Clinical Cardiology Updates

Editorial Open Access

Relevance of Modified Blalock-Taussig Shunt in the Era of Trans-Catheter Interventions and Ductal Stenting

Shegu Gilbert[1]*, Ravi Agarwal[2] and Kothandam Sivakumar[2]

[1]Department of Cardiovascular and thoracic surgery, Kovai Medical Center and Hospital, Avinashi road, Coimbatore – 641 014, Tamilnadu, India

[2]Institute of Cardiovascular Diseases,The Madras Medical Mission (MMM), 4-A, Dr. J J Nagar, Mogappair, Chennai - 600 037, Tamilnadu, India

*Corresponding author: Shegu Gilbert, Block no. 4, flat no. TA, Jains sri venkateshwara apartments, Ramanuja nagar, Uppilipalayam (po), Coimbatore 641015, Tamilnadu, India, Tel: +919840242143; Email: shegugilbert@yahoo.co.in

Original Submission

Received: February 07, 2017
Accepted: March 09, 2017
Published: March 14, 2017

Open Peer Review Status: Editorials, news items, analysis articles, and features do not undergo external peer review.

How to cite this article: Shegu Gilbert, Ravi Agarwal, Kothandam Sivakumar. Relevance of Modified Blalock-Taussig Shunt in the Era of Trans-Catheter Interventions and Ductal Stenting. Clin Cardiol Updates. (2017) 1: 5.1

Acknowledgments: would like to thank Ms. Sudha for her writing assistance and technical editing.

Cyanotic CHD is a life threatening condition and ensuring an early adequate pulmonary blood flow is lifesaving in many patients particularly those who are dependent on patency of the ductus arteriosus for their survival.

Nowadays, most patients with cyanotic CHD and biventricular morphology undergo total correction at an early age. But still some babies require systemic to pulmonary artery (PA) shunts for palliation when they are not considered suitable for total correction at that point of time (for various reasons) or to combat an emergency hypoxia situation.

Various palliative procedures are available to improve the pulmonary blood flow in patients with cyanotic CHD. The most commonly performed aorto-pulmonary shunt is the modified Blalock-Taussig shunt (MBTS). Indications for a MBTS included patients of Tetralogy of Fallot with special situations, tricuspid atresia, pulmonary atresia with intact ventricular septum, pulmonary atresia with ventricular septal defect and other single ventricle situations with pulmonary or aortic atresia. Off late ductal stenting (DS) has been added to the armamentarium of the heart team as an attractive alternative option to MBTS.

Indications for ductal stenting [1]include patients with pulmonary atresia and biventricular physiology who are considered high risk for surgery due to low birth weight, trisomy 21, comorbidities like bronchopneumonia, lung disease of prematurity and other organ malsformations, small pulmonary arteries, non-confluent PAs with type V bilateral ducts and non availability of surgical expertise. Secondindication is in patients with univentricular hearts with pulmonary atresia who require only short term palliation. However in confluence stenosis surgical shunt is preferred. Third indication is in patients who will require only a transient need for ductal patency like preparing a left ventricle for arterial switch operation. Another indication where transient ductal patency is needed is following a successful balloon pulmonary valvotomy in critical valvar pulmonary stenosis, where the accompanying diastolic dysfunction and hypoplasia prevents the entire systemic venous return to pass through the right ventricle.

The patency of a ductal stent is limited for a short period [2]. Hence it is suitable for patients with a single ventricle physiology who will anyway need a Glenn shunt by around six months of age. Regulating the pulmonary blood flow in a single ventricle patient is of great concern because an overflow results in rise of PA pressure that will complicate a later Glenn's procedure.

Patients with pulmonary atresia and a biventricular physiology for whom total correction is planned at a later age are served best by a MBTS. Ductal stenting is indicated in low birth weight babies but one has to bear in mind the vascular access related complications of manipulating a small femoral artery causing injury, distal embolism and a pulseless limb. MBTS in neonates is not so easy a procedure because of the associated technical difficulties and post-operative hemodynamic management. DS is indicated as a backup in circumstances of difficulty during a MBTS surgery resulting in poor oxygenation.

Specific anatomies of the PDA pose access challenges while stenting [3]. The vertical ductus is technically challenging and may need a carotid cut down by a surgeon to establish an easy access. The other route is through a trans- axillary approach. Tortuous PDAs also pose technical difficulties. Prostaglandin infusion makes the ductus very friable. Ductal rupture during DS is a serious complication.

In DS protrusion of the stent into the pulmonary artery produces fibrosis in the arteries. The stents get embedded into the wall of the artery causing a foreign body reaction and fibrous changes [4]. Most of the patients who underwent DS require PA arterioplasty at the time of definitive surgery or single ventricle palliation. Excision of the stent may cause a rent in the posterior wall of the PA necessitating a further complex repair. The right ventricular system is a high volume and low pressure system that facilitates adequate increase in cardiac output. Pulmonary artery fibrosis raises a red flag as it results in a non-compliant pulmonary artery that is resistant to expansion and growth. Similar problems are uncommon in MBTS. A MBTS can be easily taken down during definitive repair.

Other complications of ductal stenting include immediate complications like technical failure, ductal spasm (< 1%), acute stent thrombosis (2-3%), refractory hypotension, heart failure due to overflowing ductal stent, dissection of the duct, unilateral pulmonary hypo perfusion and stent embolization. Late complications include sub-acute stent thrombosis, stent restenosis and stenosis or disconnection of the origin of one pulmonary artery. Instent restenosis with tissue ingrowth has made the interventionists to try with serolimus eluting coronary stents, which exposes the neonate to toxic medications for brief periods of time, though this has not resulted in any systemic side-effects.

Limitations of PDA stenting include patient's age (prematurity) and duct morphology. Higher success rates are seen in patients with pulmonary atresia with intact ventricular septum and tricuspid atresia. In patients with PA IVS with well developed right ventricle and tricuspid valve Z-score of 0 to -2 may be managed in catheterization laboratory with perforation of the atretic pulmonary valve, balloon dilatation of the pulmonary valve along with ductal stenting in the same sitting, thereby completing a total correction. Complicated duct anatomy is seen in pulmonary atresia with ventricular septal defect where DS is technically challenging. DS should be avoided in branch PA stenosis as it aggravates the situation.

Other factors that might affect the choice of MBTS or a DS are the availability of the cardiologist and the cardiac surgeon, technical expertise and philosophy of the unit.

DS is an attractive option and in the future it is likely that more number of patients will be subjected to undergo this procedure as an alternative to surgical palliation in neonates with

complex congenital heart disease. Although many small series of data of DS are published sufficient data and large series comparative studies will be required to allow proper comparison between late complications of stent implantation and surgical treatmentSelection of either procedure will depend on our internal harmony to decide in the best interest of the patient.

References

1. Sivakumar K.PDA stenting in duct-dependant pulmonary circulation. In: Butera G, Chessa M, Eicken A, Thomson J, editors. Cardiac catheterization for congenital heart disease from fetal life to adulthood. Milan: Springer. 2015.
2. Gibbs JL, Uzun O, Blackburn ME, Wren C, Hamilton JR, et al. Fate of the stented arterial duct. Circulation.1999;99:2621-2625.
3. Alwi M. Stenting the ductus arteriosus: Case selection, technique and possible complications. Annals of Pediatric Cardiology. 2008;1:38-45.
4. Coe JY, Olley PM. A novel method to maintain ductus arteriosuspatency. J Am Coll Cardiol. 1991;18:837-841.