 3D TEE makes it possible to view the cardiac structure from unconventional observation planes, as well as the simultaneous observation of the different prosthesis faces. This characteristic allows the identification of structural

lesions, such as pannus, small thrombi adhered to the prosthesis elements and small vegetations.

In prostheses in aortic position, the simultaneous observation of the prosthetic face, from the coaxial and *en face* view of the left ventricular outflow tract and the ascending aorta, provides the most detailed and best anatomical identity of the prosthesis, as observed recently.[13]

In the case presented, two-dimensional echocardiography delivered the correct diagnosis, but the 3D images allowed to establish the anatomical spatial relationship of the structures involved, with better planning for the proposed intervention.

Some studies suggest that 3D TEE can improve diagnostic investigation in suspected cases with typical bacteria. The use of 3D imaging was documented in prosthetic endocarditis with Transcatheter Aortic Valve Replacement (TAVR), which compared the diagnosis based on three parameters: presence of small moving structures, focal thickening of leaflets and irregular surfaces on valves, thus increasing the sensitivity of diagnosis compared to two-dimensional echo.[10] New perspectives exist on 3D echo, mainly regarding lesions in the mitral valve cusps, providing information about the valvular apparatus.[11]

The patient met the modified diagnostic criteria of Duke for IE, since he had two major and two minor criteria, namely: two hemocultures positive for *S. sanguinis*, echocardiogram with fistulated periprosthetic abscess, fever above 38ºC and predisposition to endocarditis — history of endocarditis and intracardiac prosthesis.

Complications of IE are due to the progression of the disease with valvular and perivalvar impairment, whether due to late diagnosis or ineffective treatment. These complications include HF, abscess, perivalvar fistula and embolic phenomena. Prosthetic valve endocarditis with abscess is a devastating complication of the replaceable heart valve.[6] The myocardium may suffer the consequences of infections when there is association with abscesses and regional infarction. As a result, the patient may present ventricular arrhythmia and myocardial systolic dysfunction.

In a series of 233 patients with perivalvular abscesses associated with IE, mean survival ranged from 3 months to 75% of them.[8] Mortality was higher in older patients with staphylococcal infection, preoperative renal failure and concomitant fistula.[8]

Recognition of the presence of aortic root abscess during the course of endocarditis is of extreme prognostic importance, due to the possibility of progression to heart failure, sepsis or both.[6]

Surgery may be used to treat the complications existing on diagnosis and to prevent these complications. However, there are reports with conservative medical treatment.[9] The possibility of percutaneous approach has been recently reported.

Conclusion

Valve prosthesis vegetation is a serious disease and early diagnosis with early introduction of effective treatment reduces mortality. Diagnosis of these geometric relationships, although it is also defined by two-dimensional echocardiography, can be facilitated by that of 3D echo, mainly aiming at an efficient communication with the surgical team, since many cases of prosthesis endocarditis are surgically handled.

Finally, we present a case report illustrating this relevant recommendation of 3D echo, which assisted in the evaluation of a vegetation complicated by periprosthetic abscess, allowing better planning of the surgical strategy, which resulted in the patient's good evolution.

Potential Conflicts of Interest

There are no relevant conflicts of interest.

References

1. Que YA, Haefliger JA, Piroth L, Francois P, Widmer E, Entenza JM, et al. Fibrinogen and fibronectin binding cooperate for valve infection and invasion in Staphylococcus aureus experimental endocarditis. J Exp Med. 2005;201:1627- 35.
2. Prendergast BD, Tornos P. Valvular heart disease: changing concepts in disease management. Surgery for infective endocarditis. Who and when? Circulation. 2010;121(9):1141-52.
3. Braunwald.Tratado de Doenças Cardiovasculares. 10ª Ed. Elsevier; 2017 p. 3934- 42.
4. Tratado de Cardiologia SOCESP. 3ª Ed. São Paulo: Manole; 2015.
5. Tleyjeh IM, Abdel-Latif A, Rahbi H, Scott CG, Bailey KR, Steckelberg JM, et al. A systematic review of population based studies of infective endocarditis. Chest. 2007;132(3):1025-35.
6. Chow WH, Leung WH, Tai YT, Lee WT, Cheung KL. Echocardiographic Diagnosis of an Aortic Root Abscess after Mycobacterium Fortuitum Prosthetic Valve Endocarditis. Clin Cardiol. 1991 Mar;14(3):273-5.
7. Wallace SM, Walton BI, Kharbanda RK, Hardy R, Wilson AP, Swanton RH. Mortality from infective endocarditis: clinical predictors of outcome. Heart. 2002;88(1):53-60.
8. Choussat R, Thomas D, Isnard R, Michel PL, Iung B, Hanania G, et al. Perivalvular abscesses associated with endocarditis. Clinical features and prognostic factors of overall survival in a series of 233 cases. Eur Heart J. 1999;20:232-41.
9. Hasin T, Reisner SA, Agmon Y. Large pseudoaneurysms of the mitral-aortic intervalvular fibrosa: long-term natural history without surgery in two patients. Eur J Echocardiogr. 2011;12(3):E24.
10. Xie M, Li Y, Cheng TO, Wang X, Lu Q, He L, et al. Pseudoaneurysm of the mitral-aortic intervalvular fibrosa. Int J Cardiol. 2013;166 (1):2-7.
11. Osler W. The Gulstonian Lectures, on Malignant Endocarditis. Lectures. Br Med J. 1885 Mar 7;1(1262):467-70.
12. Gonzales YO, Ung R, Blackshear JL, Laman SM. Three-Dimensional Echocardiography for diagnosis os trancatheter prosthetic Aortic Valve Encocarditis. CASE (Phila). 2017;1(4):155–8. -
13. de Brito FS Jr, Caixeta AM, Vieira ML, Nomura C, Figueiredo GL, Perin M, et al. Pseudo early degeneration of a transcatheter aortic valve prosthesis due to thrombosis. EuroIntervention. 2015 ;10(11):1367.