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Original Article

Mid-term outcomes of patients undergoing adjustable pulmonary artery banding



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ABSTRACT

Objective: The adjustable pulmonary artery band (APAB) has been demonstrated by us earlier to be superior to the conventional pulmonary artery banding (CPAB), in terms of reduced early morbidity and mortality. In this study, we assessed the adequacy of the band and its complications over the mid-term.

Methods: Between 2002 and 2012, 73 patients underwent adjustable PAB, and their operative and follow-up data were collected and analyzed.

Results: There was one early death following the APAB. Follow-up data were available for 57 patients of which 44 patients (61.7%) underwent definitive repair, 10 were awaiting definitive repair, and 3 patients were kept on medical follow-up because of inadequate fall in pulmonary artery (PA) pressures. 14 patients (19%) were lost to follow-up. Major PA distortion or stenosis was absent in the majority. 1 patient had pseudoaneurysm of the main pulmonary artery (MPA) with sternal sinus infection and required surgical reconstruction. 1 patient had infective endocarditis of the pulmonary valve managed medically. Band migration was not encountered. There were two deaths after definitive repair and one after APAB.

Conclusions: Patients undergoing APAB fulfilled the desired objectives of the pulmonary artery banding (PAB) with minimum PA complications in the mid-term. This added to the early postoperative benefits, makes the APAB an attractive alternative to the CPAB.

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1. Introduction

Since pulmonary artery banding (PAB) was first described in 1952, by Muller and Dammann,¹ its indications have progressively diminished as a temporary palliation for only

a few subsets of patients who are not better surgical candidates for definitive repair, those requiring re-training of the regressed left ventricle in transposition of great arteries or those who require control of pulmonary artery (PA) blood flow and pressure as a part of staged univentricular palliation.²

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Conventional pulmonary artery banding (CPAB) has always been associated with high morbidity and mortality and a high reoperation rate, which has not diminished appreciably.^{3–7} This has prompted development of the concept of adjustable pulmonary artery banding (APAB), where the pulmonary blood flow can be controlled to tide over a period of hemodynamic instability in these patients, who often do not tolerate a sudden increase in the afterload to the ventricle. The APAB has been demonstrated to be superior to CPAB in terms of reduction in early morbidity and mortality. However, whether the advantage holds true in the mid-term needs to be studied.

This study therefore aims to analyze the outcomes of APAB in the mid-term in terms of the reduction of PA pressures and suitability for definitive palliation and to study the band-related complications encountered at definitive surgery.

2. Methods

The hospital records of all patients undergoing APAB between January 2002 and December 2012, at the All India Institute of Medical Sciences, New Delhi, India, were retrospectively reviewed. Only patients undergoing isolated PAB were included in the study. All patients who underwent additional procedures, such as repair of coarctation of aorta and atrial septectomy, were excluded. The study protocol was duly approved by the ethics committee of the institute and informed consent was obtained from all patients. After APAB, patients were followed up at one week, one month, and 3 months and then at 6 monthly intervals on outpatient basis and underwent clinical examination, echocardiography, and cardiac catheterization or CT angiography for progression to the next stage according to the univentricular or biventricular pathway. All the data were collected from the cardiac clinic files of these patients and were analyzed in detail. After excluding one death that occurred at the initial APAB, the study population comprised of 72 patients (45 male) with a wide range of diagnoses (Table 1). The mean age at APAB was 3 ± 2.4 (0.5–132) months and the mean weight at APAB was 3.8 ± 0.4 (1.8–21) kg. Desirable reduction in PA pressures was defined as mean PA pressure of 15 mmHg and/or 1/3rd of the

mean systemic arterial pressure with systemic saturation of at least above 75% for univentricular repair, and in patients with biventricular repair, mean PA pressure of 1/3rd to 1/2 of mean systemic arterial pressure and saturation of at least above 85%.^{8,9} The technique of APAB has been described by us in detail in our prior publications.^{10,11} Briefly, in this technique (Fig. 1), the MPA was looped with a No. 2 Ethibond (Johnson & Johnson Inc, Somerville, NJ) suture after passing a right-angle forceps between the aorta and the MPA. This right-angle forceps was again passed and the suture end was grasped again, so that the MPA was doubly looped. The two ends of this suture were passed through a 0.5×0.5 -cm polytetrafluoroethylene (PTFE) pledget, which was anchored to the adventitia of the MPA using interrupted 5-0 polypropylene suture. Both arms of the suture were clipped together with a Ligaclip (LT 200; Ethicon Endosurgery Inc, Cincinnati, OH) just on the pledget. These sutures were brought out through the pericardium and the lateral edge of the sternum and then through subcutaneous tissue and skin. After sternal closure, the two ends of the suture were passed through another 1–2 cm PTFE pledget, and these were clipped together with a big Ligaclip (LT 400, Ethicon Endosurgery). The ends of the suture were then tied to form a loop. Subsequent band tightening was achieved by placing additional big Ligaclips between the external PTFE pledget and the previously placed Ligaclip. Echocardiography was used to monitor the early postoperative gradients across the band. Once satisfactory gradients were achieved; the band was internalized by simply opening one of the skin sutures, clipping the two ends of the Ethibond suture against the sternum using a small Ligaclip, and cutting the Ethibond suture above it.

3. Results

There was 1 early death in the initial APAB procedure due to sudden cardiorespiratory arrest. The parents of this patient did not consent for an autopsy. Of the 72 survivors, follow-up data were available for 57 (79%) patients. Mean follow-up was 33 ± 28 months (median 30 months, range, 3–156 months). 54 of the 57 (94.7%) patients had desirable reduction in their PA

Table 1 – Cardiac diagnosis and the distribution of univentricular vs. biventricular physiology in patients undergoing adjustable pulmonary artery banding.

Univentricular		Biventricular	
1	Tricuspid atresia with non-restrictive ventricular septal defect, pulmonary arterial hypertension = 12	1	Large ventricular septal defect = 10
2	Atrioventricular septal defect with pulmonary arterial hypertension (unbalanced) = 4	2	Multiple ventricular septal defects = 20
3	Single ventricle with pulmonary arterial hypertension = 4	3	Atrioventricular septal defects = 5
4	Double outlet right ventricle with ventricular septal defect (non-routable) with pulmonary arterial hypertension = 3	4	Double outlet right ventricle, ventricular septal defect, pulmonary arterial hypertension = 5
5	Congenitally corrected transposition of great arteries with ventricular septal defect = 3	5	Congenitally corrected transposition of great arteries, ventricular septal defect, pulmonary arterial hypertension = 2
6	Double inlet left ventricle, ventricular septal defect, pulmonary arterial hypertension = 4		
Total = 30		Total = 42	

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