Imaging Evaluation of the Ventricular Septum

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Disclosure Information

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As a faculty member for this program, I disclose the following relationships with industry:

(GRS): Grant/Research Support  (C): Consultant  (SB): Speaker's Bureau  
(MSH): Major Stock Holder   (AB): Advisory Board  (E): Employment 
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W.L. Gore Medical: C, Echo Core Lab
Echo Evaluation

- Identify/Locate multiple defects
- Evaluate for potential interference
  - Papillary muscle(s)
  - AV valves
  - Trabeculations
- Echocardiographic guidance
VSD Location
Anatomy

Solitary defect

Defect has multiple openings

McCarthy KP, et al. Images Paed Cardiol; 4: 5-23
Anatomy – 3D Echocardiography

- 3D display can be done from LV and RV aspect
- Useful for planning
- RT3D needed during procedure
  - Transthoracic
  - Epicardial
  - TEE

Kardon, RE et al Circ;98:1307-1314
Echocardiographic tools

- **TTE** – 2D ± real time 3D
  - Pre and intraprocedure
  - Views: long and short axis, 4 and 5 chamber views
- **TEE**
  - Intraprocedure – 0 °, 45 ° and 120° and transgastric
  - Real time 3D TEE: adults
- **ICE**
  - Additional catheter
  - Difficult to obtain 4 chamber view
Perimembranous VSD

- Size
- Location
- Morphology of the defect: aneurysm
- Number of exit holes
- Tricuspid valve and subvalvar apparatus
- Aortic valve
Perimembranous VSD

- Size
- Measured in 2 planes in diastole
  - Elliptical/Button Hole
Perimembranous VSD

• If little TV tissue around it: consider the LV side (mouth of the VSD at the crest of the IVS)
Perimembranous VSD

- If there is TV tissue with aneurysm formation: consider the RV side (exit hole)
Perimembranous VSD

- Location: proximity to the aortic valve
- PMVSD with outlet extension – subaortic
  - Distance from the Aortic Valve
- 4 mm rim for device
Perimembranous VSD - outlet

Well seen on long axis and 5 chamber views

On short axis sits in the middle of the septum far from the tricuspid valve
Perimembranous VSD - outlet

Device just below the aortic valve - LVOT
Perimembranous VSD

• Aortic valve issues
  – Aortic Valve leaflet prolapse ± AR
Perimembranous VSD – AoV Prolapse

Well seen on long axis view
Perimembranous VSD – AoV Prolapse

After device implantation AR increased over time
Perimembranous VSD

- Location: proximity to tricuspid valve
- PMVSD with inlet extension
  - Potential interference with TV fxn
  - Risk for atrioventricular block
Perimembranous VSD - inlet

Well seen on 4 chamber view

short axis is seen close to the tricuspid valve
Aneurysm formation: option for device placement inside the aneurysm (? away from the conduction tissue)
Perimembranous VSD – device position
Muscular VSD
Muscular VSD - Important Issues

- Location
- Number
- Size
- Relationship with moderator band, tricuspid papillary muscles
- RV trabeculation – room for RV disc
- LV chordae
Muscular VSD - location

- Anterior muscular VSD
  - May be difficult to visualize surgically
Muscular VSD - location

Midmuscular VSD
Muscular VSD – number

- Apical VSD’s
  - ? Multiple
  - Distance between defects
  - Distance from Septum to RV free wall
Muscular VSD – measurement

Measure from multiple views
Echo Guidance

- Communication with Surgeon and/or Interventionalist
- Confirmation of VSD’s
  - Number
  - Location
  - Size
Echo Guidance

- Continuous Monitoring
- Transthoracic
- Epicardial
- TEE
  - Multiplane imaging
  - Multiple locations
Muscular VSD

- Device Delivery
  - Percutaneous
    - > 6-8 kg
    - Perventricular
    - < 6-8 kg
Muscular VSD – Issues for Closure

- Avoid Papillary Muscles
- Distance to LV free wall
- Identify space between Septum and RV free wall
- Moderator Band
- In-line with VSD
• Locate Major Structures around Defects
• Size
• Assess Distances to Structures
• LV vs RV side of Defects

• Search for Multiple Defects
• Relative Location of Defects
• 3D Structure
• Teamwork
Imaging Evaluation of the Ventricular Septum SCAI 2013

- Avoid Papillary Muscles
- Space from Septum

• Wire
• Sheath
- End of sheath
- LV Disc free

- Full deployment of RV disc
- Dense trabeculations can restrict RV disc
After Deployment
• Complete Expansion
• Interference?
• Additional Defect(s)

• Multiple Devices
• Residual Shunt
• AV Valves
Potential Problems

- Sheath/Device position
- Trabeculations vs Septum
- Papillary Muscles
MSVD - perventricular

Echo sole method of guidance
- Define location of VSD for needle entry
Perventricular VSD Closure – Epicardial
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Perventricular VSD Closure – Epicardial
VSD Closure Summary

- Pre-procedure Echo Evaluation for Patient Selection
- Number, Size, and Location of Defects
- Identification of Adjacent Structures
- Identification of Location of Delivery System
- Evaluate for Residual Shunt(s)

Communication and Teamwork are Key Components for Successful VSD Closure
Thank You