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CASE REPORT

Bentall-De Bono Reoperation Associated With Pseudoaneurysm and Infectious Endocarditis

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Abstract

We present the case of a 55-year-old patient who underwent the Bentall-De Bono procedure with mechanical prosthesis in 2005 and was admitted to the emergency department in July 2020 with mixed shock. Complementary exams showed an abscess involving the prosthetic tube, two thirds of the aortic valve circumference and the left ventricle, with a neocavity of about 45 mm in diameter from the aortic sinus to the ascending aorta. The patient underwent surgical repair, with a new procedure using the Bentall-De Bono technique, now associated with coronary artery bypass grafting with a great saphenous vein graft between the aorta and the anterior descending artery. Culture of samples collected intraoperatively showed *Staphylococcus epidermidis*. The patient received antibiotic therapy for 30 days, evolving favorably, and is under regular outpatient follow-up.

Introduction

In 1968, Hugh Bentall and Anthony De Bono described a technique for the combined treatment of diseases that simultaneously affected the aortic valve and the proximal ascending aorta, using a valved tube in which the coronary ostia were reimplanted.[1] This procedure has changed over the years, particularly regarding the reimplantation of the coronary arteries and distal anastomosis of the tube, among which is the technique performed by Cabrol.[2,3]

Keywords

Reoperation; Operative Surgical Procedures; Endocarditis.

The use of valved conduits in the ascending aorta and aortic valve is a widespread method for the surgical treatment of various pathological conditions, including aortic dissection associated with aortic regurgitation. Reoperations in these cases represent a major surgical challenge.[4]

We present the case of a patient who underwent reoperation with the Bentall-De Bono technique and developed pseudoaneurysm with infective endocarditis.

Case report

Male patient, 55 years old, with a previous history of hypertension and surgery, performed in 2005, for correction of aortic dissection with the Bentall-De Bono technique using a 27-mm mechanical prosthesis. The patient was then followed-up for anticoagulation.

The patient arrived at the emergency department with a history of pain in the right iliac fossa for 15 days, and melena. The patient developed progressive weakness, dizziness, and syncope. On admission, hypovolemic shock, increased response to coumarin anticoagulants — international normalized ratio (INR) > 10 —, partial thromboplastin time (aPTT) of 100.8 seconds and mixed acidosis were evidenced. After clinical compensation and coagulation management, an upper digestive endoscopy was performed, which revealed a Dieulafoy's lesion, managed during the procedure.

The patient had mixed shock due to fever and significant leukocytosis (57,000/mm^3) with a shift to the left. Blood and urine cultures were negative. During the investigation, a chest computed tomography was

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performed, which identified bilateral pleural effusion predominantly on the left side and hypoattenuating lesion on the posterior face of the valved tube, suggestive of thrombus or intraluminal vegetation measuring 15 x 08 mm that insinuates into the ostium of the anterior descending artery. There was also a rupture of the tube from the plane of the mechanical prosthesis to the height of the ascending aorta, with a neocavity measuring 60 x 38 mm, related to the pulmonary trunk (cranially), right ventricular outflow tract (anteriorly) and anterior descending artery (posteriorly). Signs of extrinsic compression of the proximal portion of the anterior descending artery and the pulmonary trunk were observed. This was an interesting finding, since the circumflex artery originates from the ostium of the right coronary artery and runs through retroaortic path adjacent to the plane of the aortic valve prosthesis.

A transthoracic echocardiogram was performed and showed infective endocarditis complicated with a possible pseudoaneurysm of the valved tube. The esophageal echocardiography showed, in the ascending portion of the prosthesis, a neocavity involving about two thirds of the prosthetic circumference, extending from the aortic sinus measuring about 45 mm, suggestive of a fistula to the left ventricular cavity and a vegetation adhered to the prosthetic ring measuring 28 x 11 mm. This neocavity was fed by a 6-mm perforation between the lumen of the ascending aorta and the neocavity; there was also a systolic-diastolic flow on Doppler associated with an irregular echogenic mass adhered to the wall of the prosthetic tube, measuring approximately 18 x 09 mm, suggestive of endocarditis. The double-disk mechanical prosthesis had good excursion of its mobile elements and maximum and mean gradients of 43 and 27 mmHg, respectively, with minimal prosthetic reflux.

After clinical compensation of the patient and Heart Team discussed and decided for surgical intervention.

Intraoperatively, a large amount of vegetation was seen around the mechanical prosthesis and the internal face of the Dacron graft, close to the reimplantation of left coronary artery, which explains the occurrence of suture dehiscence and extensive pseudoaneurysm. Thus, it was necessary to ligate the ostium of the left main coronary artery. Replacement of a 25-mm mechanical aortic prosthesis with a 28-mm Dacron tube was performed using the Bentall-De Bono technique combined with coronary artery bypass grafting using a great saphenous vein graft from the tube to the anterior descending artery, with anoxia time of 65 minutes. Right coronary artery reimplantation was performed *en bloc* due to the position of the circumflex artery ostium that was adjacent to the right coronary ostium (Figures 1 and 2).

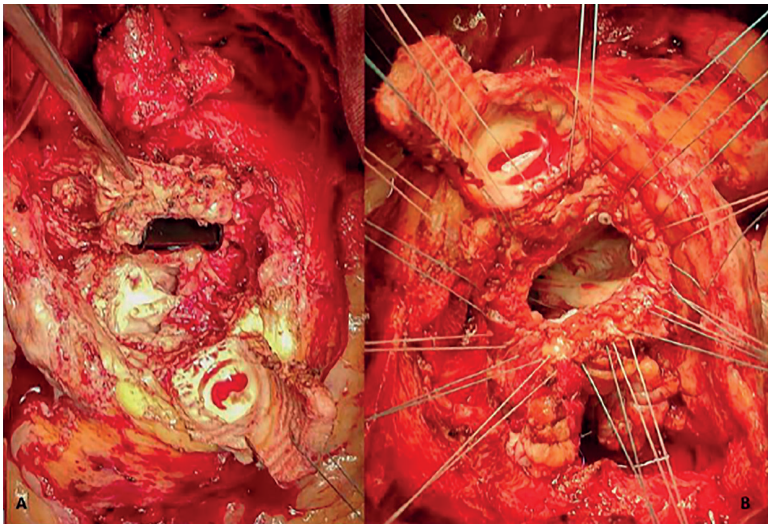

Figure 1 – The intraoperative view showed the vegetation around the Dacron graft and entering in left coronary artery with the mechanical prosthesis in the center of the figure (A). The composite graft was inserted using multiple sutures reinforced by subannular Teflon (B).

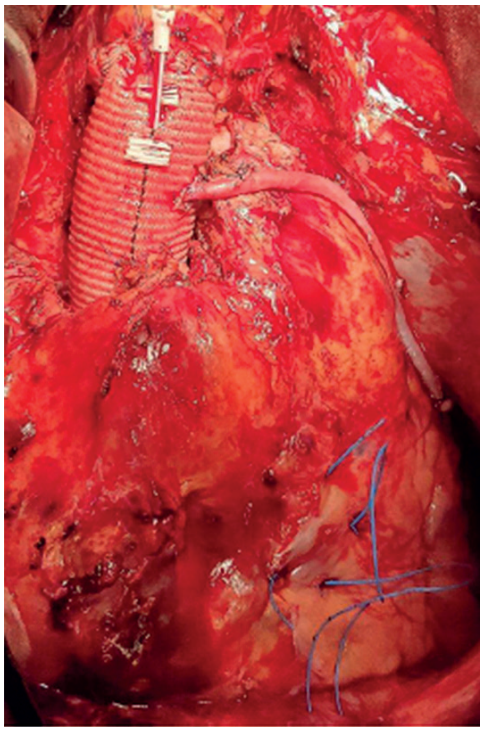

Figure 2 – The final view in the Bentall-De Bono technique combined with coronary artery bypass grafting to the anterior descending artery.

Culture of samples collected intraoperatively showed vancomycin-sensitive *Staphylococcus epidermidis*. The patient received antibiotic therapy for 30 days, with a favorable course. He remained eight days in the intensive care unit and 22 days in the ward. The patient was discharged from hospital in August 2020 with the electrocardiogram (Figure 3) showing sinus rhythm and change in ventricular repolarization in the lower wall, chest X-ray with small pleural effusion on the left and no pulmonary congestion, INR 1.75, and leukocytes 8,000/mm^3. The last echocardiogram showed with hypocontractility of the middle and basal segments of the inferior and inferolateral walls of the left ventricle with ejection fraction of 68%, biological prosthesis in aortic position with thin leaflets, preserved opening and mobility, minimum reflux, no paravalvular leak, maximum gradient of 32 mmHg and average gradient of 17 mmHg, valve area of 1.9 cm^2. The patient is under regular outpatient follow-up.

Discussion

The techniques for approaching the ascending aorta have undergone several changes over the decades, due

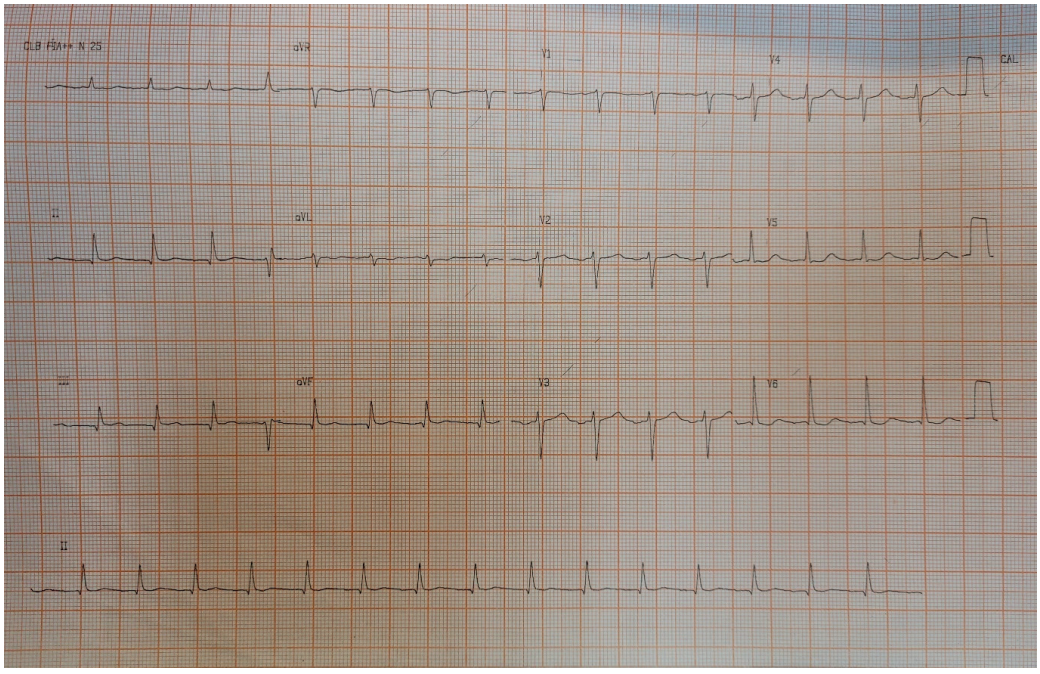

Figure 3 – Electrocardiogram showing regular and sinus rhythm after surgical management of the patient.

to the technical difficulties imposed by the challenging scenario of aortic aneurysms and dissections. Among them, the techniques of Bentall-De Bono and Cabrol[1,3] stand out, due to their vital importance for the cardiovascular surgery

In the present case, a Bentall-De Bono reoperation was performed 15 years after the first surgery. The patient evolved with mixed (hypovolemic and septic) shock and complementary tests showed the evidence of a neocavity suggestive of an abscess with a large amount of intraluminal vegetation compromising the prosthetic tube and part of the aortic valve circumference, which was confirmed during the surgery.

Kirali et al.,[4] in a 15-year analysis of patients with aortic root abscess, a severe form of infective endocarditis, reinforced the surgical challenge of these cases. These patients may have fistulas to any cardiac chamber, pseudoaneurysms, arrhythmias and conditions associated with significant hemodynamic instability. In their series of 27 patients, the main microorganism was *Staphylococcus aureus*, in contrast to our case, in which *Staphylococcus epidermidis* was evidenced.

In line with the case presented, Wilbring et al.,[5] in a prospective cohort study of patients with endocarditis undergoing the Cabrol and Bentall-De Bono procedures, inferred that infection is a serious complication in this group of patients. In these patients, clinical treatment alone does not provide good results, and surgery is imperative; however, it is associated with high mortality rates ranging from 20% to 80%. These results were corroborated by Umminger et al.[6]

It is worth highlighting that the proximity of dehiscence and abscess to the previous reimplantation of the left coronary artery promoted the formation of pseudoaneurysm and made it imperative to ligate the left coronary trunk with subsequent coronary artery bypass grafting.

Thus, the Bentall-De Bono reoperation isa challenge for the surgical team, being associated with high mortality, increased bleeding and thromboembolic events, especially when associated with endocarditis, which is considered an independent risk factor for mortality.[7,8] Recently, there have been updates to the modified Duke criteria, which are fundamental to the diagnosis of infective endocarditis. These updates have provided new microbiological evidence, imaging methods, and predisposing conditions among the minor criteria (e.g., transcatheter valves), in addition to the inclusion of surgical evidence (abscesses, vegetations or changes in the structure of the valve annulus) identified by the cardiovascular surgeon[9] (Table 1).

The present case illustrates the importance of surgery, even in patients at high cardiovascular risk, and the importance of the Heart Team and the cardiovascular surgery team involved, in view of the ongoing challenges of the specialty.

Author Contributions

Conception and design of the research, acquisition of data, analysis and interpretation of the data, statistical analysis, obtaining financing: Rabelato J, Antonio IBG; writing of the manuscript: Rabelato J, Antonio IBG, Maia AS, Dantas DC; critical revision of the manuscript for intellectual content: Rabelato J, Antonio IBG, Maia AS, Dantas DC, Almeida AF, Issa M.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any thesis or dissertation work.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the Instituto Dante Pazzanese de Cardiologiaunder the protocol number 4.694.868 (Protocolo CEP5156). All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

Table 1 – Updates to modified duke criteria by the 2023 Duke-ISCVID criteria for infective endocarditis. Adapted from Fowler et al.9

PATHOLOGIC CRITERIA	Change
Microorganism identification	Microorganisms identified in appropriate sample by PCR, amplicon or metagenomic sequencing, or in situ hybridization
MAJOR CLINICAL CRITERIA	**Change**
Blood cultures	Removed requirements of timing and separate venipunctures for blood cultures
Definition of typical organisms	Other typical pathogens were added: 1) S. lugdunensis; E. faecalis; all streptococci except S. pneumoniae and S. pyogenes; Granulicatella spp.; Abiotrophia spp.; & Gemella spp. 2) Organisms to be considered "typical" IE pathogens in the setting of intracardiac prosthetic material: coagulase negative staphylococci, Corynebacterium striatum; C. jeikeium, Serratia marcescens, Pseudomonas aeruginosa, Cutibacterium acnes, non-tuberculous mycobacteria, and Candida spp.
Other microbiological tests	New major criteria for fastidious pathogens: 1) PCR or amplicon/metagenomic sequencing identifies C. burnetii, Bartonella sp., or T. whipplei from blood; or 2) IFA > 1:800 for IgG antibodies identifies B. henselae or B. quintana.
IMAGING	
Echocardiography	Similar to earlier versions. Cornerstone of imaging criterion.
Cardiac computed tomography	New major criterion. Findings equivalent to echocardiography.
[18F]FDG PET/CT	New major criterion. Findings for native valve, cardiac device, or prosthetic valve > 3 months after cardiac surgery are equivalent to echocardiography.
Surgical	New major criterion. Intraoperative inspection constitutes Major Criterion in absence of Major Criterion by cardiac imaging or histopathology.
MINOR CLINICAL CRITERIA	
Predisposition	Transcatheter valve implant/ repair, endovascular CIED, and prior diagnosis of IE was added.
Fever	Unchanged.
Vascular phenomena	Splenic and cerebral abscess was added.
Immunologic phenomena	Definition for immune complex-mediated glomerulonephritis was added.
Microbiological	PCR or amplicon/metagenomic sequencing evidence of typical pathogen was added.
Imaging	PET/CT evidence < 3 months of cardiac surgery was added
Physical examination	New auscultation of regurgitant murmur when echocardiography is unavailable.

PCR: polymerase chain reaction; FDG: fluorodesoxyglucose; PET/CT: positron emission tomography; CIED: cardiac implantable electronic devices; IFA: indirect immunofluorescence assay; IgG: immunoglobulin G; IE: infective endocarditis.

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