ROLE OF TRANSESOPHAGEAL ECHOCARDIOGRAPHY IN THE INTRAOPERATIVE OF COMPLEX HEART SURGERY. CASE REPORT

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ABSTRACT

The combination of myocardial revascularization (CABG) and valve surgery is a viable strategy for patients with both comorbidities, avoiding multiple approaches and increasing survival. However, this method is related to a higher risk of postoperative morbidity and mortality. To guide hemodynamic management in a more rational way and to minimize unfavorable outcomes, the use of intraoperative transesophageal echocardiography (TEE) has emerged as an important tool in cardiac surgery. The case is a male patient, 75 years old, with a history of arterial hypertension, coronary atherosclerotic disease, mitral valve heart disease and the presence of prosthesis in the aortic valve was referred for surgical correction where he opted for intervention in a single session. The initial intraoperative TEE showed the significant mitral regurgitation seen in the preoperative period, paravalvular aortic leak in the right coronary leaflet of the prosthesis with calcification and reduced mobility of its components. Aortic valve was removed with long-term bioprosthesis implant (number 23) and mitral valve repair followed by CABG - saphenous vein to right coronary bypass. CPB time was 111 minutes and 76 minutes of aortic clamping. At the end of the correction, the TEE confirmed the absence of regurgitation and adequate opening of the mitral valve (indicating satisfactory result of the plasty) and absence of important paravalvular leaks in the aortic valve. The patient presented a favorable clinical evolution and was discharged seven days after the procedure, with adjunct medication and guidance for outpatient follow-up.

KEYWORDS: CARDIAC SURGICAL PROCEDURES; MYOCARDIAL REVASCULARIZATION; HEART VALVE PROSTHESIS IMPLANTATION; ECHOCARDIOGRAPHY, TRANSESOPHAGEAL; HEMODYNAMIC MONITORING.

INTRODUCTION

The correlation between population aging and the higher prevalence of coronary artery disease (CAD) and valvular heart disease is a topic widely explored in the literature and the results reinforce the need to adopt therapeutic methods that favor the maintenance of the elderly's functional capacity, prolonging their survival [1]. In this context, an increase in the incidence of cardiovascular surgery in the elderly population is likely to occur in the coming years, making it a challenge for the cardiac surgeon to choose an intervention strategy that can reconcile the restoration of the organ with the improvement of the individual's quality of life [2,3].

With the remarkable technological advance, it became possible to improve and incorporate different surgical techniques and options, among them the single-session approach of surgical myocardial revascularization (SMR) associated with double valve surgery in selected patients. Although controversial, combined surgery is a viable strategy for individuals with both comorbidities, avoiding multiple approaches and increasing long-term survival. However, it is a highly complex method, requiring effective myocardial protection and associated with a higher risk of postoperative morbidity and mortality [1]. As with any therapeutic approach, its indication must be substantiated and individually contextualized, considering the benefits and adverse consequences [3].

Mortality rates from concomitant cardiac surgeries vary widely between centers and are related to factors in the pre, intra and postoperative period. Among the surgical variables, surgery time, prolonged aortic clamping time, and cardiopulmonary bypass time (CPB) are directly related to the increase in complications [2]. In order to minimize unfavorable developments, similar to other technologies added to the routine of the operating room, the use of intraoperative transesophageal echocardiography (TEE) has emerged as an important tool in cardiac surgery [4]. TEE has the potential to guide hemodynamic management in a more rational way and significantly influence the surgeon's decision-making, which can eventually change the course

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of surgical procedures, as well as their outcome [5].

The aim of this study is to report a case of combined surgical treatment of aortic and mitral valve pathology associated with SRM with intraoperative monitoring through TEE.

The Research Ethics Committee of the Hospital de Urgências de Goiânia, linked to Plataforma Brasil, approved this study (CAAE: 38630920.7.0000.0033).

CASE REPORT

Male patient, 75 years old, hypertensive, with benign prostatic hyperplasia, atrial flutter, CAD, with significant lesion in the right coronary artery (RCA) and mitral valve insufficiency. He underwent a previous cardiac procedure: aortic valve replacement for a bioprosthesis. Using pantoprazole, doxazosin mesylate associated with finasteride, olmesartan and hydrochlorothiazide.

During clinical follow-up, a transthoracic echocardiogram was performed, which showed a biological prosthesis in the aortic position with structural and hemodynamic dysfunction and mitral valve insufficiency. On Doppler ultrasound examination of the carotids and vertebral areas, the patient presented mild stenosis in the common and right internal carotids and mild to moderate stenosis in the left internal carotid. Patent vertebral artery with bilateral antegrade flow. Therefore, a combined valve intervention associated with SRM was proposed to the patient.

The procedure was performed under general anesthesia and, after tracheal intubation, an echo transesophageal probe was inserted for intraoperative analysis of the cardiac chambers, valves and aorta. At that moment, TEE in mid-esophageal long axis section showed paraprosthetic leak in the right coronary leaflet (Figure 1) and important mitral valve regurgitation being demonstrated in different planes of echocardiography (Figure 2 A, B and C).

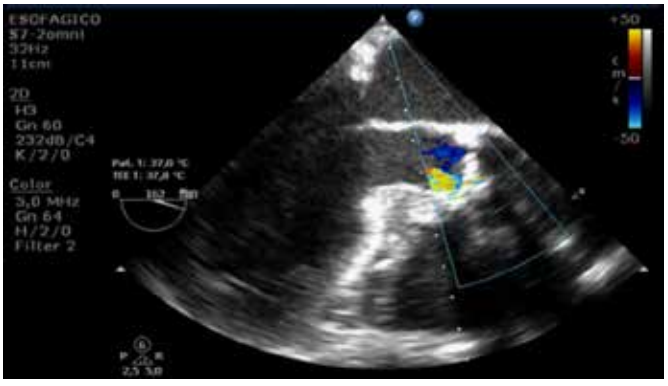

Figure 1. Image of the transesophageal echocardiogram, pre-CPB, in mid-esophageal long axis section, showing paravalvular leak in the right coronary leaflet of the aortic valve bioprosthesis.

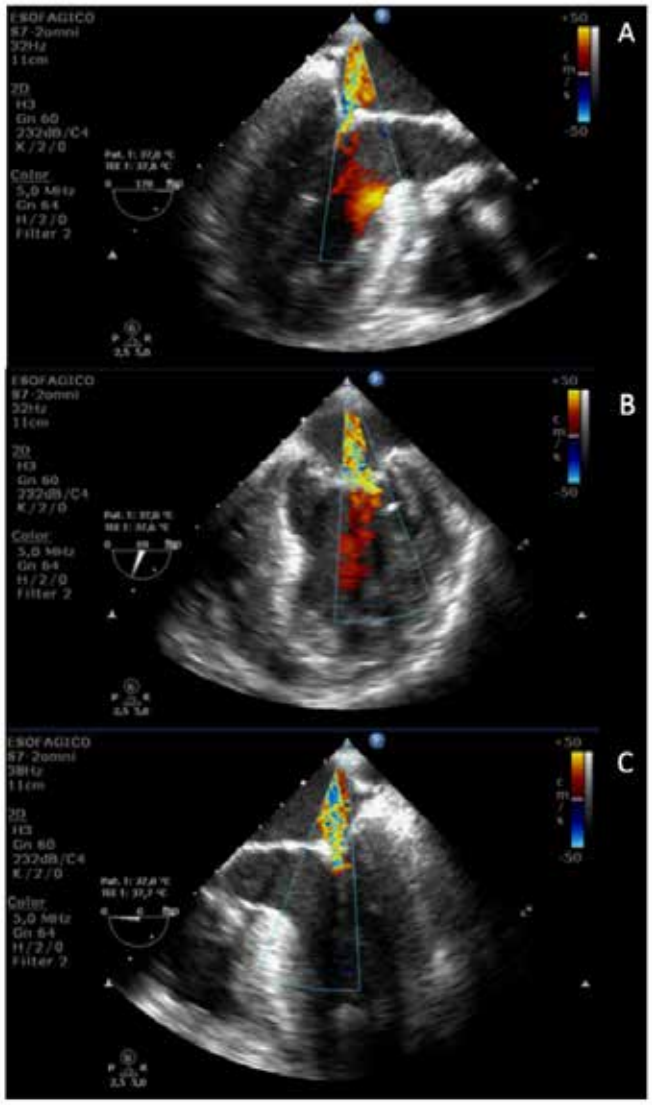

Figure 2. Pre-CPB transesophageal echocardiogram image. A: Mid-esophageal long axis section showing eccentric and important blood reflux from the mitral valve towards the walls of the left atrium. B. Mitral commissural middle esophagus section demonstrating accelerated and turbulent blood flow towards the left atrium. C. Mid-esophageal four-chamber section indicating mitral valve insufficiency.

A median sternotomy and pericardiotomy were performed, followed by full heparinization and connection of the patient to the CPB circuit through the cannulation of the distal ascending aorta and the superior and inferior vena cava. After aortic clamping, a transverse aortotomy was performed and a biological prosthesis removed from the aortic valve, which was dysfunctional, with important signs of degeneration and calcification. A new long-lasting aortic bioprosthesis, number 23, was implanted. Mitral valve exposure was obtained through left atriotomy followed by correction of the lesion responsible for regurgitation through mitral valve repair. Subsequently, SRM was performed using the great saphenous vein as con-

duit in anastomosis with the right coronary artery. Aortic clamping was released after 76 minutes and CPB time was 111 minutes.

At the end of the interventions, TEE demonstrated aortic biological prosthesis with preserved mobility and without paravalvular regurgitation (Figure 3) and mitral valve repair with good appearance, adequate opening and absence of residual insufficiency (Figure 4 A and B).

Figure 3. Transesophageal echocardiogram image, after aortic valve bioprosthesis replacement, in aortic middle esophagus long axis section, demonstrating the absence of paravalvular leak.

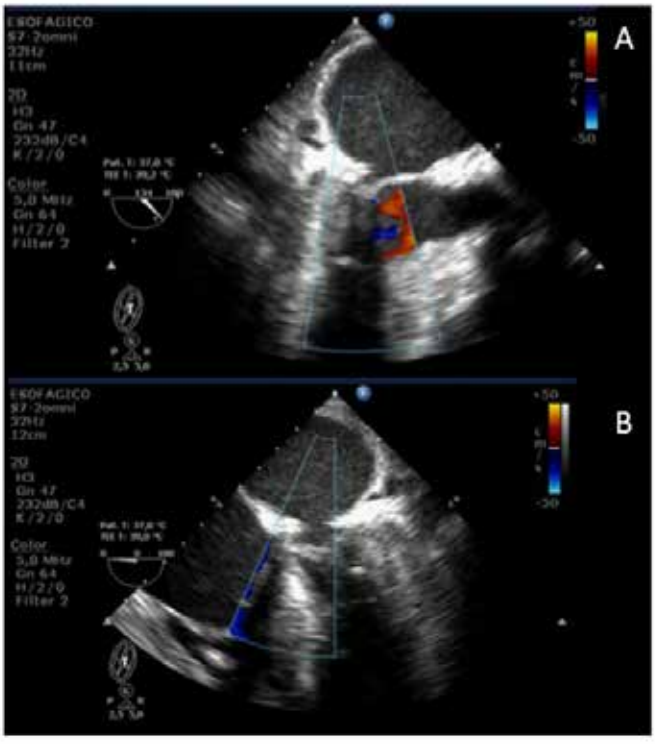

Figure 4. Transesophageal echocardiogram image after mitral valve repair. A. Middle esophageal long axis cut showing adequate mitral valve opening without regurgitation towards the left atrium. B. Mid-esophageal four-chamber view showing absence of mitral insufficiency.

The patient presented a favorable clinical evolution and was discharged from the hospital seven days after the procedure, with adjunct medication and guidance for outpatient follow-up.

DISCUSSION

TEE was incorporated as a diagnostic tool in cardiology about 40 years ago and its role in perioperative assessment is well established, and its purposes are described through a set of guidelines. Great scientific and technological advances have resulted from the expansion of its use, which has allowed its validation as a versatile and highly reliable tool in defining diagnoses, also consolidating itself as an important part of the composition of the monitoring arsenal within the surgery room [4,6].

According to the literature, intraoperative monitoring through TEE has as main objectives: confirming the preoperative diagnosis, detecting new unidentified or previously unsuspected pathologies, guiding surgical interventions, diagnosing the etiology of hemodynamic disorders and evaluating the surgical results in real time [6].

Guidelines for the application of intraoperative TEE were developed by the American Society of Anesthesiologists and the Society of Cardiovascular Anesthesiologists in the 1990s, and, according to these entities, TEE has a positive impact and should be used routinely in all conventional cardiac surgeries and in thoracic aorta procedures, in adults who do not present contraindications [6]. It is currently a notorious procedure, widely used and routinely used in North American and European cardiac surgical centers. On the other hand, in Brazil, its use is still discreet and is concentrated in centers that present a significant number of cardiac interventions [7].

In 2009, the Brazilian Society of Cardiology (SBC) published the document entitled "Echocardiography Indications Guidelines", and later, in 2018, the Brazilian Society of Anesthesiology together with the SBC Cardiovascular Imaging Department published the Consensus on Perioperative TEE aiming to standardize the performance of intraoperative TEE for anesthesiologists and echocardiographers. In line with international guidelines. Brazilian recommendations include a wide spectrum of surgical procedures, such as surgical repair or replacement of valve lesions, aortic diseases and hypertrophic cardiomyopathy, ventricular aneurysm, removal of cardiac tumors, intracardiac thrombectomy, congenital heart disease surgery with cardiopulmonary bypass, placement of intracardiac devices, evaluation of transcatheter procedures (Level of evidence class I) [8].

Due to the proximity of the heart and the esophagus, the exam allows for an accurate analysis of the intra and extra-cardiac anatomy and vessels. Furthermore, through its adjustments, it is able to provide images with higher resolution and number of anatomical cuts. For the method to be applied effectively, the operator must be able to master the manipulation movements of the probe and the

transducer to obtain adequate echocardiographic recordings and to prevent complications [8]. These considerations are especially important in high-risk patients undergoing complex cardiac surgery, such as the case reported here.

Images for mitral valve evaluation can be obtained through two-, four- and five-chamber middle esophagus views, commissural middle esophagus view, basal transgastric short axis view and views of the left atrium and ventricle. The aortic valve complex must be evaluated essentially in the short axis and long axis middle esophagus, long axis transgastric and deep transgastric sections. The purpose of the pre-CPB exam is to verify the morphology, define the disease mechanism, location and extension of the lesions, which are determining factors for surgical decision-making, therapeutic guidance, and may result in changes to the previously planned procedure [5,8]. In an American retrospective review, TEE changed the surgical course in 5.6% of patients [9]. A Brazilian retrospective analysis showed that the examination led to a change in intervention in 3.5% of cases. Its variations and applications must be carefully analyzed, considering the small sample number [4].

After completion, whether of a valve repair or replacement, the multiple axes are again revised, allowing for immediate evaluation of the surgery. At that time, surgeons have the opportunity to perform repairs and, in case of inadequate surgical results, determine the immediate re-approach, preventing morbidity and mortality from possible subsequent reoperations and reducing hospital costs. Studies have shown that post-CPB TEE identified the need for valve revision and repair in up to 6% of cases and that routine intraoperative TEE is associated with an estimated cost savings of $230 per cardiac surgery performed [7,9].

In contrast to the use of echocardiography in valve operations, the assessment of myocardial function after SRM with or without CPB through TEE remains controversial (level of evidence IIa) [10]. Considering CAD as a dynamic and evolutionary, multifactorial process, the pre-SRM examination must be comprehensive and detailed. In this case, the focus is on the assessment of systolic pressure, ventricular function and grading the severity of diastolic dysfunction. It should also include the study of the aorta artery in its proximal ascending and descending portions, in addition to the aortic arch. In the post-procedure, it is essential to assess myocardial function, detect significant complications and ventricular dysfunction, the latter being especially important for weaning from CPB and defining the need for mechanical circulatory support or the use of inotropic agents in the post-CPB period. Changes in blood volume and the level of sedation must be considered when analyzing the ventricular function because they affect the pre- and afterload, which can affect the evaluation [6].

Despite being considered a low-risk procedure, TEE is not free from complications, which are generally related to direct trauma to the airway and esophagus, such as lacerations, esophageal bleeding and burns, dysphagia, bacteremia and paralysis of the vocal cords; or, the indirect effects of the procedure, including the occurrence of hypertension, hypotension, arrhythmias, bronchospasm, inadvertent manipulation of the airway and distraction in patient care [7,8].

CONCLUSION

The use of surgical monitoring through TEE is extremely useful, as it allows the cardiac surgeon and anesthesiologist to evaluate and validate the results in the post-CPB, providing the opportunity to perform immediate corrective measures, diagnosis and adequate management of situations that can lead to weaning of challenging CPB, avoiding unfavorable evolution and additional surgical procedure in the short term. Although a prospective and randomized multicenter study is needed, these data suggest that the routine use of intraoperative TEE in cardiac surgeries, especially in valve replacements and repairs, can reduce the morbidity of patients undergoing complex interventions.

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