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Review article

Right ventricle to pulmonary artery connection: Evolution and current alternatives

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Abstract

Despite the introduction of different right ventricle to pulmonary artery reconstructive techniques and conduits, the ideal option is yet to be developed. Valved conduits mimicking the natural right ventricular outflow, however, they do not grow and re-operation for conduit replacement is inevitable. So, surgeons have constantly tried to evolve surgical techniques that would obviate their use and allow age-related growth. We tried to review the evolution of these techniques and the current status of these alternatives focusing on their suitability for variable age groups and different pathological entities.

Keywords: Congenital heart disease; Allograft; Homograft; Pulmonary arteries; Rastelli procedure

Contents

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1. Introduction

A sizeable proportion of congenital heart defects have a component of RVOT abnormality. This may be in the form of a simple stenosis, severe pulmonary regurgitation (PR) or a more complicated right ventricle – pulmonary artery (RV-PA) discontinuity [1].

Absence of continuity between the RV and PA calls for a more complicated intervention. In these cases, a conduit must be implanted, or the pulmonary arteries must be approximated to the pulmonary ventricle directly, using a variety of well-known techniques [1–3]. Those lesions could be collected and categorized into three major groups (Table 1).

Despite the introduction of different RV–PA reconstructive techniques and conduits, the ideal options are yet to be developed [3]. We tried to review the evolution and current status of these options, focusing on value and limitations of each option and its suitability for variable age groups, anatomical and clinical situation. The different types of RV-PA conduits and reconstructive options were collected [1–4] and suggestively classified based mainly on the valvular element (Table 2).

2. Evolution

The journey started in 1964 when Rastelli and coworkers inserted a non valved pericardial tube as the first right ventricle to pulmonary artery (RV-PA) conduit in a child with pulmonary atresia [5]. Valved conduits were first used by Ross [6] and soon after by Rastelli [7] and since then have remained the mainstay of the treatment of RV – PA discontinuity. Irradiated cryopreserved homografts were used but were found to calcify and degenerate rapidly, resulting in severe conduit stenosis [8]. So the initial difficulties were homograft conduit patency besides limited availability [3].

Stented glutaraldehyde treated porcine aortic valve mounted in Dacron tubes (Hancock conduits) were developed to address these problems. Despite suboptimal handling characteristics, the relatively wide commercial availability in a range of sizes down to 12 mm made the value of these conduits [9].

Table 1
Types of RVOT discontinuity.

Absent RVOT	Pulmonary atresia
	Truncus arteriosus
Unsuitable RVOT	D-TGA + VSD + PS
	L-TGA + PS
	Complicated DORV
Iatrogenic	Ross procedure

Table 2
RV-PA conduits and reconstructive options.

Valved conduits	Homografts	Aortic homograft	
		Pulmonary homograft	
	Xenografts	Stentless (native)	Bovine jugular vein (Contegra)
			Porcine aortic root (Free Style)
		Stented (synthetic)	Hancock valve
	Manually constructed	Composite	Prosthetic valve in a synthetic tube
		Autologous	Valved pericardial tubes
Valve less options	Non valved conduits	Native	Pericardial tubes
		Synthetic	Dacron
			PTFE
	Non conduit repair	• REV procedure	
		• Nikaido operation	
		• Half turned truncal switch	
		• Barbero Marcielo technique	
Pulmonary valve replacement	Surgical	• Tissue valves	
		• Mechanical valves	
	Interventional	Trans catheter pulmonary valve implantation	