Transcatheter Replacement of Pulmonary Valve: Native Site

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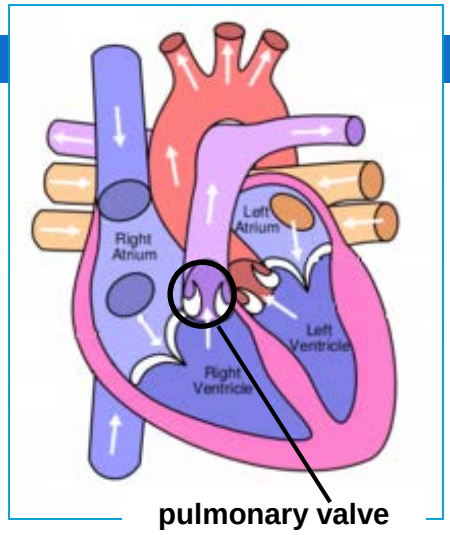
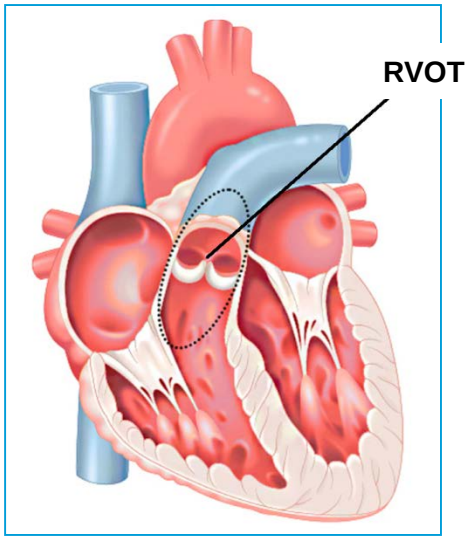
Pulmonary Valve Anatomy and Function

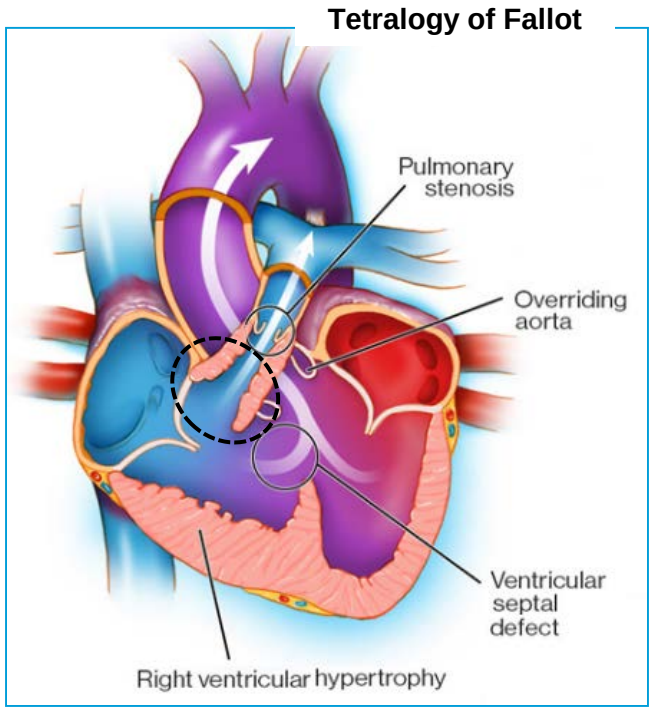
- The pulmonary valve is situated between the right ventricle and the main pulmonary artery.
- The valve controls the flow of deoxygenated blood from the right side of the heart to the pulmonary arteries and on to the lungs.
- The pulmonary valve also prevents backflow of blood into the right ventricle.
- The right ventricular outflow tract (RVOT) is made up of the upper extension of the right ventricle, the pulmonary valve, and the main pulmonary artery.





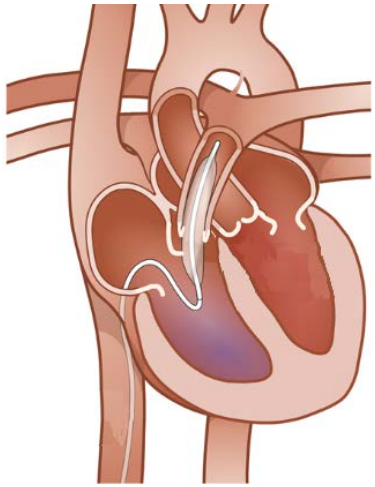
Pulmonary Valve Disorders

- Pulmonary valve disorders generally involve RVOT obstruction.
- This hinders the flow of blood to the lungs for reoxygenation.
- Many pulmonary valve disorders are congenital, including:
  - tetralogy of Fallot
  - pulmonary valve stenosis
  - pulmonary valve atresia
  - truncus arteriosus
  - double-outlet right ventricle

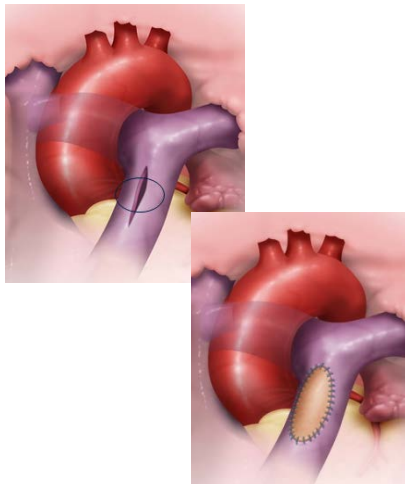


Treatment for RVOT Obstruction

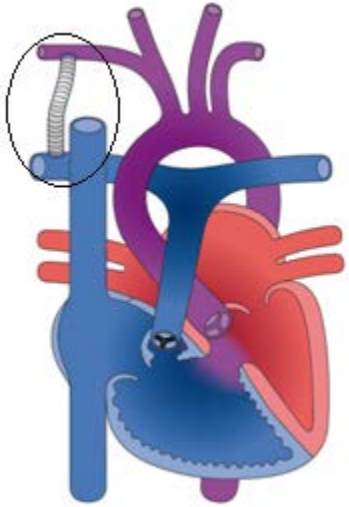
- Early intervention, typically in infancy, is necessary to immediately improve blood flow to the lungs to pick up oxygen.
- The early procedures are not permanent correction, but allow surgical valve replacement to be delayed until early adulthood.



Balloon valvuloplasty of anomalous pulmonary valve



Enlargement of RVOT with patch graft

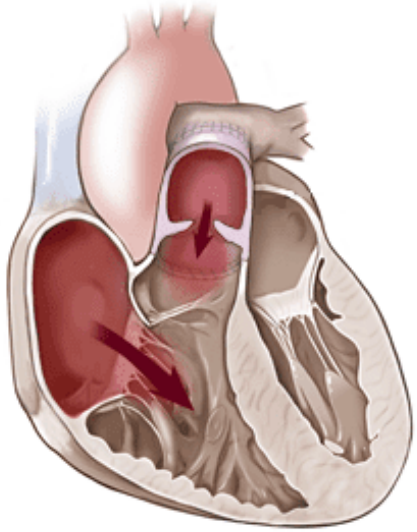


Blalock-Thomas-Taussig shunt (subclavian to pulmonary artery)

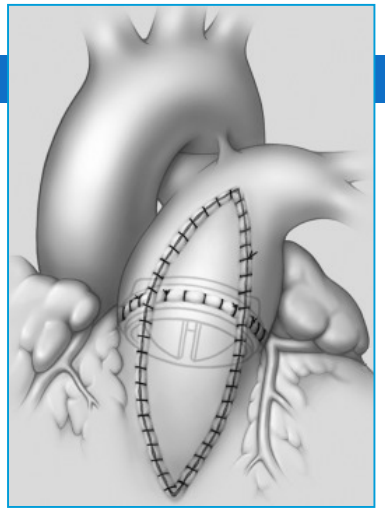
RV-PA valved conduit

RV Backflow and Valve Insufficiency

- Valvuloplasty, RVOT patch, and BT shunt improve blood flow to the lungs, but do not prevent backflow into the right ventricle.
- Patients may eventually develop pulmonary valve insufficiency from backflow, as a known consequence of these early procedures.
- Pulmonary valve insufficiency can be tolerated but eventually leads to:
  - chronic volume overload
  - right-sided heart failure
  - right ventricular hypertrophy
  - clinically significant arrhythmias



Pulmonary Valve Replacement



Open Valve Replacement

- Pulmonary valve replacement has conventionally been an open procedure.

Transcatheter Valve Replacement

- Transcatheter replacement of the pulmonary valve at its native site is now available.
- The new transcatheter procedure is performed on patients with previous balloon valvuloplasty or RVOT patch graft, and/or BT shunt.

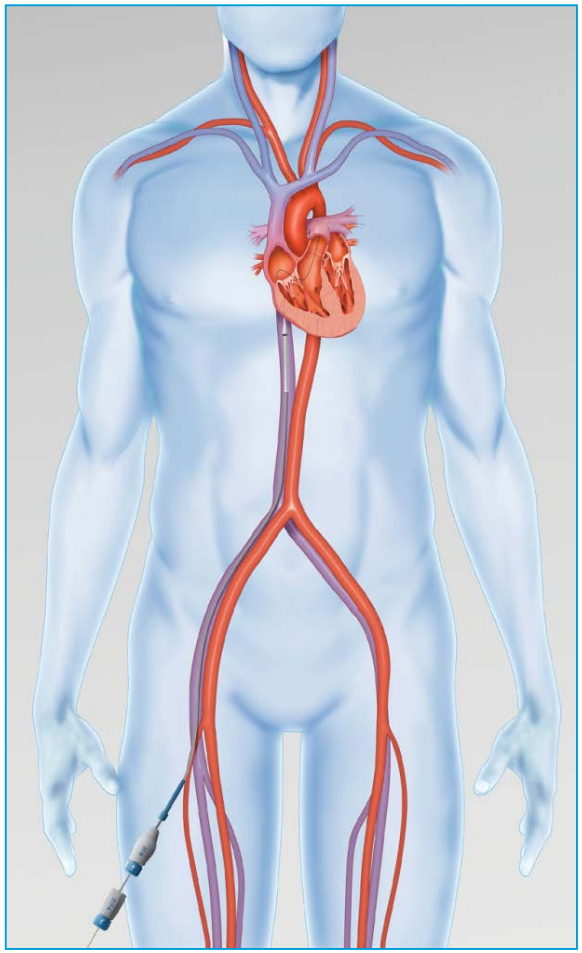
☒ It is not performed on patients who previously received an RV-PA conduit.

Transcatheter Pulmonary Valve

- The device is specifically designed for transcatheter pulmonary valve replacement.
- The leaflets, composed of porcine tissue, are situated at the device's waist.
- The skirts on either end of the nitinol frame serve to seat the valve properly.
- Using a funnel, the valve is loaded onto a catheter for delivery to the native valve site between the right ventricle and the main pulmonary artery.

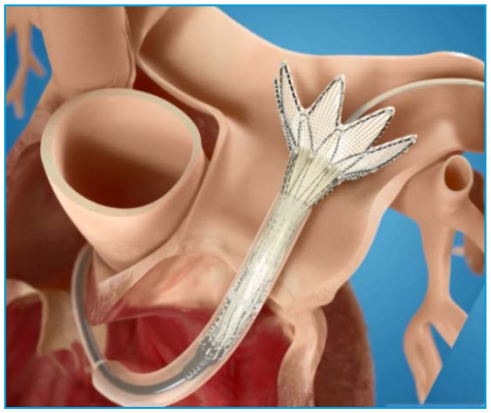
Transcatheter Replacement Procedure

- Access is typically at the femoral vein or the internal jugular vein.
- RVOT angiography is performed first, with particular attention to the pulmonary artery bifurcation.
- The valve delivery catheter is advanced to the superior vena cava.
- The delivery catheter is then advanced into the right atrium, through the tricuspid valve, and into the right ventricle.



Transcatheter Replacement Procedure

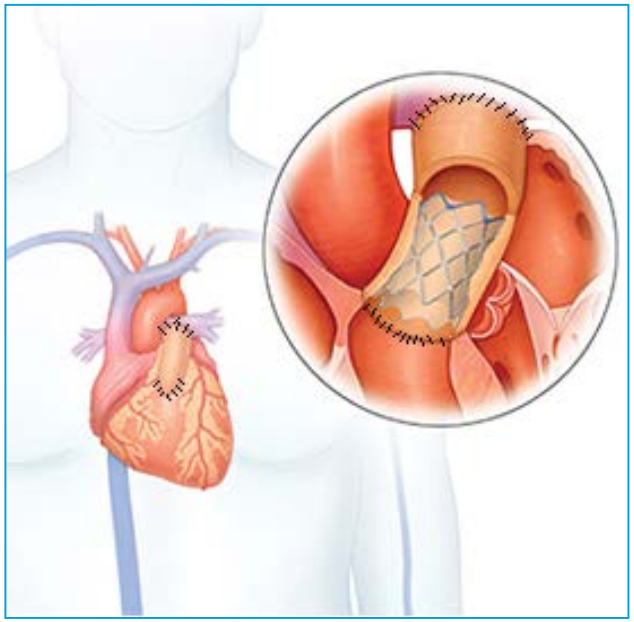
- The valve delivery catheter is advanced from the right ventricle into the main pulmonary artery and beyond the bifurcation.
- As the sheath is withdrawn, the new valve opens in place.
- The leaflets are at the valve's native position, secured by the skirts at the pulmonary bifurcation and the upper right ventricle.
- On release, the new valve immediately begins working.



Conduit Valve Replacement

☒ A different type of transcatheter pulmonary valve replacement takes place within a previously placed RV-PA conduit.

- The RV-PA valved conduit is an early intervention that assumes the function of the pulmonary valve.
- As the patient grows, the valve inside the conduit invariably becomes dysfunctional (usually obstructive and leaky).
- The dysfunctional valve is replaced in a transcatheter procedure implanting another valve inside the conduit.



Documentation

Transcatheter Pulmonary Valve Replacement: Native Site

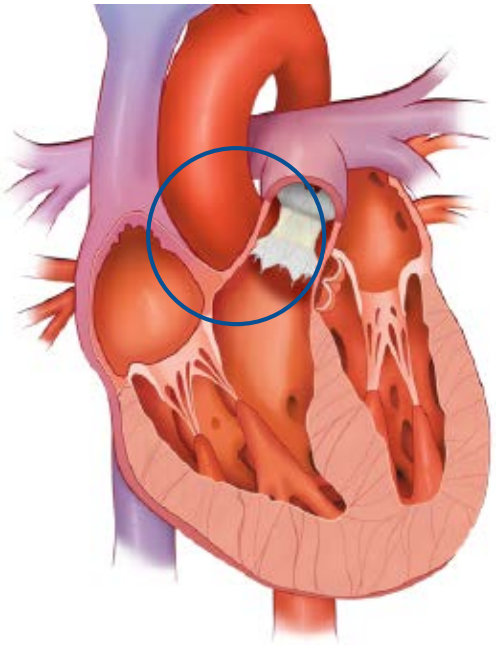
- History of balloon valvuloplasty, or RVOT patch graft, or BT shunt
- Advancement of delivery catheter from the right ventricle into the main pulmonary artery
- Confirmation of new valve position between RV and pulmonary artery
- Harmony valve

Transcatheter Pulmonary Valve Replacement: Conduit

- Surgical history of previous RV-PA conduit
- Advancement of delivery catheter from the right ventricle into the conduit
- Confirmation of new valve position within conduit
- Melody valve

Clinical Data

- There are significant anatomic and functional distinctions between transcatheter pulmonary valve replacement at the native site and within a previously placed conduit.
- Differentiating the two procedures allows separate tracking and outcomes analysis.
- Transcatheter pulmonary valve replacement at the native site can be identified distinctly in the data.



Thank you!