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Transapical valvuloplasty for correction of severe mitral stenosis with arrhythmic repercussion in a pregnant woman: case report

Valvoplastia transapical para correção de estenose mitral grave com repercussão arritmica em gestante: relato de caso

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ABSTRACT – This report describes a therapeutic alternative for correction of severe mitral stenosis causing high-response atrial fibrillation, and consequent syncope in a woman at 8 weeks gestational age. A percutaneous valvuloplasty attempt failed, because the transseptal puncture was not possible, and a definitive resolution was achieved by transapical valvuloplasty, via left thoracotomy through an inframammary incision, with direct access to the mitral valve. Since this was an original and complex procedure, this case is of relevant importance in the treatment of severe mitral stenosis in patients whose conditions render a conventional procedure impossible.

Keywords: Mitral valve stenosis; Balloon valvuloplasty; Pregnancy

RESUMO – Este relato descreve uma alternativa terapêutica para a correção de estenose mitral grave determinante de fibrilação atrial de alta resposta e consequente síncope em gestante de 8 semanas. Houve insucesso em valvuloplastia percutânea, pela impossibilidade de punção do septo atrial e subsequente resolução definitiva com valvoplastia transapical, por toracotomia em janela inframamária esquerda, com acesso direto à valva mitral. Sendo um procedimento original e de complexidade, este caso apresenta relevante importância no tratamento de estenose mitral grave em pacientes cujas condições impossibilitam o procedimento convencional.

Descritores: Estenose da valva mitral; Valvuloplastia com balão; Gravidez

INTRODUCTION

Rheumatic mitral stenosis is the most frequently found valve pathology in pregnant women.¹ The condition tends to worsen during pregnancy, due to increased cardiac output and heart rate.² As to its effects on the fetus, mitral stenosis may cause intrauterine growth restriction and higher incidence of preterm and low-birth weight neonates.³

Since drug treatment is ineffective in severe cases, the valve dysfunction needs to be repaired.¹ However, in cardiac surgeries performed during pregnancy, maternal mortality ranges from 8.6% to 13.3%, whereas fetal mortality can reach up to 33.3%.⁴ Mitral balloon valvuloplasty has gained popularity, and became the treatment of choice, for being a safe procedure with the same results of conventional surgery. However, the procedure should be avoided in the first trimester of pregnancy, due to radiation exposure to the fetus; additional contraindications to the procedure are moderate or severe mitral insufficiency, presence of thrombus in the left atrium, absence of commissural fusion, or severe calcification.⁵

The transcatheter valve implantation procedure was first performed in 2002, for replacement of an aortic valve. The procedure was successful and the method was disseminated worldwide. The first transapical mitral valve replacement was performed in 2009, and then extensive research and development have been invested in this field

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within cardiology, especially regarding individuals at high risk for complications, including patients with advanced age, peripheral vascular disease, chronic lung disease, or ventricular dysfunction.⁶

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CASE REPORT

A 36-year-old female patient, primigravida, with an ultrasound gestational age of 8 weeks and 6 days, previously asymptomatic and without known comorbidities. She sought care due to syncope secondary to tachycardia due to atrial fibrillation with high ventricular response. The transesophageal echocardiography showed mitral valve with rheumatic aspect; thickened leaflets, dome opening of the anterior leaflet and restriction of the posterior leaflet; minimal calcification and bilateral commissural fusion; maximum diastolic gradient of 16.5mmHg and mean diastolic gradient of 8.6mmHg; estimated valve area of 0.85cm² with slight reflux; Wilkins score of eight and presence of thrombus in the left atrial appendage.

Clinical stability was achieved with 100mg metoprolol and 60mg enoxaparin every 12 hours. At 17 weeks of gestation, an attempt was made to perform a percutaneous mitral valvuloplasty. This procedure was indicated as the first option, since a commissurotomy was contraindicated, due to the significant fetal morbidity and mortality rates caused by the use of cardiopulmonary bypass.

The procedure, guided by transesophageal echocardiography, was performed via puncture of the right femoral vein and the right femoral artery, with a 7F venous and 5F arterial introducer, respectively. The right atrium was reached with a 63-cm Mullins 8F sheath (Cook Medical, Bloomington, Indiana, USA), and an attempt was made to puncture the interatrial septum with a Brockenbrough needle (Cook Medical, Bloomington, Indiana, USA); however, it was unsuccessful (thick septum).

It was decided to maintain the clinical treatment until 28 weeks of gestation, for better development of the fetus, with 100mg metoprolol, 60mg enoxaparin sodium, and 30mg diltiazem every 12 hours, and the patient remained clinically stable.

At the gestational age of 28 weeks and 2 days, the patient underwent left thoracotomy via inframammary incision, followed by transapical cardiac catheterization, with direct access to the mitral valve, as shown in figure 1, and balloon valvuloplasty. The procedure was performed under general anesthesia and guided by transthoracic echocardiography. Continuous cardiotocographic monitoring was performed by an obstetrician, accompanied by an obstetric scrub nurse and a neonatologist. The team was ready to perform a cardiopulmonary bypass, if any complication required a conversion to conventional surgery.

Figure 1. Transapical access.

The right femoral artery was punctured with a 5F introducer to manage the mitral regurgitation, and a pigtail catheter was advanced into the left ventricle. The next steps were performing a left inframammary thoracotomy associated with pericardiotomy and the exposure of the ventricular apex, followed by puncturing the left ventricular apex with a needle, and the passage of another 10-cm 5F introducer. Using an MPA 2 catheter, on a 0.035"x150-cm guidewire, an attempt was made to reach the left atrium, which was not possible. The catheter was replaced by an AR 2.0 Amplatz right angiographic catheter, and the attempt was also unsuccessful, and finally by a 5F angiographic catheter with a modified internal mammary tip, which rendered it possible for us to access the left atrium.

After reaching the left atrium, the hydrophilic guide was replaced with a dedicated curved guidewire, followed by the insertion of a 14F Fast-Cath™ introducer (St. Jude Medical, Saint Paul, Minnesota, USA). The attempted progression of the 28-mm Inoue balloon (Terumo Medical Corporation, Shibuya-ku, Tokyo, Japan) using the introducer was not successful. After extensive maneuvers with a 18F Dryseal Invasive (W. L. Gore & Associates, Newark, Delaware, USA) introducer, the mitral valve was crossed, and several insufflations were performed with the 28-mm catheter, as shown in figure 2, achieving the desired result.

After a final control left ventriculography, the device was removed, the cardiac surgeon sutured the incision, and an intrathoracic drain was installed. The patient remained with significant mitral regurgitation after the procedure, but without clinical repercussions. She was referred to the intensive care unit (ICU) for follow-up and drain removal on the third day. She was discharged from

Figure 2. Balloon valvuloplasty.

the ICU after 5 days and remained in a ward for another 24 hours, with subsequent discharge from the hospital. A two-dimensional transthoracic echocardiography conducted in the late postoperative period, 32 days after the procedure, showed the mitral valve with thickened anterior and posterior leaflets, mild stenosis (maximum diastolic gradient of 14mmHg and mean diastolic gradient of 5mmHg, estimated valve area of 1.8cm²), and moderate regurgitation, with a central jet and an eccentric jet.

Pregnancy was followed up until 35 weeks and 1 day, with severe intrauterine growth restriction and oligohydramnios. A cesarean section was indicated with the birth of a female neonate weighing 1,460g, Apgar 9 and 10, without the need for resuscitation in the delivery room. The newborn was referred to the neonatal intensive care unit due to very-low birth weight, and remained there for 18 days, until weight gain. Then newborn was transferred to rooming-in for later discharge.

DISCUSSION

Heart disease remains the most prevalent cause of non-obstetric maternal death during pregnancy.⁷ The gestational period, due to physiological changes, can bring out the first symptoms of heart disease in women, due to increased blood volume and cardiac preload, in addition to peripheral vasodilation and decreased afterload.⁸ Women with cardiac involvement, even if previously asymptomatic, may not tolerate an increase of about 40% in cardiac output during the gestational period, which starts approximately at five weeks and has its maximum peak at 32 weeks.⁹

Mitral stenosis is the valve disease with the highest risk for thromboembolic events, with a 1.5% incidence of thromboembolism during pregnancy and 5% in the puerperium. When associated with atrial fibrillation, the incidence of thromboembolic events may reach up to 10%. The opposite is also true: among systemic thromboembolic events in pregnancy, 80% occur in patients with atrial fibrillation.⁹ This arrhythmia is found in 40% to 60% of patients with mitral stenosis, and is one of the most common arrhythmias in this valvular heart disease, often leading to the development of heart failure in pregnant women.¹⁰

In severe mitral stenosis, a pressure gradient is developed between the left atrium and the left ventricle, and its magnitude depends on severity of stenosis and blood flow. With the increase in cardiac output during pregnancy, the existing pressure gradient also increases, and this may cause pulmonary hypertension and edema, in addition to tachycardia, fatigue, syncope, and arrhythmias. Therefore, without proper treatment, the condition increases maternal and fetal risks.

Medical treatment may be the initial approach to this condition, including beta-blockers and bed rest. The option for surgical procedures is considered when the drug treatment fails. Conservative treatment may also include the use of diuretics, as needed, and oral anticoagulation, preferably using low molecular weight heparin, with close medical monitoring.¹¹ Especially in pregnant women, conservative treatment should be optimized as much as possible, due to maternal and fetal risks associated with invasive procedures, which include maternal and fetal mortality, hemodynamic repercussions, and fetal distress.²

The echocardiographic evaluation of the mitral valve is a predictor of the procedure success, and can assess the presence of calcification.^{12,13} The New York Heart Association (NYHA) functional classification is also used as a predictor of mortality. The NYHA classification subdivides mortality into <1 % for classes I and II, and between 5% and 15% for classes III and IV.⁹ Percutaneous valvuloplasty is a procedure indicated for pregnant women with mitral stenosis in classes III and IV, refractory to medical treatment, and it is recommended after 12 weeks of gestation.

Ideally, mitral stenosis should be repaired by commissurotomy before conception. However, the percutaneous mitral balloon valvuloplasty technique has become the procedure of choice for treatment of symptomatic mitral stenosis in pregnant women, because it contributes to a drop in pulmonary capillary wedge pressure, allowing the pregnancy to take its natural course until term. A successful valvuloplasty increases mitral valve area to >1.5cm², ideally not increasing regurgitation,⁹ and has clinical results equal or superior to those of surgical commissurotomy.¹²

When analyzing the results of mitral valvuloplasty during pregnancy, Esteves et al. showed the procedure is safe and effective, since 98% of pregnant women (previously classified as NYHA III or IV) progressed to functional class I or II at the end of pregnancy. In addition to maternal cli-

nical improvement, the incidence of premature births was 13%, and 88% of newborns achieved ideal birth weight. These results underline the fact that a successful valvuloplasty allows the pregnancy to continue until term, with favorable conditions for the mother and fetal development until delivery.¹⁴

Surgical commissurotomy, in spite of decreasing the risk of maternal mortality, substantially increases fetal mortality, due to the hypoxia and prematurity caused by the need for cardiopulmonary bypass, reaching up to a 33% mortality rate.^{11,14}

There are multiple techniques for a minimally invasive mitral valve repair with no need for cardiopulmonary bypass. Due the anatomical complexity and complex structure of the valve apparatus, in addition to the diversity of etiologies of the disease, percutaneous procedures are challenging.¹⁵ Despite limitations, percutaneous mitral valve implantation techniques via antegrade transeptal or apical access have been developed, similar to the techniques developed for the aortic valve.

Mitral stenosis valvuloplasty via transapical access provides direct access for mitral valve repair with a minimally invasive procedure. Eliminating the need for cardiopulmonary bypass is the main advantage of the procedure, which is extremely relevant when this procedure is performed in pregnant women. However, the use of a transapical access is not exempt of complications, mainly due to the potential need for a conversion to conventional surgery. However, new descriptions in the literature are required, to better compare the advantages and disadvantages of the existing procedures.

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DECLARATION OF CONFLICTS OF INTEREST

The authors declare there are no conflicts of interests.

CONTRIBUTION OF AUTHORS

Conception and design of the study: BCSB, ACGB, VLJ and KSMP; data collection: BCSB, ACGB and VLJ; data interpretation: VLJ; text writing: BCSB and ACGB; approval of the final version to be published: BCSB.

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