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Commentary: Right ventricular unloading with valved conduit for end-stage pulmonary arterial hypertension: When Eisenmenger is the last hurrah

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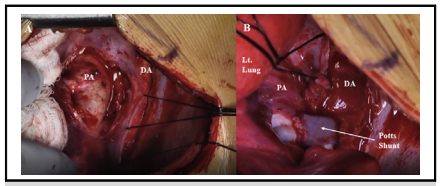

Left thoracotomy showing modified Potts shunt using a cryopreserved vein homograft.

CENTRAL MESSAGE

Right ventricular unloading with a pulmonary-to-aortic shunt has the potential to improve functional class and right ventricular function in patients with end-stage pulmonary arterial hypertension.

In 1946, Willis J. Potts and his research fellow Sidney Smith devised an aortopulmonary shunt to improve blood flow to the lung and palliate blue baby syndrome.[1] With the advances in pediatric heart surgery since then, many thought that we no longer needed this historical procedure. The Potts shunt was resurrected recently under a new indication,[2] end-stage pulmonary hypertension with systemic/suprasystemic pulmonary artery pressure (PAP) to unload the right ventricle and create an Eisenmenger-like physiology with differential cyanosis that improves cerebral and upper body saturation (reverse Potts shunt).[3] In some reports, this procedure was even successful in delaying the need for lung transplantation.[4]

I read with interest the small case series reported by Rosenzweig and colleagues[5] in which the authors used a valved pulmonary-to-descending aortic conduit (univalved conduit [UVC]) as an alternative to reverse Potts' shunt, in addition to the creation of a 3- to 6-mm atrial-level shunt (ASD). The authors supported 4 of 5 patients with veno-venous extracorporeal membrane oxygenator (ECMO). They argue that this approach, in combination with an ASD, eases the postoperative transition to the new physiology. At the latest follow-up (median, 6 ± 11 months), all patients were alive and reported improvement in their functional class and the right ventricular fractional area change (FAC) by transthoracic echocardiography from 22% to 35% at follow-up. I congratulate the authors on their excellent outcomes in such a challenging group of patients, and on the novelty of their approach.

Nevertheless, one could argue the following points:

1. A reverse Potts shunt with interposition graft through a left thoracotomy may be technically easier and does not require cardiopulmonary bypass. A valve can be added to maintain a unidirectional flow, especially in those with systemic PAP. One can argue that there is no need for a valve in patients with suprasystemic PAP, such as in the current series. A snare can be placed around the graft to facilitate its control when the time comes for lung transplantation.
2. The use of postoperative anticoagulation is not without risk in these cases. I believe in making this shunt as short as possible so that the risk of thrombosis is much lower. (Thrombosis occurred in 1 patient in the current series.)
3. The need for prophylactic ECMO support is unclear to me, and ECMO comes with its own risks. An additional option is a temporary right ventricular assist device, which may avoid the need for systemic anticoagulation.
4. The creation of an additional ASD may defeat the purpose of the UVC, and although it might not result in adequate unloading, it will lead to cerebral and upper body desaturation. The actual size needed for the ASD is also unclear.
5. What is the ideal valved conduit? We know that regardless of the type, these conduits will eventually fail, and

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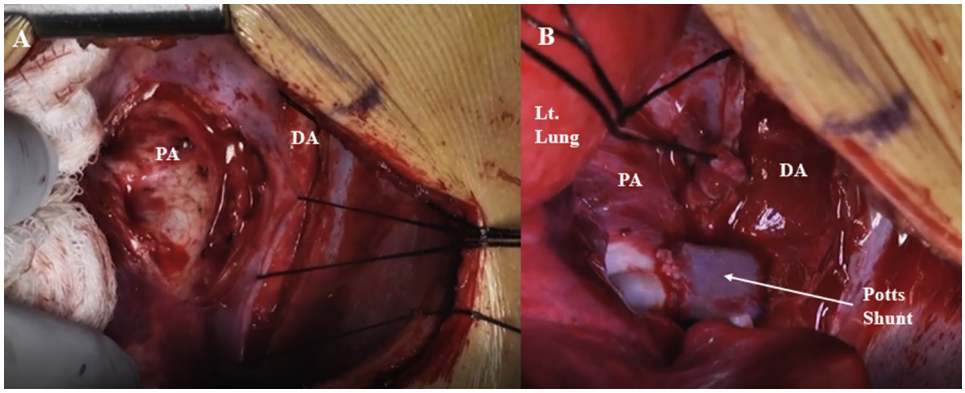

FIGURE 1. Left thoracotomy showing modified Potts shunt using a cryopreserved vein homograft. *PA*, Pulmonary artery; *DA*, descending aorta; *Lt*, left.

reintervention may be required. Much earlier failure of these conduits in this position can be expected owing to its extra-anatomic location and the suprasystemic PAP to which they are exposed.

6. The optimal design and mechanism of right ventricular unloading in these cases remain unknown. This includes optimal size of the conduit (the authors used a 12-mm conduit in all patients), valved versus nonvalved, and the approach, either left thoracotomy or sternotomy.

We have performed reverse Potts shunt through a left thoracotomy in patients with irreversible pulmonary hypertension (Figure 1) using a cryopreserved homograft vein. In my opinion, both approaches are valid, and keeping an open mind when making the decision and tailoring the approach according to the patient's profile is mandatory. Nonetheless, it remains to be determined when to pull the trigger on performing a reverse Potts shunt/alternative, and whether to wait for medical failure or not, but we definitely should not wait for frank right ventricular failure. Finally, the need for longer-term data with a larger group of patients to determine the efficacy and durability of the available approaches is critical.

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