Successful Dilation of a Novel Expandible Polytetrafluoroethylene Pulmonary Artery Band Negating Need for Further Surgery

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Successful Dilation of a Novel Expandible Polytetrafluoroethylene Pulmonary Artery Band
Negating Need for Further Surgery

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Running Head: Dilatable ePTFE PA Band

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Central Message: Utilization of a novel dilatable ePTFE main PA band for VSD palliation during a left thoracotomy coarctation repair allowed for successful dilation upon follow-up negates need for subsequent surgery.

Central Picture: Successful interventional dilation of a main PA band negating need for further operation.

Glossary:

Pulmonary artery banding (PAB)
ventricular septal defects (VSD)
Expanded Polytetrafluoroethylene (ePTFE)
Trans-thoracic echocardiography (TTE)
patent ductus arteriosus (PDA)
day of life (DOL)
Introduction

Pulmonary artery banding (PAB) is a useful adjunct for surgeons palliating several congenital cardiac conditions such as multiple muscular ventricular septal defects (VSD), VSD in the setting of congenital lesions being approached via a left thoracotomy, and other more complex congenital conditions. While initial sizing technique has been explored by several groups, there comes a time that the PAB must be removed surgically even in the absence of requirements for additional procedures (for example, closure of a muscular VSD that was the original indication for PAB application). We present the use of a novel expanded Polytetrafluoroethylene (ePTFE) graft (exGraft™, PECA Labs, Pittsburgh, PA) as the material for main PAB creation; this material is dilatable up to 250-300% of its original size without affecting physiologic microstructure; this allowed for the dilation of the main PAB and prevention of further surgery in a patient with coarctation of the aorta repaired via left thoracotomy and PAB placement for a VSD which subsequently closed.[1]

Clinical Summary

Ethics

Informed consent was obtained from the patient’s legal guardian for utilization of de-identified information for this report; IRB approval was not required.

Case Description

A female term infant underwent screening trans-thoracic echocardiography (TTE) in the newborn nursery for a family history significant for bicuspid aortic valve disease. She was found
to have a bicuspid aortic valve, patent ductus arteriosus (PDA), and a moderate-sized mid-
muscular ventricular septal defect (VSD) that was 7-8mm in size. Follow-up imaging on day of
life (DOL) 2 demonstrated a closed PDA but was significant for development of severe juxta-
ductal coarctation requiring prostaglandin initiation and persistent VSD.

The patient underwent left thoracotomy on DOL 6 with primary repair of the coarctation
with end to side anastomosis, PDA ligation, and PAB placement. The PAB was fashioned
utilizing a 3mm wide segment of cut exGraft ePTFE conduit initially sized based on Trusler’s
rule (23.7mm diameter; Figure 2). After PAB placement and securing with serial clips to obtain
oxygen saturations in the mid 90% range with an FIO2 of 40%, the patient recovered without
complication and was discharged on post-operative day 3.

The patient was followed with serial TTE imaging, and near-complete resolution of the
VSD (<1mm by TTE) was observed by 14-months. Peak and mean gradients across the PAB
were 92 mmHg and 62mmHg respectively, and she was referred for cardiac catheterization.
Cardiac catheterization confirmed right ventricular pressure to be 93 mmHg (supra-systemic)
with a direct 80 mmHg gradient across the PAB; QP:QS was 1:1 with only trivial residual
anterior muscular VSD by angiography. A 12 mm x 2 cm expandable balloon catheter was
positioned across the PAB and dilated twice to nominal pressure with good angiographic
expansion of the PAB; of note, a small therapeutic tear in the pulmonary endothelium was noted
with a contained pocket of contrast (Figure 1 A-E). Post-dilation peak and mean residual
gradients across the PA band were 19mm Hg and 12 mmHg demonstrating successful dilation of
the PAB.

Discussion
Study Implications

The exGraft ePTFE conduit is manufactured without an outer wrap and single-layered construction; it can be dilated up to 300% of its original diameter while maintaining physiologic range microstructural properties.[1] The exGraft conduit has successfully been used in patients undergoing congenital heart surgery requiring RV-PA conduit implantation and has demonstrated the ability to undergo successful clinical dilation in the cardiac catheterization laboratory.[2] Our report expands upon the possible uses of this novel dilatable conduit leveraging the conduit material being applied as a PAB with plans for later dilation when PA banding is no longer indicated, eliminating the need for further surgery. This also could have therapeutic implications in bilateral PAB for hybrid palliation, ventricular training for corrected transposition of the great vessels, and transplantation strategies.

Catheter directed relief of PAB has been reported on a limited basis with other PAB materials.[3] However, residual gradients were higher in those studies. PA pseudoaneurysm formation has been reported in instances of attempted catheter de-banding with other non-dilatable materials; indeed, a therapeutic contained tear was encountered in our patient as well.[4] There is still much to learn about longer-term outcomes of catheter PAB relief no matter the material, and the use of exGraft material deserves further consideration in this regard.

Conclusions

We report the successful use and dilation of exGraft ePTFE conduit as a main PAB in a patient eliminating the need for surgical de-banding procedure. Further investigation on materials and techniques for PAB construction and subsequent de-banding in the catheterization laboratory is warranted to optimize PAB strategy.
References


Figure Legends

Figure 1:

Anterior-posterior (A) and lateral (B) Views of the main pulmonary artery (MPA) band prior to intervention. Following balloon dilation (C) of the MPA band, anterior-posterior (D) and lateral (E) views demonstrate successful dilation of the MPA band.

Figure 2:

A pulmonary artery (PA) band was fashioned utilizing a ring cut from a 16mm exGraft expandable Polytetrafluoroethylene conduit to a circumferential length of 27mm (A) and sutured into the PA band configuration (B) with an approx. diameter of 8mm. The PA band was dilated and achieved a circumference of 38mm (C) and approximate diameter of 13mm (D).