VSD DEVICE CLOSURE: CURRENT STATUS

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I ANATOMICAL SUITABILITY

- **Muscular VSD:** Ideal for device closure due to being surrounded by a thick muscular rim. Most common indication.
- **Perimembranous VSD (pmVSD):** Technically feasible but controversial due to the proximity of the Tricuspid valve and the Bundle of His.
- **Doubly Committed Subarterial VSD:** Generally not suitable for device closure as it lacks a superior rim and risks causing Aortic Valve prolapse/regurgitation.
- **Post-MI VSD:** High-risk surgical patients. Device closure acts as a bridge to surgery or a primary therapy, though tissue fragility makes it challenging.

II INDICATIONS FOR CLOSURE

- **Hemodynamic Significance:** Left-to-right shunt with Qp:Qs ratio of 1.5 to 1 or higher.
- **Left Heart Overload:** Progressive Left Atrial or Left Ventricular enlargement on echocardiography.
- **History of Endocarditis:** Regardless of the shunt size.
- **Symptomatic Patients:** Failure to thrive (infants), dyspnea, or reduced exercise tolerance.
- **Pulmonary Hypertension:** Indicated if Pulmonary Vascular Resistance is less than 3 Wood Units.

III PROCEDURAL TECHNIQUES

- **Arteriovenous (AV) Loop:** The standard technique. A wire is passed from the arterial side, through the VSD, into the venous system, and snared to create a stable rail for device delivery.
- **Imaging:** Transesophageal Echocardiography (TEE) or Intracardiac Echocardiography (ICE) is used alongside fluoroscopy to guide placement.
- **Device Selection:**
  - **Amplatzer Muscular VSD Occluder:** Double-disc nitinol device with a thick waist to match the muscular septum.
  - **Amplatzer Membranous VSD Occluder:** Specifically shaped to avoid interference with the heart valves.
  - **Amplatzer Duct Occluder (ADO I / ADO II):** Frequently used “off-label” for certain perimembranous defects to minimize conduction system pressure.

IV COMPLICATIONS AND LIMITATIONS

- **Complete Heart Block (CHB):** The most significant risk in perimembranous VSD closure (up to 5 percent). Can occur acutely or as a late complication due to mechanical compression of the AV node.
- **Tricuspid/Aortic Regurgitation:** Caused by device interference with valve leaflets or subvalvular apparatus.
- **Device Embolization:** Risk is higher in large defects with inadequate muscular rims.
- **Vascular Injury:** Significant risk in small children due to the large sheath sizes required for the AV loop.
- **Hemolysis:** High-velocity residual shunting through or around the device can cause mechanical red cell destruction.

V CURRENT EVIDENCE AND OUTCOMES

- **Muscular VSD:** Device closure is the established gold standard with success rates exceeding 95 percent and minimal complications.
- **Perimembranous VSD:** Remains a debated topic. While technically successful, the risk of permanent pacemaker implantation leads many centers to prefer surgery in young children.
- **Post-MI VSD:** Early device closure is associated with high mortality due to necrotic tissue, but delayed closure (after 3 to 4 weeks) shows significantly better outcomes as the tissue becomes fibrotic.