Commentary

# Postoperative pulmonary artery stenosis: current options and future directions

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*Provenance:* This is a Guest Commentary commissioned by the Section Editor Xicheng Deng (Department of Cardiothoracic Surgery, Hunan Children's Hospital, Changsha, China).

*Comment on:* Kim H, Chan Sung S, Choi KH, *et al*. Sutureless Patch Angioplasty for Postoperative Pulmonary Artery Stenosis in Congenital Cardiac Surgeries. Ann Thorac Surg 2016;101:1031-6.

Submitted Jul 05, 2016. Accepted for publication Jul 10, 2016.

doi: 10.21037/tp.2016.08.01

**View this article at:** http://dx.doi.org/10.21037/tp.2016.08.01

This study by Kim *et al*. (1) addresses an important and frequent issue in pediatric cardiac surgery, which is the management of postoperative pulmonary artery (PA) branches stenoses. Different options are currently available to treat a PA branch stenosis, including a conventional surgical plasty using (or not) a biological patch (autologous pericardium, human cryopreserved pericardium, bovine or equine pericardium, or decellularized porcine intestinal submucosa extracellular matrix) or a synthetic patch (polytetrafluoroethylene, terephtalate, ...), percutaneous procedures (balloon dilation, stent placement, cutting balloon dilation, ...) and hybrid procedures.

The percutaneous techniques are not always adapted to the anatomical features of the PA stenosis, depending on the location, extent and severity of the stenosis. Also, an isolated balloon dilation is not always successful. The use of stents definitely has some limitations, including the absence of growth potential, risk of fracture, risk of embolization, risk of stenosis with intra-stent neoproliferation and the increased risk and complexity for further surgery.

A conventional surgical patch angioplasty for PA stenosis can be challenging. The dissection of the PA branches can be difficult in some clinical situations (severe adhesions, risk of injury of the PA branches themselves and other vascular structures around, such as the ascending aorta, superior vena cava or left atrial appendage). Extensive dissection of the PAs can also lead to nerve injuries (phrenic nerve or recurrent laryngeal nerve) and an increased cardiopulmonary bypass time or even increased aortic cross-clamp time.

Kim *et al*. report a sutureless patch angioplasty. This technique is based on the concept that postoperative adhesions and peel tissue around the previous patch material can be used as an autologous vascular support. This concept of suturing a patch around a vascular structure instead of anchoring it into the media of the vessel is not new. It was first described for the treatment of pulmonary vein stenosis almost 20 years ago (2-3) in order to try to reduce trauma to the veins in hopes of reducing any stimulus for regrowth of obstructive tissue. Then the concept was extended to total anomalous pulmonary vein connection (4) in order to avoid geometric distortion of pulmonary venous suture lines and preventing post-repair pulmonary vein stenosis. Here Kim justifies the concept of sutureless repair in order to simplify the technical procedure and get rid of potential complex geometrical considerations to deal with if a conventional PA plasty would have been performed.

Despite some limitations related to the concept of the technique (including the risk of postoperative intravascular thrombus requiring the use of coumadin for 2 months and aspirin lifelong, the risk of aneurysm formation and restenosis by shrinkage of the scar tissue), this technqiue has some advantages and is definitely a potential good "surgical tool" to keep in one's surgical "toolbox". Actually, we have been using this concept in the Department of Pediatric Cardiac Surgery at Columbia University in some specific situations. The most frequent situation is when the right PA branch is "stucked" to the posterior face of a

dilated (neo-)ascedning aorta in patients with hypoplastic left heart syndrome or conotruncal anomalies (redo surgery after repair of tetralogy of Fallot with or without absent pulmonary valves or pulmonary atresia, especially in adults). We have been using this concept not only for PA branch stenosis, as described by Kim *et al*. but also for pulmonary valve replacement requiring a hood on top of the bioprosthetic valve in pulmonary position. In this situation, the patch can be sewn to the fibrotic tissue around the PA branches and the right infundibulotomy to avoid any excessive and dangerous dissection of these regions and also avoid the risk of right ventricular outflow tract obstruction.

Nevertheless, the surgical expertise is definitely needed and is probably the most important element which can ensure a safe dissection of PA branches and an harmonious reconstruction of PA branches. Also, the use of tissue engineered patches or vessels (5,6) may be of interest to improve the outcomes of surgical PA plasty. From a structural standpoint, the ideal cardiovascular patch/ graft would be non-thrombogenic and match the compliance and mechanical strength of the native tissue. Such a potential living autologous tissue-engineered patch could avoid any stenosis (of PA branch or any other vascular structure), thanks to an ideal biological remodeling and a growth potential. However, there are still many hurdles that must be overcome before engineered tissues can be used in pediatric patients.

## Acknowledgements

None.

**Cite this article as:** Kalfa D. Postoperative pulmonary artery stenosis: current options and future directions. Transl Pediatr 2017;6(1):57-58. doi: 10.21037/tp.2016.08.01

## Footnote

*Conflicts of Interest:* The author has no conflicts of interest to declare.

## References

1. Kim H, Chan Sung S, Choi KH, et al. Sutureless Patch Angioplasty for Postoperative Pulmonary Artery Stenosis in Congenital Cardiac Surgeries. Ann Thorac Surg 2016;101:1031-6.
2. Lacour-Gayet F, Rey C, Planché C. Pulmonary vein stenosis. Description of a sutureless surgical procedure using the pericardium in situ. Arch Mal Coeur Vaiss 1996;89:633-6.
3. Najm HK, Caldarone CA, Smallhorn J, et al. A sutureless technique for the relief of pulmonary vein stenosis with the use of in situ pericardium. J Thorac Cardiovasc Surg 1998;115:468-70.
4. Yanagawa B, Alghamdi AA, Dragulescu A, et al. Primary sutureless repair for "simple" total anomalous pulmonary venous connection: midterm results in a single institution. J Thorac Cardiovasc Surg 2011;141:1346-54.
5. Heydrick S, Roberts E, Kim J, et al. Pediatric cardiovascular grafts: historical perspective and future directions. Curr Opin Biotechnol 2016;40:119-24.
6. Pontailler M, Illangakoon E, Williams GR, et al. Polymer-Based Reconstruction of the Inferior Vena Cava in Rat: Stem Cells or RGD Peptide? Tissue Eng Part A 2015;21:1552-64.

 