Transesophageal Echocardiogram in the Diagnosis of Superior Vena Cava Syndrome in a Patient With a Long-Term Catheter

Marcus Vinicius Silva Freire de Carvalho,[1,2] *Endy de Santana Alves,*[1,2] *Laila Caroline Gomes,*[1,2] *Carolina Thé Macêdo,*[1,2] *Marco André Moraes Sales,*[1,2] *Alexandre Costa Souza,*[1,2]

Hospital São Rafael, Rede D'Or,[1] *Salvador, BA – Brazil*

Instituto D'Or de Pesquisa e Educação (IDOR),[2] *Salvador, BA – Brazil*

Introduction

The superior vena cava syndrome (SVCS) is caused by the obstruction or severe occlusion of the superior vena cava (SVC) and can result in significant morbidity or mortality.[1,2] Malignancy is the most common cause of this obstruction, corresponding to approximately 70% of the cases.[3] However, more recently, the incidence of SVCS related to devices, such as central venous catheters and electrodes of a pacemaker or defibrillator, have increased.[4,5]

These devices, together with states of hypercoagulability, can precipitate the formation of thrombi.[4] In extreme situations, in the context of bacteremia, these can lead to the formation of a complex thrombus-vegetation association.

The traditional clinical findings include: facial, periorbital, cervical, and upper limb edemas, followed by venous dilations of the anterior thoracic wall, illustrating collateral circulation.[1-3] Although it generally does not represent an imminent risk, SVCS is often associated with symptoms of high morbidity-mortality, such as dyspnea, dysphagia, and even intracranial hypertension, which can result in a coma.[1,2]

To diagnose this condition, the transesophageal echocardiogram (TEE) plays a complementary role in a bedside multimodal image to demonstrate the presence of thrombus in SVC topography.[6] New tools, such as the real-time three-dimensional TEE (3D TEE), has enabled a greater quantification of the lesions in the right atrium and the SVC, with the risk of evolving into SVCS.

Case Report

A 52-year-old male patient, who was hypertensive, diabetic, and diagnosed with prior coronary artery disease and chronic dialytic kidney disease, underwent a kidney transplant in 2021, evolving with graft loss. The patient was hospitalized in February 2022 due to a fungal endocarditis and remained hospitalized during antifungal treatment. After six months, he developed a new medical condition of fever and chills associated with the use of the dialysis catheter and the poor functioning of this device, in addition to redness and facial edema, dysphagia, and dyspnea. The blood cultures showed the growth of *S. epidermidis*, and the patient had been taking vancomycin, staggered with teicoplanin and meropenem, and continued to use fluconazole. The two-dimensional (2D) TEE showed the presence of a large hyperechogenic image within the right atrium, protruding to the SVC, measuring approximately 40 x 08 mm (Figure 1). A 3D technique was used, which allowed for a better characterization of the lesion and its extension, occupying approximately 67% of the circumferential diameter of the SVC, associated with the presence of a mobile filament image in its outer portions, which can correspond to a thrombus or to vegetation (Figure 2). An angiotomography of the cervical and thoracic blood vessels was conducted, with signs of a partial thrombosis of the internal jugular veins, the left subclavian vein, the brachiocephalic veins, and the SVC. The dialysis catheter was moved by the vascular surgery team to the left femoral vein, and anticoagulation was begun.

Discussion

The incidence of SVCS related to devices has increased considerably due to the increased use of catheters, pacemakers, and defibrillators.[1,2] In a recent study, 28% of all SVCS were related to devices.[3] Venous thrombosis, which is normally clinically silent, occurred in nearly 30% of all patients using pacemaker electrodes.[3] However, the obstruction of the SVC is rare and observed in only 0.1% to 3.3% of all patients.[2,3] The stenosis in the SVC-atrial junction occurs due to the deposit of fibrin on the surface of the stimulating electrodes and their incorporation in a person's reproductive organs, followed by the inflammation of the blood vessel wall, fibrosis, the formation of thrombosis, and stenosis.[3] The chronic mechanical irritation and reaction of the foreign body are the main mechanisms of the formation of thrombi and vegetations in this location. The extraction of devices and posterior re-implant also caused mechanical trauma and can be considered additional risk factors for the emergence of thrombi and venous occlusion.[4]

The diagnosis of this complication can be difficult. Although the computed tomography can show the location of the catheter, it is quite limited in revealing the structural details concerning the implanted device itself.[5] The proximal portion of the SCV can be viewed in the TEE through the subcostal window. However, the views are generally quite limited in many patients.[6] The TEE in this scenario is an excellent diagnostic approach as it is minimally invasive

Keywords

Transesophageal echocardiography; diagnosis; syndrome, vein.

Mailing Address: Marcus Vinicius Silva Freire de Carvalho •
Hospital São Rafael, Ecocardiografia, Cardiologia. Avenida São Rafael, 2.152. Postal Code 41253-190. São Marcos, Salvador, BA – Brazil
E-mail: marcusviniciusfrc@hotmail.com
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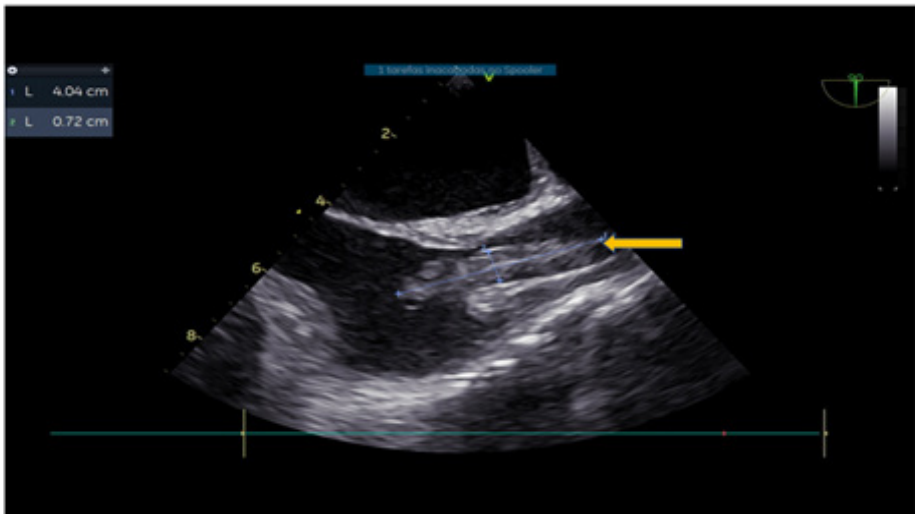

Figure 1 – *TEE showing a hyperechogenic image in the inner portion of the right atrium, projecting to the superior vena cava (yellow arrow).*

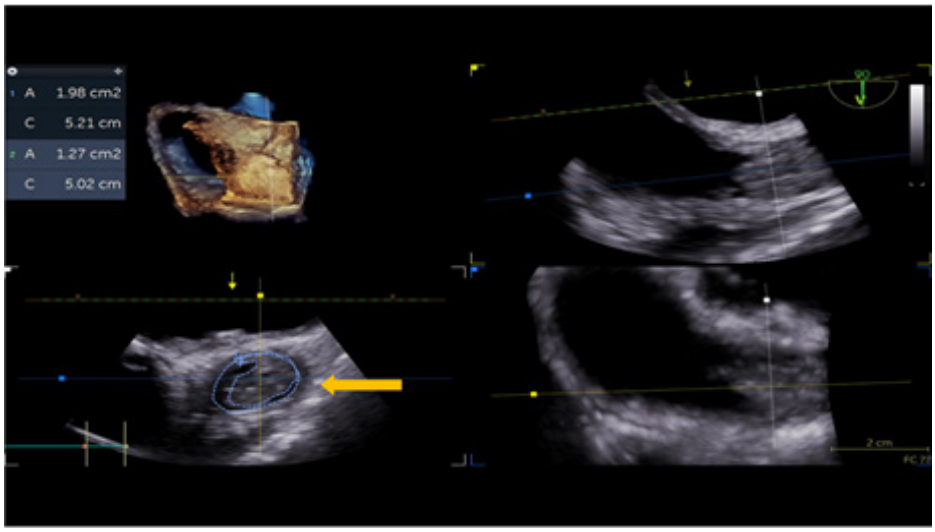

Figure 2 – *TEE with 3D reconstruction of the superior vena cava: Hyperechogenic image occupying approximately 67% of the circumference diameter of the superior vena cava (yellow arrow).*

and has few contra-indications.[6,7] The SVC can be easily observed, as demonstrated in our case, especially through the transesophageal acoustic window in a medium esophagus with an angulation of about 90° (bicaval incidence). The good spatial resolution of the echocardiographic images allows for an adequate definition of the catheter and associated pathology. In addition, follow-up using this imaging method is feasible, presents a low morbidity-mortality, and can guide additional treatment.[8]

A prior study evaluated the role of the TEE in the diagnosis of central venous thrombi associated with the implant of intracardiac devices (pacemaker electrodes), using the TEE and venography. After 06 months, the transesophageal method enabled the detection of most of the episodes of thrombosis in the intracardiac devices. By contrast, the venogram detected only thrombi in the subclavian vein and/or innominate vein. The main finding of this prospective study was that the thrombosis associated with the pacemaker electrode in the right atrium and with SVC is not uncommon six months after the implant, and that the 3D TEE was superior in the diagnosis of these thrombi when compared to the venogram with peripheral intravenous contrast and the TEE.[4]

The study of these emboligenic sources is essential, as it can reduce the rate of pulmonary embolism, the emergence of

infectious endocarditis, and even rare cases of the SVCS due to the subtotal/total occlusion of this blood vessel, as seen in the present case report. In this context, the TEE is extremely useful, as it is a semi-invasive method, which is readily available, inexpensive, and capable of detecting thrombi in devices and/or long-term catheters, even in asymptomatic patients.[4,5]

The venogram by digital subtraction, by contrast, represents the gold standard in this syndrome, defining the severity of the obstruction and enabling the interventionist to develop the strategy for revascularization.[3,9,10] However, the viewing of the superior right vena cava is still a challenge due to the acoustic shadow imposed by the ribs and the lungs. In this context, it is important to perform not only the fluoroscopy, but also the TEE, which has the power to evaluate the insertion of the SVC in the right atrium.[6,7] The inadequate observation of the SVC junction – right atrium by the fluoroscopy enhances the accuracy of the TEE, making it an excellent ally in the visualization of this portion through the image obtained in the bicaval acoustic window, which is a quick, safe, and technically precise method for the differential diagnosis of SVCS.[7]

In the spectrum of the TEE, the use of the 3D TEE is an additional tool capable of bringing relevant information provided by an adequate spatial relationship.[7,8] In this sense, the 3D TEE allows for an improved evaluation of the SVC and its relation with the thrombus area, determining the occupation rate and the respective hemodynamic effects resulting from this obstruction, characterizing lesions with a greater risk of developing SVCS.[7,8]

Conclusion

The incidence of SVCS related to devices, such as central venous catheters and electrodes from pacemakers and defibrillators, have increased progressively. In this light, the echocardiogram, especially the transesophageal analysis, emerges as a quick, safe, and technically precise method to evaluate the presence of thrombi and/or vegetations that may well be related to SVCS, as seen in the present case report. The good spatial relation of the 3D TEE allows for an additional value in the topographical evaluation of the lesion in relation to the adjacent planes and a better evaluation of its dimensions.

Author Contributions

Conception and design of the research: De Carvalho MVSF, Souza AC; acquisition of data: De Santana EA, Souza AC; analysis and interpretation of the data: De Carvalho MVSF; writing of the manuscript: De Carvalho MVSF, De Santana EA, Gomes LC; critical revision of the manuscript for intellectual content: De Carvalho MVSF, Gomes LC, Sales MAM, Macedo CT, Souza AC.

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Ethics Approval and Consent to Participate

This article does not contain any studies with human participants or animals performed by any of the authors.

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