

Implantation of transcatheter aortic valve prosthesis through the ascending aorta concomitant with coronary artery bypass grafting without cardiopulmonary bypass

Implante de prótese valvar aórtica transcater através da aorta ascendente concomitante com revascularização do miocárdio sem circulação extracorpórea

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Abstract

Introduction: The transcatheter aortic valve implantation in the treatment of high-risk symptomatic aortic stenosis has increased the number of implants every year. The learning curve for transcatheter aortic valve implantation has improved since the last 12 years, allowing access alternatives.

Objective: The aim of this study is to approach the implantation of transcatheter aortic valve through transaortic via associated with off-pump cardiopulmonary bypass surgery in a 67-year-old man, with chronic obstructive pulmonary disease, arterial hypertension and kidney transplant.

Methods: Off-pump coronary artery bypass surgery was performed and the valve in the aortic position was released successfully.

Results: There were no complications in the intraoperative and postoperative period. Gradient reduction, effective orifice in-

creasing of the prosthesis and absence of valvular regurgitation after implantation were observed by transesophageal echocardiography.

Conclusion: Procedural success demonstrates that implantation of transcatheter aortic valve through the ascending aorta associated with coronary artery bypass surgery without CPB is a new option for these patients.

Descriptors: Thoracic Aorta. Aortic valve stenosis. Valve Prosthesis Implantation. Cardiopulmonary bypass, Coronary artery bypass grafting, Systemic inflammatory response syndrome.

Resumo

Introdução: O implante de prótese aórtica transcater no tratamento da estenose aórtica sintomática de alto risco vem aumentando de número a cada ano no mundo. A curva de apren-

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Abbreviations, acronyms & symbols	
CABG	Coronary Artery Bypass Grafting
CCS	3 Canadian Cardiovascular Society Angina Classification
COPD	Chronic obstructive pulmonary disease
CPB	Cardiopulmonary by-pass
LVEDD	Left ventricular end diastolic diameter
NYHA	New York Heart Association
TEE	Transesophageal echocardiography

dizado para implante da prótese aórtica transcater melhorou os resultados ao longo dos últimos 12 anos, o que permitiu o surgimento de outras vias de acesso como alternativas.

Objetivo: Este trabalho refere-se ao implante de prótese aórtica transcater pela via transaórtica associada à revascularização do miocárdio sem em paciente do sexo masculino de 67 anos

INTRODUCTION

The learning curve for transcatheter aortic prosthesis implantation over the last 12 years has improved the results and allowed the emergence of other approach vias as implant alternatives. Access through the ascending aorta is a possibility for cases in which the transfemoral and transapical vias are contraindicated, mainly in combined procedures of aortic valve replacement and coronary artery bypass grafting. This study describes the implantation of a transcatheter aortic prosthesis through the ascending aorta concomitant with coronary artery bypass grafting without cardiopulmonary bypass in high risk patients.

METHODS

Operative sequence

67-years-old male patient, white, with chronic obstructive pulmonary disease (COPD), hypertension and right kidney transplanted seven years ago, was admitted to our hospital with angina *pectoris*, CCS 3 (Canadian Cardiovascular Society Angina Classification) and dyspnea at minimum effort, NYHA Class IV (New York Heart Association).

Arterial blood pressure of 150x90 mmHg, heart rate 98 bpm, cardiac auscultation with presence of an ejection murmur in the aortic area, presence of Gallavardin phenomenon^[1] and B1 hypophonetic sound. Coronary angiography showed critical obstructive lesions of 80% in the distal third of the right coronary anterior descending artery with 70% in the proximal third, 99% *diagonalis* in the proximal third and 80% in the first marginal branch ostium.

A transthoracic echocardiogram (TTE) showed a double aortic valve lesion with predominant severe and calcified stenosis. The flow rate was 4.44 m/s, mean gradient of 48

com doença pulmonar obstrutiva crônica, hipertensão arterial sistêmica e transplante de rim.

Métodos: A revascularização miocárdica e o implante da prótese aórtica transcater foram realizados com sucesso sem o auxílio da circulação extracorpórea.

Resultados: No intra e pós-operatório não houve complicações, a redução do gradiente transvalvar, o aumento do orifício efetivo e ausência de regurgitação paravalvar foram observados pelo ecocardiograma transesofágico.

Conclusão: O implante da prótese aórtica transcater pela aorta ascendente associado com revascularização do miocárdio sem circulação extracorpórea é uma nova alternativa para pacientes de alto risco.

Descritores: Aorta torácica. Estenose da valva aórtica. Implante de Prótese de Valva. Circulação extracorpórea. Revascularização do miocárdio. Síndrome da resposta inflamatória sistêmica.

mmHg aortic valve, ejection fraction of 80%, left ventricular end diastolic diameter (LVEDD) of 51 mm, left atrium and aorta of 46 mm and 31 mm, respectively. The creatinine was 2.8 mg/dl and creatinine clearance of 58 ml plasma/min/m². Other comorbidities included left carotid disease with significant asymptomatic atherosclerotic plaque. The EuroSCORE II was 14.86%. CABG and implantation of transcatheter aortic prosthesis for ascending aorta without the use of CPB (Figures 1 and 2) were performed. Both internal thoracic arteries were dissected and a segment of the magna right saphenous vein was removed. The CPB circuit was installed by the vein and femoral artery in case of any complication during the procedure.

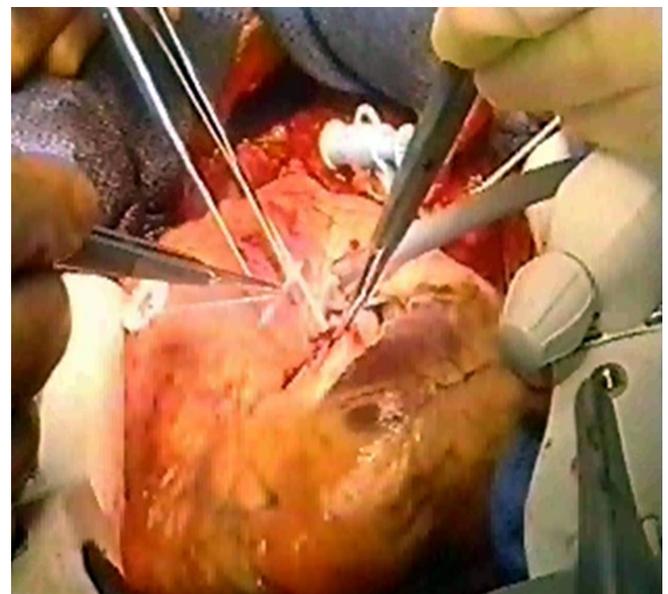


Fig. 1 – Image of the procedure.

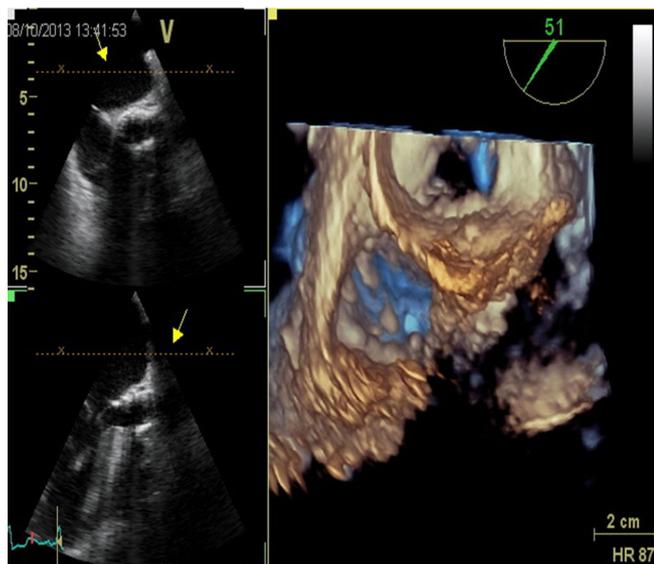


Fig. 2 – Intraoperative 3D Transesophageal Echocardiogram.

The procedure was performed in a hybrid operating room with C-shaped arch Philips BV Pulsera and transesophageal echocardiography (TEE) GE Vivid E9 3D. The response curve dose of systemic heparin, described by Bull and colleagues in 1975 was used^[2]. The right internal thoracic artery was anastomosed to the left internal thoracic artery, making a Y-shaped branch. Thus, the left internal thoracic artery was grafted to the descending artery and the right internal thoracic artery to the diagonal branch, and the saphenous vein segment to the first marginal branch. CPB was not used at any stage of the procedure.

During the anastomoses of coronary grafts we used stabilizer and intracoronary shunts of 1.5 for diagonal and 1.75 for anterior descending and first marginal branch. In the anastomosis of the saphenous marginal branch there was a hemodynamic instability due to the presence of cardiac dislocation and severe aortic stenosis, by releasing the heart to hemodynamic stability, then resumed the anastomoses without instability. The implantation of transcatheter aortic valve prosthesis was performed through the ascending aorta in the anterior, superior and lateral wall, locations with lower prevalence of calcification^[3].

To prevent bleeding a purse was performed using 4.0 prolene wires and bovine pericardial pledges. The prosthesis used was No. 24 and the 28 balloon catheter, the implantation in the aortic valve annulus without pre-dilatation guided the previously introduced guidewire into the left ventricle. Heart rate was increased to 160 bpm using a temporary pacing electrode in the right ventricle, this maneuver was used to decrease blood flow in the aorta during the release of the prosthesis and the total time of the aortic procedure lasted 28 minutes.

There was no intraoperative and postoperative complication, the patient was extubated eight hours after the procedure

without the need for inotropic support or temporary pacemaker. Postoperative TEE showed reduced transvalvular gradient, effective increased orifice, and absence of paravalvular regurgitation. The patient was asymptomatic and returned to professional activity after three months follow-up.

DISCUSSION

The implantation of transcatheter aortic prosthesis represents a paradigm shift in the treatment of aortic stenosis in symptomatic or high risk patients considered inoperable.

The first implantation of transcatheter aortic prosthesis in humans was published in 2002^[4], and the first randomized study to determine safety and effectiveness of transcatheter prosthesis in the aortic position demonstrated the noninferiority of the method compared with conventional surgery^[5]. The global sample exceeded 100 thousand cases of transcatheter prostheses implantation over the last twelve years. In Brazil, three types of transcatheter prostheses are used, including a Brazilian prosthesis with good results through transapical access^[6] and as an alternative it was implemented by femoral access with success^[7].

Transapical and transfemoral approaches are the most used for the transcatheter treatment of symptomatic calcified aortic stenosis. However, in patients with peripheral arterial disease, deformed chest and fragile left ventricular apical segment, other approaches can be used. The transaortic approach through the ascending aorta and ministernotomy is an attractive therapeutic option^[8]. However, there are few reports in the literature on thoracotomy through a median sternotomy involving implantation of transcatheter aortic prosthesis concomitant to off-pump coronary artery bypass grafting. The study by Mohammad et al.^[9] in 2011 on the transcatheter aortic prosthesis implantation through the ascending aorta and coronary artery bypass grafting showed reproducible results with success.

Our study concerns a patient who had severe aortic stenosis and associated coronary artery disease, and the “Heart Team” opted for transaortic via in the ascending portion with full median sternotomy due to the need for CABG; two mammary arteries and one great saphenous vein segment were used. The aid of 3D TEE allowed the release of INOVARE® transcatheter aortic prosthesis at the desired location without complication. Full off-pump CABG was performed, and the right coronary artery was not revascularized because it presented an obstructive lesion in the distal third. The CPB system was on standby, allowing to perform the procedure safely if there were any complications.

However, there were some difficulties during the procedure, the largest of which was to establish the optimal length of the introducer and release device of the transcatheter valve between puncture in the aortic wall up to the aortic valve annulus. Leaving the guidewire until the tip of the left ventricle

and determine the exact point of release of the prosthesis are important maneuvers to the aforementioned procedure.

The hybrid operative treatment with transcatheter aortic prosthesis implantation through the ascending aorta and CABG is an alternative therapy that justifies the indication for symptomatic calcified aortic stenosis associated with coronary artery disease in high-risk patients.

Authors' roles & responsibilities	
JCFL	Analysis and/or interpretation of data, conception and design of the study, performing surgeries and/or experiments
LEA	Performing surgeries and/or experiments
AAF	Performing surgeries and/or experiments
TFA	Performing surgeries and/or experiments, writing of the study or critical analysis of its content
DMB	Writing of the study or critical analysis of its content

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