Hybrid transcatheter pulmonary valve implantation: The first case series from Turkey

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Introduction

Chronic severe pulmonary valve regurgitation (PVR) following the surgical repair of tetralogy of Fallot (TOF) and similar pathologies in infancy leads to right ventricular enlargement, which predisposes patients to right heart failure, arrhythmias, and sudden cardiac death. Subsequently, nearly all of these patients require pulmonary valve implantation (PVI) later in life (1). PVI can be performed either through a surgery (under cardiopulmonary bypass) or transcatheter route. In cases where the patient's condition poses high risk for surgery and/or is not suitable for transcatheter PVI, a hybrid procedure might be an alternative approach.

Case Report

Between November 2014 and January 2018, 52 patients were evaluated for percutaneous PVI. Of these patients, 45 received percutaneous PVI and four were not suitable for percutaneous PVI and therefore underwent surgical PVI. The remaining three patients underwent a hybrid PVI procedure. Here, we present these three patients who had severe PVR after the transannular patch repair of TOF in the infancy.

Procedure: Basic tests for PVI (coronary compression and balloon interrogation tests) were performed during previous cardiac catheterization; therefore, patients directly underwent stenting and valve implantation during the hybrid procedure. Table 1 shows the indications and demographic data of cases.

All patients were intubated under general anesthesia. A left anterior 8–10-cm thoracotomy was performed to expose the right ventricular (RV) anterior wall (Fig. 1a). Two purse string stitches with pledgets were placed on the RV anterior wall. An 18-gauge needle was used to puncture the RV wall, and an 11-Fr introducer sheath was placed in RV.

Initially, the Back-up Meier guidewire was placed in the distal pulmonary artery; then, an 11-Fr sheath was exchanged with a 26-Fr Edwards SAPIEN delivery sheath (Edwards Life Sciences, Irvine, CA) over the wire (Fig. 1b). Second, a 48-mm Andra XXL

Table 1. Patients' procedural data

	Patient 1	Patient 2	Patient 3
Age (year)	20	17	20
Weight (kg)	58	90	56
Hybrid indication	Jugular and femoral vein occlusion or inadequate vein diameter	Development of frequent ventricular extrasystoles and ventricular tachycardia after advancing the long sheath in previous catheter angiography	Abnormal RVOT anatomy preventing advancing of long sheets into the distal pulmonary artery in previous catheter angiography
Valve	29-mm Edwards SAPIEN XT	29-mm Edwards SAPIEN XT	29-mm Edwards SAPIEN S3
Procedure time	60 min	50 min	40 min
Fluoroscopy time	10.2 min	10.1 min	6.5 min
Complication during procedure cautery by ventricular stimulation	None	None	Ventricular fibrillation due to the
Complication after procedure	None	None	Trivial paravalvular leak
Duration of hospitalization	4 days	3 days	4 days
Follow-up period	4 months	3 months	3 months
Valve regurgitation	None	None	None

RVOT - right ventricular outflow tract

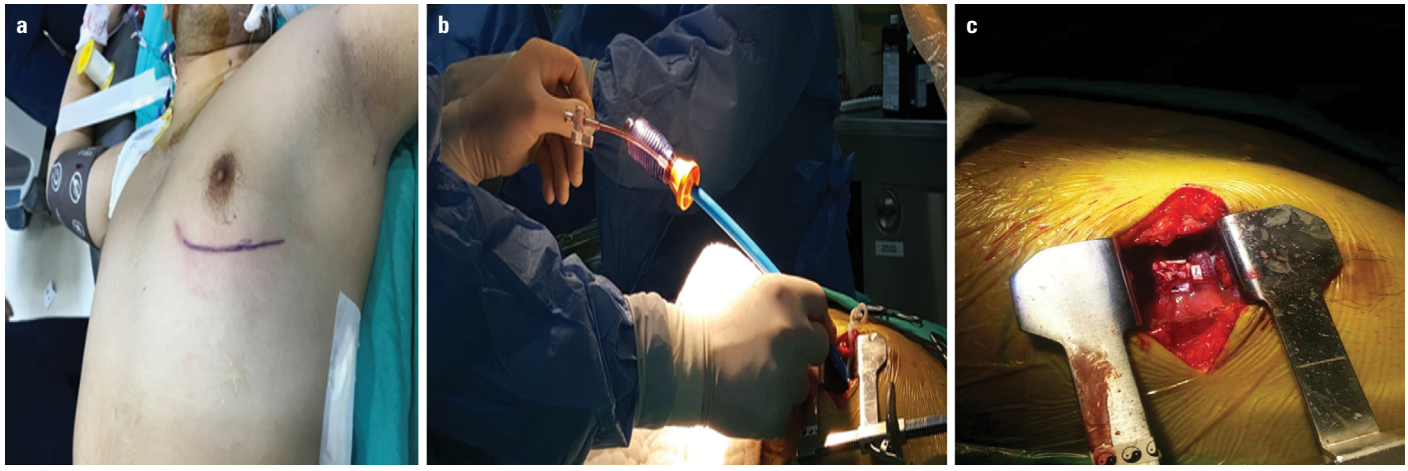

Figure 1. (a) Left anterior 8-10 cm thoracotomy line. (b) A 26-Fr Edwards SAPIEN delivery sheath placed on the RV anterior wall. (c) The sheath was removed, and the purse string sutures were tightened

stent (Andramed, Reutlinger, Germany) was mounted over a 30 mm×4.5-cm Z-med balloon (NuMED, Inc., Hopkinton, NY, USA) and deployed in to the right ventricular outflow tract/main pulmonary artery over the wire. Next, either an Edwards SAPIEN XT or S3 valve (Edwards Life Sciences, Irvine, CA) was deployed under fluoroscopic guidance. Control angiography of the main pulmonary artery showed a well-placed, well-functioning pulmonary valve without significant pulmonary insufficiency (Video 1). The sheath was removed, and the purse string sutures were tightened (Fig. 1c). A 24-Fr drain was placed, and the chest was closed. All patients were extubated in the catheterization laboratory. The patients received aspirin for the next 6 months (Table 1).

Discussion

In the literature, several hybrid PVI techniques have been described (1-5); however, all these hybrid PVI procedures involved some sort of surgical exposure, from a limited subxyphoid incision to anterior thoracotomy or full median sternotomy (5). Each method has different advantages and indications. Table 1 summarizes our indications for the hybrid approach.

The implementation of hybrid approach makes PVI possible without crossing the tricuspid valve with large and stiff delivery systems. Also, it improves patient safety by reducing the procedure time (3). Other benefits of hybrid PVI are as follows: lower possibility of blood transfusion; avoidance of warm beating-heart cardiopulmonary bypass, and the psychological promise of avoiding open-heart surgery (5). The hybrid approach reduces the impact of patient size on the procedure as it is not limited by the small size of a child's vascular system (3). We suggested that a straightforward catheter course during the hybrid approach facilitates advancing the pulmonary valve system into MPA. Also, an operator can easily change the course of the valve during the whole procedure by manipulating the angle of the apical delivery system.

Conclusion

Hybrid PVI can play an increasing role in patients who are not suitable for percutaneous PVI and have a compelling reason to avoid standard surgical PVI, and it may become an alternative for standard-risk PVI candidates as well (5).

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Video 1. Angiography of Patient 1

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