Percutaneous valved stent repair of a failed homograft: Implications for the Ross procedure

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A case of percutaneous pulmonary valve implantation following a failed homograft in the pulmonary position is reported. A 16-year-old boy developed infective endocarditis of his pulmonary homograft, which was implanted four years earlier during a Ross procedure for congenital aortic stenosis. Following successful medical therapy, the boy was symptomatic due to pulmonary stenosis and regurgitation. A 22 mm Melody valve (Medtronic, USA) was successfully implanted percutaneously. His symptoms resolved and he was discharged home one day after the procedure. Echocardiography at the six-month follow-up demonstrated a normally functioning pulmonary valve. Percutaneous pulmonary valve replacement may make the Ross procedure a more attractive option for patients with aortic stenosis, particularly in the pediatric population.

Key Words: Cardiovascular surgery; Percutaneous valve; Pulmonary homograft; Ross procedure

Correction par endoprothèse percutanée expansible de l'échec d'une homogreffe : Répercussions sur la technique de Ross

On présente ici un cas de correction valvulaire pulmonaire percutanée après l'échec d'une homogreffe pulmonaire. Un jeune homme de 16 ans a développé une endocardite infectieuse au niveau de son homogreffe pulmonaire, implantée quatre ans auparavant au moyen de la technique de Ross pour une sténose aortique congénitale. Après la réussite du traitement médical, le jeune homme a développé des symptômes dus à une sténose et à une régurgitation pulmonaires. Une valvule Melody de 22 mm (Medtronic, É.-U.) a été implantée avec succès par voie percutanée. Ses symptômes sont rentrés dans l'ordre et il a reçu son congé un jour après l'intervention. L'échocardiographie effectuée au sixième mois de suivi a révélé une valvule pulmonaire normale et fonctionnelle. La prothèse valvulaire pulmonaire percutanée peut rendre la technique de Ross plus attrayante pour les patients qui souffrent de sténose aortique, particulièrement dans la population pédiatrique.

CASE PRESENTATION

After two balloon dilations in his neonatal period for a stenotic bicuspid aortic valve, a 16-year-old boy presented with aortic stenosis and left ventricular dilation secondary to severe aortic insufficiency. A Ross procedure was performed using a 24 mm pulmonary homograft to replace the pulmonary valve. Following the procedure, he had excellent function of his neo-aortic valve and homograft. Four years later, he presented to his local hospital with a two-month history of malaise, weight loss, fever, chills, hemoptysis, anemia, leukocytosis and bilateral pleural effusion. A chest computed tomography scan demonstrated bilateral pneumonic processes in the lungs due to septic emboli. An echocardiogram demonstrated a large, mobile vegetation on the pulmonary homograft measuring 1.5 cm in diameter, severe pulmonary regurgitation and pulmonary stenosis (peak gradient 70 mmHg). The autograft was not affected. Unfortunately, blood cultures were only obtained after intravenous antibiotic therapy was started and were continuously negative for growth. After six weeks of antibiotic therapy, the patient's condition improved, with normalization of the chest x-ray and disappearance of the vegetation. Clinical signs of sepsis completely resolved and did not recur following cessation of antibiotic therapy; repeated blood cultures remained negative when he was no longer taking antibiotics. As seen on echocardiography, he continued to have severe pulmonary regurgitation and stenosis, accompanied by right ventricular dilation and severe central tricuspid regurgitation.

Recently, the Melody percutaneous valved stent (Medtronic, USA) became available for placement in the pulmonary position at the University of Alberta Hospital (Edmonton, Alberta). The Melody valve consists of a bovine jugular vein valve segment, mounted inside an expandable metal stent. In the cardiac catheterization suite, intravascular contrast images confirmed suitable anatomy for Melody valve placement (Figure 1). A 20 Fr introducer placed through the femoral vein was used to guide the stent into position over a

Figure 1) Pulmonary angiogram before procedure, revealing pulmonary stenosis (short white arrow) and free pulmonary incompetence (long black arrow)

guidewire. A 22 mm Melody valve was then secured inside the pulmonary homograft with balloon stent expansion. Following the procedure, contrast injections in the right ventricle and pulmonary artery revealed resolution of the stenosis and competence of the pulmonary valve (Figure 2 and Video 1 – click here to view).

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Figure 2) Pulmonary angiogram after valved stent (short white arrow) implantation demonstrating a competent pulmonary valve (long black arrow)

Three months following the procedure, the patient was completely asymptomatic; an echocardiogram revealed normalization of right ventricular dimensions and only minor tricuspid regurgitation. The percutaneous valve had a peak Doppler gradient of 27 mmHg, with minor insufficiency. The neo-aortic valve function remained excellent, with no stenosis or incompetence since the Ross procedure five years earlier.

DISCUSSION

The pulmonary autograft procedure, introduced by Dr Donald Ross, has advantages in terms of growth potential and superior hemodynamics, as well as the avoidance of anticoagulation, making it an attractive option for children with aortic valve pathology (1).

However, it introduces the potential for complications in two valves. Failure of the pulmonary homograft develops at a greater rate than the autograft (2). Although reoperation for pulmonary homograft replacement is generally safe, it is still subject to complications. The Melody percutaneous valve has been developed for placement in the pulmonary position. Worldwide, more than 150 Melody valve implantations have been performed since 2000 for various pulmonary valve pathologies. Follow-up as long as five years has demonstrated good results (3).

The pulmonary position is suitable for total percutaneous valved stent placement because of the ability of the femoral vein to accept large introducers, the absence of coronary ostia and the lesser effect of incidental embolization from this position. Potential complications, such as pulmonary artery rupture, stent migration and compression of the coronary arteries still exist (4). In our case, the procedure was well tolerated. The percutaneous approach gave our patient a distinct advantage, allowing him to be discharged home one day after the procedure. The ability to treat failed pulmonary homografts with a truly minimally invasive technique reduces one of the major concerns of the Ross procedure, namely, inevitably having to reoperate on the pulmonary homograft. Initially, it was believed to be necessary to operate emergently on the present patient due to his signs of sepsis and significant right ventricular dysfunction. We were concerned that the presence of severe lung involvement in the infectious process would have made the operation hazardous. Fortunately, the infection completely resolved with antibiotic therapy, allowing him to undergo percutaneous valve implantation into a presumably sterile homograft.

Although this patient did well in the early stages, long-term evaluation of the Melody valve is required.

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