Percutaneous transhepatic and transseptal dilatation of a surgically implanted Melody® Valve in the mitral position in a 2-year-old child

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ABSTRACT
The use of the Melody® (Medtronic, Minneapolis, MN, USA) biological prosthesis in mitral position has shown acceptable short-term results. Furthermore, it allows its expansion with a balloon when the patient grows up, and this procedure can be performed by a venous catheterization through transseptal approach through an interatrial communication or puncturing the septum. Patients with complex congenital heart disease undergoing multiple surgical and percutaneous interventions may present with vascular complications such as thrombosis of the femoral venous system that make percutaneous access impossible. In this situation, the transhepatic approach is a very useful alternative to access the heart.

Keywords: Children, congenital heart disease, prosthesis, thrombosis

INTRODUCTION
Mitral valve replacement in newborns or infants is limited by the lack of availability of an implantable valve of adequate size to their mitral annulus. In this situation, the implant, using a hybrid procedure, of the biological prosthesis Melody® (Medtronic, Minneapolis, MN, USA) in mitral position has shown acceptable short-term results. However somatic growth of these patients warrant redilatation of this valve by a transseptal catheterization. This procedure can be performed by a venous catheterization through a transseptal approach through an interatrial communication or puncturing the septum. Patients with complex congenital heart disease undergoing multiple surgical and percutaneous interventions may present with vascular complications such as thrombosis of the femoral venous system that make percutaneous access impossible. In this situation, the transhepatic approach is a very useful alternative to access the heart.

This report describes the first case to our knowledge of a patient with a Melody® valve (Medtronic, Minneapolis, MN) implanted in the mitral position, in which a valvuloplasty was subsequently performed by transhepatic and transseptal approach.

CASE REPORT
A male infant antenatally diagnosed with critical aortic stenosis, pansystolic mitral regurgitation and severe left ventricular systolic dysfunction underwent three different surgeries including a Ross operation, a mitral valvuloplasty, and a mitral valve replacement with a mechanical prosthesis (St. Jude Medical Regent® 17-mm) in supramitral position complicated by premature prosthetic valve thrombosis. He underwent a Melody® valve (Medtronic, Minneapolis, MN) implantation in mitral position performed with a 16 mm × 30 mm Tyshak II® balloon (NuMED, Cornwall, ON) at the age of 6 months [Figures 1 and 2]. The postoperative progress was uneventful.
During follow-up, the patient developed severe stenosis of the Melody valve with a mean gradient of 10 mmHg. Therefore, a percutaneous balloon valvuloplasty of the prosthesis was performed at the age of 2 years and 9 months (weight 10.5 kg). Due to a previous complete thrombosis of both venous femoral systems and the presence of an intact interatrial septum, a transhepatic procedure with transseptal puncture was chosen as a feasible approach for this patient.

A 22G Chiba needle was guided using ultrasound into the middle hepatic vein, then a 0.018” guidewire and a 4Fr Check-Flo Performer® sheath (Cook Medical, Bloomington, IN) were advanced into the right atrium. A long Emerald® 0.035” guidewire (Cordis, Miami Lakes, FL) was then implanted into the superior vena cava and progressive dilators were advanced. Finally, an 8F Swartz® Transseptal sheath and a BRK-1® needle (St. Jude Medical, Minneapolis, MN) were advanced to the superior vena cava.

Subsequently, under transesophageal echocardiography and fluoroscopic guidance, the transseptal puncture was performed [Figure 3]. Heparin was then administered. With the help of a 5F Internal Mammary Glidecath® catheter (Terumo Europe, Leuven, Belgium) and a HiWire® 0.035” hydrophilic guidewire (Cook Medical, Bloomington, IN), the Melody prosthesis was probed, and through the left ventricle, the guidewire was advanced to the descending aorta.

An exchange of this guide was made for an EMERALD® 0.035” Amplatz type Super Stiff Guidewire (Cordis, Miami Lakes, FL). Two balloons for angioplasty were successfully advanced over this guide, first, an 18 mm × 40 mm Cristal Balloon® (Balt Extrusion, Montmorency, France) and then a 20 mm × 30 mm Tyshak II® balloon (NuMED, Cornwall, ON) with which the valvuloplasty was performed obtaining a good anatomical and hemodynamic results [Figure 4].

Hemostasis of the transhepatic access was achieved embolizing the tract with a 6-mm Amplatzer™ Vascular Plug IV (St. Jude Medical, Minneapolis, MN) and with manual external compression of the skin at the puncture site [Figure 5].

Abdominal ultrasound was performed after the procedure with neither evidence of any hepatic nor peritoneal hematoma. There were no complications and the patient could be discharged the next day. On the predischarge echocardiography, the mean gradient across the valve had decreased down to 6 mmHg without an increase in the degree of the valve regurgitation.

**DISCUSSION**

Since the first description by the group of the Boston Children’s Hospital,[1] the implantation of a Melody® prosthesis in a mitral position using a hybrid procedure has been reported by different groups with good results.[3,4]

However, this is a technique that is not exempted from complications, such as AV block, paravalvular leaks, endocarditis, obstruction of the left ventricular outflow tract,[3] compression of the circumflex coronary artery, or stent fracture.[5]

Fortunately, in our patient, the procedure was uneventful.
One of the main advantages of this valve is the possibility of being dilated percutaneously up to a diameter of 22 mm–24 mm, being essential in this situation an homogenous dilation of the Melody valve to avoid stenosis of the distal end.\[6\]

In our case, the stenosis of the prosthesis caused by the patient’s growth was successfully treated by percutaneous balloon expansion 27 months after its implantation.\[9\]

To facilitate subsequent percutaneous catheter access to the left atrium,\[10\] it is recommended during the surgical implant to leave a fenestration in the interatrial septum or in the closure patch of the atrial septal defect.

However, it is common for these fenestrations to close spontaneously, as in our case, making transseptal perforation necessary.\[6\]

Some pediatric series have reported higher complication rates of transseptal puncture, varying between 3.3\% and 4\%,\[7,8\] while other groups perform this technique without complications.\[9\] There were no complications in this patient.

In addition, the transhepatic approach is a useful alternative to access the heart when there is venous thrombosis, although it is a technique with a rate of major adverse events of 8\%, mainly due to bleeding and atrioventricular block.\[10\] We guided the procedure with abdominal ultrasound, which allowed us to introduce the needle into a suprahepatic vein of good size for posterior catheter access. This was also an uneventful procedure.

**CONCLUSIONS**

The transhepatic approach used in this patient due to the thrombosis of his iliofemoral venous system allowed a percutaneous valvuloplasty of the Melody prosthesis in an efficient and uneventful way.

The presence of an intact interatrial septum required its perforation with a needle. However, this procedure was also effective and free of complications.

The use of abdominal ultrasound was very useful for achieving a transhepatic approach, and the use of transesophageal echocardiography was essential to guide transseptal puncture.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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