

# A Case of Life-threatening *Staphylococcus aureus* Endocarditis Involving Percutaneous Transcatheter Prosthetic Pulmonary Valve

Deepti P. Bhat, MD, Thomas J. Forbes, MD, and Sanjeev Aggarwal, MD

Division of Pediatric Cardiology, The Carman and Adams Department of Pediatrics, Children's Hospital of Michigan, Wayne State University School of Medicine, Detroit, Mich, USA

## ABSTRACT

While right ventricle to pulmonary artery homograft is the surgical procedure of choice for relieving right ventricle outflow tract obstruction; it is limited by the need for multiple surgical replacements owing to progressive conduit obstruction, valve dysfunction, or patient growth. Since January 2010, percutaneous transcatheter placement of prosthetic pulmonary valve (Melody valve) has emerged as an attractive alternative to surgical replacement of dysfunctional right ventricle to pulmonary artery homograft in the United States. We report a case of 19-year-old girl born with truncus arteriosus who underwent transcatheter placement of prosthetic pulmonary valve due to homograft insufficiency. She presented after 4 months with a febrile episode and was found to have *Staphylococcus aureus* endocarditis of her prosthetic valve. The infection caused multi-organ dysfunction despite bacteriological clearance and led to severe dysfunction of the valve which ultimately required surgical removal. The case highlights a rare but serious complication of percutaneous prosthetic pulmonary valves.

**Key Words.** Transcatheter Percutaneous Pulmonary Valve; Endocarditis

## Introduction

Surgical placement of a right ventricle (RV) to pulmonary artery (PA) homograft has become the procedure of choice for palliation of RV outflow tract obstruction in many forms of complex congenital heart disease.<sup>1</sup> Homograft placement is, however, limited by the need for surgical replacement owing to progressive conduit obstruction, valve dysfunction, or patient growth.<sup>1,2</sup> Prolongation of the conduit life may be achieved with bare metal stent placement, though this comes at the cost of creating free conduit insufficiency.<sup>3</sup> Transcatheter placement of percutaneous prosthetic pulmonary valve (Melody valve, Medtronic Corp., Minneapolis, MN, USA) was introduced in the year 2000 in some parts of the world as an attractive and safe alternative to surgical revision of the RV-PA conduit.<sup>4,5</sup> The US Food and Drug Administration (FDA) approved the use of Melody Transcatheter Pulmonary Valve on January 25, 2010.<sup>6</sup> We describe a case of poten-

tially life-threatening infective endocarditis (IE) involving Melody valve implanted at our center.

## Case Report

A 19-year-old girl with repaired truncus arteriosus presented to the emergency room with complaints of vomiting and diarrhea. She denied fever, any exposure to sick contacts, or recent dental or gynecological procedures.

Her medical history was significant for repair of truncus arteriosus in infancy with placement of a RV to PA homograft and patch closure of the ventricular septal defect (VSD). The conduit was replaced twice due to progressive stenosis. At the age of 3 years, she underwent surgical augmentation of her conduit along with placement of a transannular patch. While she remained asymptomatic from cardiovascular standpoint, her echocardiogram at 18 years, showed free conduit insufficiency with moderate to severe dilatation of the RV which was confirmed on a subsequent cardiac magnetic resonance imaging (MRI) with indexed RV end diastolic volume of 167.4 mL/m<sup>2</sup>.

Disclosures: None.

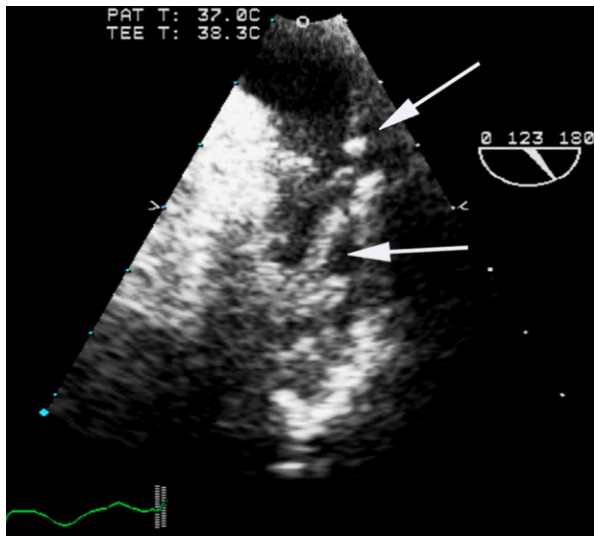
For relief of her pulmonary insufficiency, she underwent placement of a Melody valve using a 22 mm Ensemble delivery system 4 months prior to the presentation. The post procedure and 3-month follow-up echocardiograms did not reveal any significant regurgitation or stenosis of the Melody valve.

Upon admission, the patient was febrile (temperature 38.8°C) with tachycardia of 130 beats/minute, blood pressure of 120/77 mm Hg, respiratory rate of 21 breaths/minute, and saturations of 97% on room air. Her cardiovascular examination showed normal heart sounds with a grade 3/6, medium-pitched, ejection systolic murmur heard best at the left parasternal area. There was no hepatosplenomegaly. Her initial laboratory tests were significant for thrombocytopenia (platelet count of 37 000/mm<sup>3</sup>) and hyponatremia (sodium 126 meq/L). An ultrasound of the abdomen and pelvis did not show any abscesses.

Her blood cultures showed immediate growth of *Staphylococcus aureus* for which she was started on vancomycin and ceftriaxone, which were subsequently replaced with oxacillin after the organism was found to be Methicillin-sensitive (MSSA). Her urine and stool cultures from admission also grew MSSA and the blood cultures remained positive for 7 days after starting antibiotics.

Transthoracic echocardiography (TTE) performed at the time of admission showed a new finding of mild to moderate conduit stenosis (maximum PA pressure gradient = 46 mm Hg) and elevated RV systolic pressures (RVSP) to 3/4th systemic (77 mm Hg). The Melody valve did not show any regurgitation or vegetations. Due to persistently positive blood cultures, a repeat transesophageal echocardiogram was performed on day 8 of admission, which showed worsening of RV function, increasing RVSP (87 mm Hg) and worsening conduit stenosis (maximum PA gradient of 62 mm Hg). Also, a linear vegetation in the proximal part of RV conduit was visualized (Figure 1). The gradient across RV-PA conduit was significantly increased (maximum PA gradient estimated as 62 mm Hg) compared to post-Melody valve placement hemodynamics (20 mm Hg) raising possible concerns for a Melody valve stent fracture. This was subsequently ruled out under fluoroscopic interrogation.

Despite achieving bacterial clearance, the patient continued to show clinical deterioration. She developed clinical signs of disseminated intravascular coagulopathy with INR of 3.1, aPTT of 52



**Figure 1.** Transesophageal echocardiogram showing the prosthetic pulmonary valve (upper arrow) and a linear thread-like vegetation in the proximal right ventricle to pulmonary artery conduit (bottom arrow).

seconds and PT of 33 seconds along with renal failure due to immune mediated glomerulonephritis. Her serum creatinine increased to 2.4 mg/dL with proteinuria (2+) and hematuria (3+). Her renal function further deteriorated and she required hemodialysis for about 1 week. She also developed worsening pulmonary edema. Her echocardiograms showed severe depression of LV and RV function with elevated RVSP (90 mm Hg). She was started on intravenous inotropes and aggressive diuretic therapy. Over the next 2 weeks, her repeat blood cultures remained negative, her clinical status improved with resolution of renal failure and she was weaned off of inotropic support. Two months after the initial presentation, she underwent surgical removal of the Melody valve and placement of a valved RV-PA conduit. She was doing well at 7 months follow-up.

## Discussion

Prosthetic valves are a known risk factor for IE. Correa de Sa et al. conducted a population based survey of IE in Minnesota from 1970 to 2006.<sup>7</sup> A total of 150 cases of IE were identified among the adult population, of which 33 (22%) involved a prosthetic valve. Few large studies conducted on incidence of IE in children reveal lower rates of IE when compared to adults. Day et al. reviewed multi-centric data on 1588 children admitted with IE.<sup>8</sup> A prosthetic valve was the site of infection in

54 patients (3.4%) and the infection was fatal in 7.4% of patients. The most common site of prosthetic valve involvement was the aortic valve followed by the mitral valve. IE has rarely been reported in surgically placed prosthetic pulmonary valves. Rosenthal et al. studied 72 children with known heart disease who developed IE between 1992 and 2004 at a single center.<sup>9</sup> Seven patients (10%) developed IE in surgically placed prosthetic pulmonary valve. Among 64 pediatric patients who had surgical implantation of RV-PA conduit with prosthetic bovine pulmonary valve,<sup>10</sup> Shebani et al. reported one patient with endocarditis within 2 weeks of surgery due to *Staphylococcus aureus* who required valve explantation.

Transcatheter percutaneous pulmonary valve (Melody valve) implantation was introduced in the year 2000 in some parts of the world as an attractive and safe alternative to surgical revision of the RV-PA conduit. The Melody valve is made from a cow's jugular vein valve that is sewn into a small metal stent (scaffolding). While there is not much long-term data on Melody valves from the United States, reports from outside the country indicate that Melody valve is not a common site of involvement for IE. In a review of 155 patients from United Kingdom who underwent Melody valve placement (aged between 7 to 71 years), Lurz et al. reported endocarditis in only five patients (0.03%).<sup>4</sup> The pathogens included staphylococcus aureus, streptococcus species and Candida. Three patients required valve explantation while two were treated successfully medically. Eicken et al. found that among 102 patients (aged 16–30 years) in Germany who underwent Melody valve placement,<sup>5</sup> only one patient developed *Staphylococcus aureus* endocarditis after 6 months which required valve explantation and replacement with homograft. Butera et al. studied 63 patients from Italy (aged 11–65 years) who underwent Melody valve placement from 2007 to 2010.<sup>11</sup> Two patients developed IE and needed surgical explant. In a multi-centric study by Roberts et al. 15 patients (aged 8–64 years) underwent transcatheter implantation of percutaneous tricuspid valve,<sup>12</sup> one of whom developed endocarditis. None of the authors have reported serious life-threatening complications from endocarditis as seen in our patient.

In our center, among 35 patients who have undergone transcatheter implantation of Melody valve one developed potentially life-threatening IE. To our knowledge, this is the first reported case of IE involving the Melody valve from the United States. Our patient developed late onset

endocarditis of the Melody valve 4 months after valve implantation. An aggressive *Staphylococcus aureus* infection of the valve led to rapidly progressive ventricular dysfunction in this patient with subsequent multi-organ failure despite bacteriological clearance. The most likely port of entry of the bacteria was through gastrointestinal tract, which then seeded the valve leading to endocarditis of the prosthesis. The infection finally led to the surgical removal of the Melody valve and placement of a RV-PA conduit.

Our case highlights a rare but important complication of percutaneous prosthetic pulmonary valves. Melody valve has recently been introduced in the United States, and the long-term data on complications are not yet available. However, the delay of 4 months between the placement of Melody valve and onset of IE in our patient indicates that the IE was not related to the catheterization procedure or technique. Further longitudinal follow-up studies would help in assessing the overall risk, incidence, and outcome of IE in these patients. Our report, confirms the AHA recommendation that patients should be advised IE prophylaxis after implantation of the Melody valve.<sup>13</sup> A high index of suspicion should be maintained for IE in these patients similar to those with mechanical or surgically placed prosthetic valves.

#### Author Contribution

DB acquired the data, interpreted the data, and drafted the manuscript. TF Reviewed and revised the manuscript. SA interpreted the data, and reviewed, and revised the manuscript.

**Corresponding Author:** Deepti P. Bhat, MD, Division of Pediatric Cardiology, Children's Hospital of Michigan, 3901, Beaubien Boulevard, Detroit, MI 48201-2119, USA. Tel: +3137455993; Fax: +3139930894; E-mail: drdeeptibhat@yahoo.com

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