

A Case Report of Modified Cabrol Technique in a 60-Year-Old Male with Coronary Origin Anatomical Variant

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Rezumat

Tehnica Cabrol modificată la un pacient în vârstă de 60 ani cu variantă anatomică a ostiilor coronariene

Introducere: În majoritatea cazurilor chirurgia reconstructivă a aortei proximale este formată din înlocuirea aortei cu o proteză valvulată și este urmată de reimplantarea ostiilor coronariene în proteză. Dar există cazuri unde datorită variantelor anatomiche a ostiilor coronariene, chirurgia standard a rădăcinii aortice necesită o strategie terapeutică diferită.

Prezentare caz: În cele ce urmează, vă prezentăm un pacient de 60 de ani cu multipli factori de risc cardiovascular (fumător, hipertensiv, dislipidemic) cunoscut cu stenoză degenerativă severă a valvei aortice bicuspe asociată cu un anevrism de aortă ascendentă ce crează o stenoză extrinsecă la nivelul arterei coronare stângi. După bilanțul preoperator, se decide asupra unei operații de înlocuire a valvei aortice și a aortei ascendente. În timpul intervenției chirurgicale, se descoperă că ambele origini ale ostiilor coronariene se regasesc la nivelul cuspei coronare stângi, formând un trunchi coronarian comun. Din cauza acestei variante anatomiche se decide intraoperator implantarea ostiilor coronariene într-o pastilă unică la nivelul protezei valvulate printr-o interpoziție cu proteză vasculară ePTFE nr 10.

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Concluzie: Așadar este vorba despre un caz rar unde chirurgia rădăcinii aortice este asociată cu varianta anatomică a originilor ostiilor coronariene în "țeava de pușcă" unde o tehnică chirurgicală Cabrol modificată a fost folosită.

Cuvinte cheie: anevrism aortic, chirurgia rădăcinii aortice, tehnica Cabrol modificată, varianta anatomică a ostiilor coronariene, bicuspidie aortică

Abstract

Introduction: Reconstruction surgery of the proximal aorta in most cases involves the use of an aortic conduit, followed by reimplantation of the coronary ostia. Although uncommon, the origin of the coronary arteries in certain anatomical variants poses additional difficulties when performing surgery on the aortic root and requires a different treatment rationale.

Case report: We hereby present the case of a 60-year-old patient with multiple cardiovascular risk factors (smoking, arterial hypertension and dyslipidemia), suffering from severe degenerative stenosis of a bicuspid aortic valve, associated with ascending aorta aneurysm and a significant extrinsic stenosis of the left coronary artery caused by the aneurysm. The patient presented with severe degenerative bicuspid aortic valve stenosis associated with ascending aorta aneurysm and a significant extrinsic stenosis of the left coronary artery caused by the aneurysm. Following the preoperative assessment, it was decided that the best course of action was to perform surgery on the aortic valve and ascending aorta. During the surgery, the origin of the right and left coronary ostia were found at the level of the left coronary cusp, both forming a common coronary button. Due to this particular anatomical variant, it was decided to reimplant them as a common button onto the main conduit by means of an interposed No.10 PTFE (Polytetrafluoroethylene) vascular prosthesis.

Conclusion: A rare case of aortic root surgery associated with coronary ostia origin variant "shot-gun barrel", which required a different method of reimplantation: modified Cabrol technique.

Key words: Cabrol, aneurysm, dissection, aortic root replacement, bicuspid aortic valve, coronary ostia anatomical variant

Introduction

Surgical repair of ascending aortic aneurysms is now commonly performed using a composite graft. In 1968, Bentall and De Bono were the first to describe such an approach to treating aortic root abnormalities and their method of treating dysfunctions of the aortic valve, aortic root and ascending aorta by using a valved conduit (1). Though it was widely used, the Bentall procedure was not risk-free. In the original Bentall procedure the coronary

arteries are directly anastomosed to the aortic valved conduit (2). This put the suture lines under tension and the only means to control the bleeding were the circumferential suture lines and an overall aortic wraparound (3). Thus, postoperative complications such as coronary detachment, formation of false aneurysms were common and the need for reintervention was high. In order to reduce the likelihood of complications several modified techniques emerged, all of them involving the creation of coronary "buttons", which are then

implanted into the aortic valved conduit (4-6). Due to their better postoperative outcomes, this kind of procedures gained more and more acceptance and are now considered the standard of care (7). One such technique was developed by Cabrol and coworkers in order to further simplify the coronary reimplantation process and to minimize complications (8). The original Cabrol technique involves connecting the coronary buttons and the aortic valved conduit by means of an interposed vascular graft, sewn in a side-to-side fashion to the medial aspect of the aortic graft (9,10). This greatly reduced the tension along the suture lines and offered a better outcome for the patients (11). In order to better suit the local anatomy, several variants of the Cabrol technique were developed, each offering a tailored approach to the situation at hand.

Coronary reimplantation is one of the most challenging aspects of the aortic root replacement surgeries and can be complicated by damage to the coronary button, leading to bleeding, coronary occlusion or malperfusion, or by the challenging local anatomy (12). Although uncommon, facing an anomaly of the coronary arteries or a rare variant poses a significant challenge in the course of the surgery (13). The literature defines normal as morphological finding in >1% of the population, normal variants as unusual morphological finding in >1% of the population and anomaly as a morphological finding in <1% of the general population (14). Based on large patient population studies, the most common anomalies involve the ectopic origin of the coronary arteries, of which the origin from a wrong sinus of Valsalva predominates (4).

Case Report

A 60 year old patient with multiple cardiovascular risk factors (smoking, arterial hypertension and dyslipidemia), with severe degenerative bicuspid aortic valve stenosis associated with ascending aorta aneurysm (51mm ecographic, 54 mm angioCT) and a significant extrinsic stenosis of the left coronary artery caused by the aneurysm. *Fig. 1*

presents the intraoperative aspect of the ascending aorta aneurysm. The patient was symptomatic, exhibiting signs of exertional dyspnea and complained of angina during heavy effort. He was admitted to hospital to undergo surgery.

The transthoracic ultrasound examination displayed multiple abnormalities: a significant hypertrophy of the left ventricle's middle segment with antero-lateral papillary muscle hypertrophy, a 51 mm aneurysm on the ascending aorta with recalibration at the level of the aortic arch, a severely stenotic bicuspid aortic valve with bound left and right cusps Aortic Valve Area (AVA) 0.9 cm², mean gradient 57 mmHg, Vmax 4.7 m/s) and moderate aortic valve regurgitation. The echographic aspect of the stenotic bicuspid aortic valve and the degree of aortic valve regurgitation is represented in *Fig. 2*.

The coronarography displayed a left coronary trunk with a 90-95% ostial stenosis on its proximal and ostial segment, possibly due to extrinsic compression caused by the

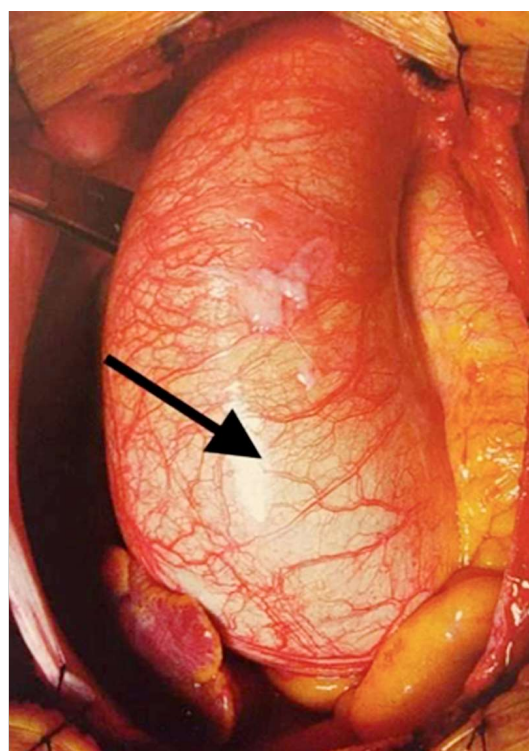


Figure 1. Intraoperative aspect of the ascending aorta aneurysm

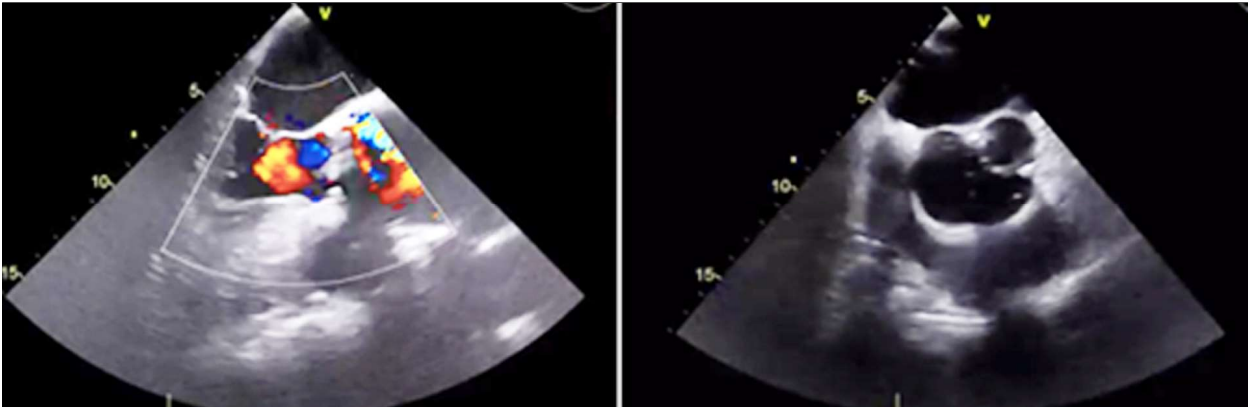


Figure 2. Echographic aspect of the stenotic bicuspid aortic valve and the degree of aortic valve regurgitation.

aneurysm. *Fig. 3* presents a coronary angiogram showing the left coronary trunk with a 90-95% ostial stenosis. The computed tomography angiogram of the thoracic aorta presented in *Fig. 4* revealed calcium deposits on the aortic valve, an ascending aorta aneurysm with a maximum diameter of 54 mm, recalibrating to 36 mm in diameter at the level of the aortic arch (anterior to the brachiocephalic trunk), a fully permeable descending aorta, 24 mm in diameter, showing no signs of degeneration.

According to the current guidelines the patient fit into the IA category for aortic valve replacement and due to the size of the

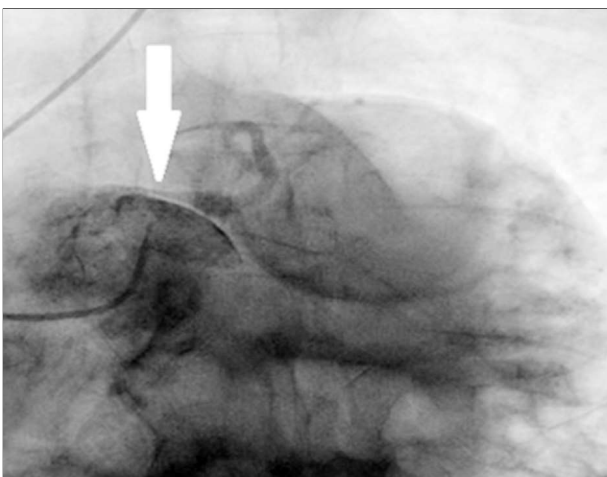


Figure 3. Coronary angiogram showing the left coronary trunk with a 90-95% ostial stenosis.

aneurysm and the associated valve condition the patient also met the indications for performing surgery on the aneurysm. Consequently, the indication for surgery was given and an informed consent was signed by the patient. Median sternotomy was performed, followed by central cannulation, cross-clamping and single dose antegrade cardioplegia. The aneurysm was identified

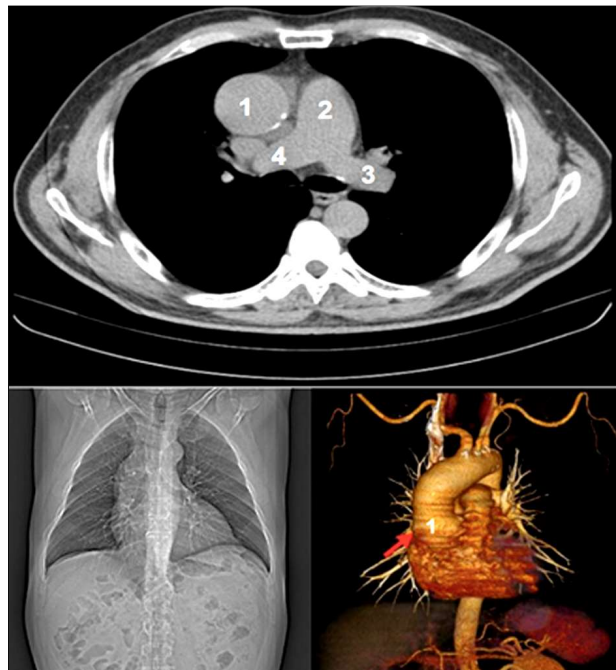


Figure 4. CT (Computed Tomography) angiography: Dilation on the ascending aorta: 1- Aortic aneurysm, 2-Descending aorta, 3-Left pulmonary artery, 4- Right pulmonary artery.

and after performing aortotomy the bicuspid aortic valve was revealed, showing a significant degree of calcification. The excision of the native valve was performed, and the origin of the coronary ostia was found at the base of the left cusp. A coronary ostia variant was discovered, the origin of the two coronary ostia having a “shotgun barrel” conformation as presented in *Fig. 5*.

This anatomical variant led to the necessity of performing a modified version of the original Cabrol technique in order to better suit the local anatomy. The replacement of the aortic valve and of the ascending aorta was performed using a No. 25 Carbomedics valvulated conduit, followed by the reimplantation of a single coronary button (with both coronaries emerging from it) onto the main conduit by the means of an interposed No. 10 PTFE (Polytetrafluoroethylene) vascular prosthesis, thus creating a prosthetic coronary supertrunk (Modified Cabrol technique). *Fig. 6* presents the intraoperative aspect of the modified Cabrol technique.

The postoperative course was uneventful, with no need for blood transfusions, the patient was extubated 5 hours postoperatively, showing sinus rhythm and no ECG (Electrocardiogram) abnormalities. Drainage tubes were removed 2 days postoperatively. The patient later developed atrial fibrillation with rapid ventricular response for which he was given antiarrhythmic medication (Amiodarone).

The postoperative control echocardiography showed a 55% ventricular ejection fraction, with a fully permeable, functional prosthesis, with no signs of bleeding. The patient was discharged 7 days after being admitted. The patient has provided informed consent for publication of the case.

Case Particularities

The particularity of the case consists of the existing coronary ostia anatomical variant, with both arteries originating from the same coronary sinus, in a “shotgun barrel” conformation. Due to this specific local anatomy the

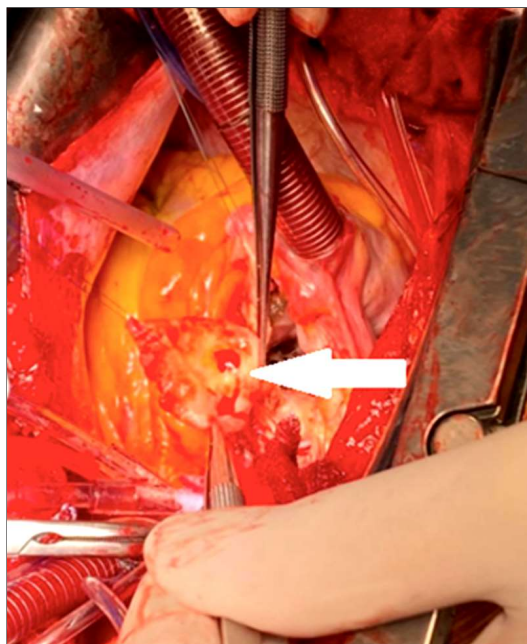


Figure 5. “Shotgun barrel” conformation of the coronary ostia

surgeon applied a modified Cabrol technique. The surgical technique used was to implant the bicoronary single button on the aortic valve conduit using a single vascular

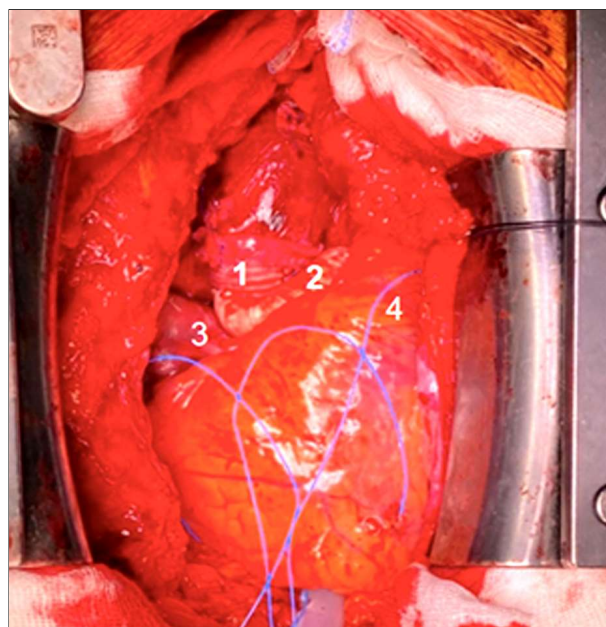


Figure 6. Intraoperative aspect of the modified Cabrol technique: 1-No.25 Carbomedics valvulated aortic conduit, 2-No.10 PTFE vascular prosthesis, 3-Right auricle, 4- Infundibulum.

prosthesis. The reason for the method used was to avoid traction of the coronary button, and to prevent putting the anastomoses under tension.

Discussion

From the literature, we know that the original Cabrol technique involves connecting the coronary buttons and the aortic valved conduit by means of an interposed vascular graft, sewn in a side-to-side manner to the medial aspect of the aortic graft (3,10). This greatly reduced the tension along the suture lines and the traction on the coronaries, offering a better outcome for the patients (15,16). In time, in order to better suit the local anatomy, several variants of the Cabrol technique were developed (17,18). This offers the surgical team the advantage to be able to adapt according to each individual case.

Among the diagnostic imaging techniques, TEE (transesophageal echocardiography) is a noninvasive and cost-effective examination, able to comprehensively characterize the morphology and functional status of the cardiac and vascular structures; this information is essential in the setting of the surgical approach (19). Also, before establishing the best surgical approach, the accurate individual anatomical assessment of lesions should be done by using all the appropriate diagnosis methods and involving other medical specialties (interventional cardiology and radiology). Therefore, in cases with high risk, complex patients, a strong collaboration between all specialties is needed (20-25).

In our clinical case, due to the presence of the anatomical variant described, the modified Cabrol technique used involved the implantation of the bicoronary single button on the valved aortic conduit using a single vascular prosthesis. This approach may provide a solid alternative to the conventional Cabrol procedure, especially when the anatomy of the patient is not favourable for smooth single graft placement between the coronary ostia and the aorta (26,27).

Conclusion

Despite existing coronary anatomic variations, by modifying the surgical technique used in the replacement of the aortic valve and ascending aorta surgery becomes feasible. The Cabrol technique offers the possibility for modifications that adapt at local anatomy, thus allowing the surgical team to practice a personalized surgical intervention, best suited to the patient's needs.

Conflicts of Interest

The authors declare no conflict of interest.

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Informed Consent Statement

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Data Availability Statement

Data available on request.

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