KATHOLIEKE UNIVERSITEIT
LEUVEN

TOE for percutaneous closure of septal defect (ASD, VSD)

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Conflict of interest

- None

Introduction

- Atrial septal defect
- Ventricular septal defect

Main message

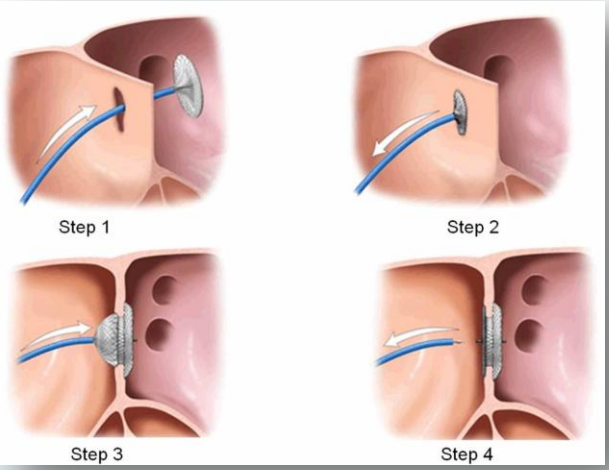
- The input of the sonographer is essential in percutaneous septal procedures!!

Sonographer + Interventionalist =

- Safety
- Efficiency
- Efficacy

The general idea

- To close a defect with a device:
  - Double disk / umbrella / helex
  - (Coils)



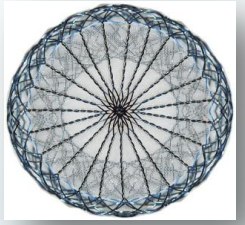
One disk on the left
One disk on the right

ASD


Amplatzer


Figulla


CeraFlex


NitOcclud

...

VSD

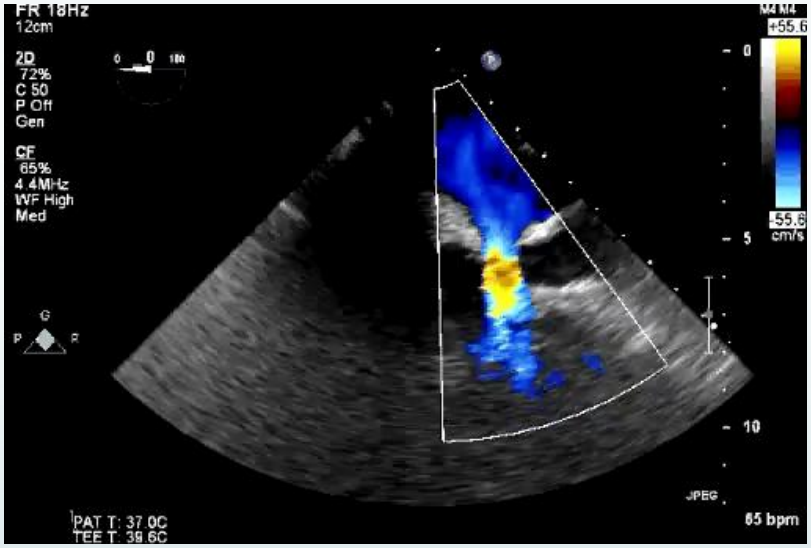

Amplatzer muscular


Amplatzer perimembranous

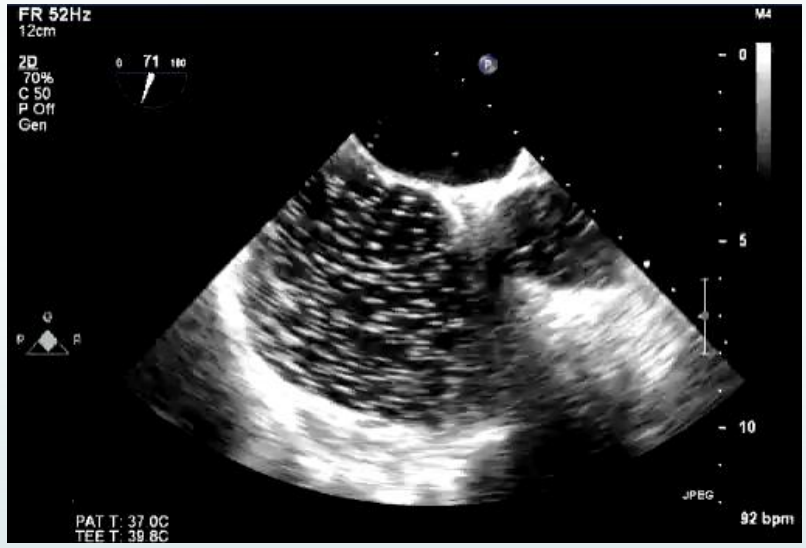
...

Select the right patient

- Only the ASD secundum type is feasible for percutaneous closure
  - Exclude *ASD primum type* and *ASD sinus venosus type*



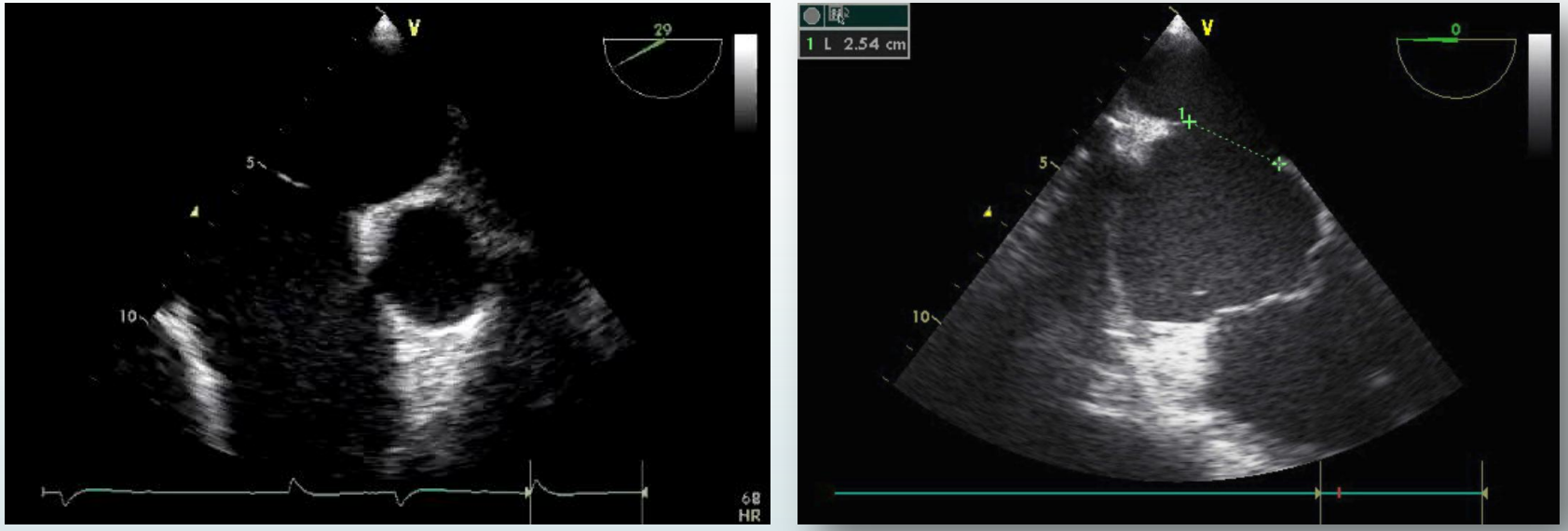
ASD primum type
Close to mitral valve
- Mitral valve repair -



Sinus venosus defect
SVC and pulmonary vein involved
- Atrial rerouting -

Select the right patient

- Only the ASD secundum type is feasible for percutaneous closure
  - Sizes up to 40 mm (stretched) can be closed percutaneously (maximal unstretched diameter + 25 to 50%)



ASD secundum type

Select the right patient

- Evaluate all rims (and measure corresponding diameters)
  - Anterior, posterior, superior, and inferior

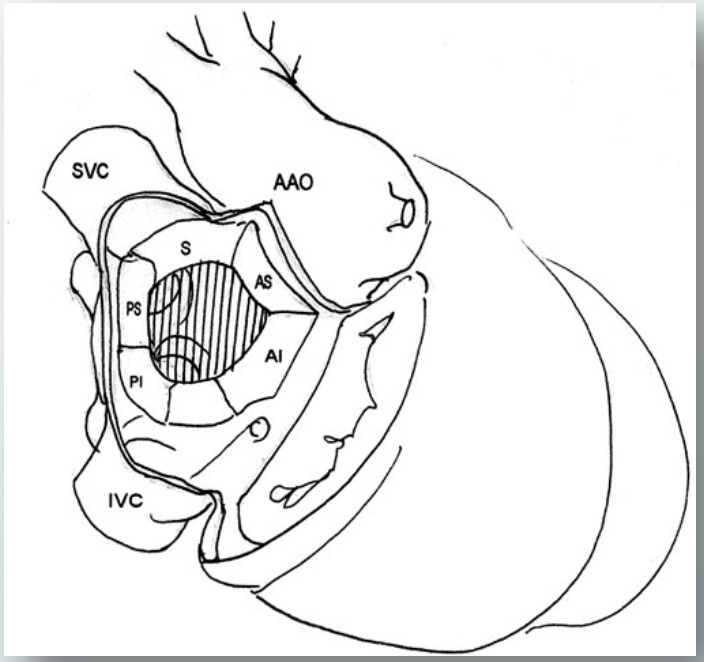
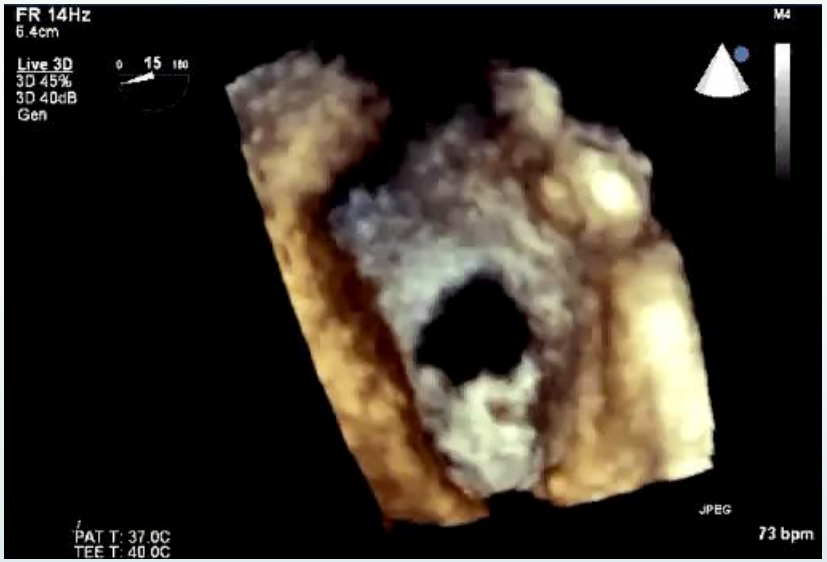


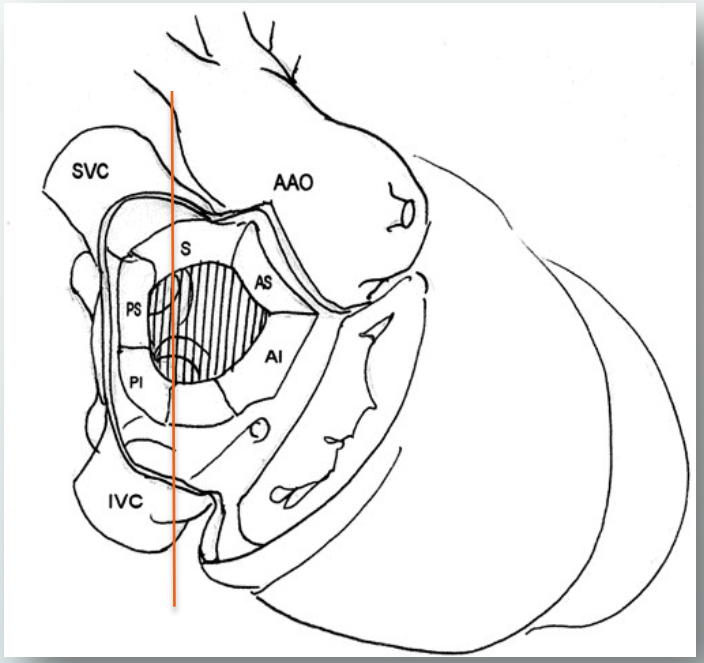
Figure 1. Artist's drawing of right anterior surface of heart with right atrial free wall removed. Approximate locations of 5 measured atrial septal defect rims are labeled. *AAO*, Ascending aorta; *AI*, anteroinferior; *AS*, anterosuperior; *IVC*, inferior vena cava; *PI*, posteroinferior; *PS*, posterosuperior; *S*, superior; *SVC*, superior vena cava. Mathewson et al. J Am Soc Echocardiogr 2004.



3D view from right atrium

Select the right patient

- Evaluate all rims (and measure corresponding diameter
  - (Postero)*inferior and superior rims* need to be sufficient



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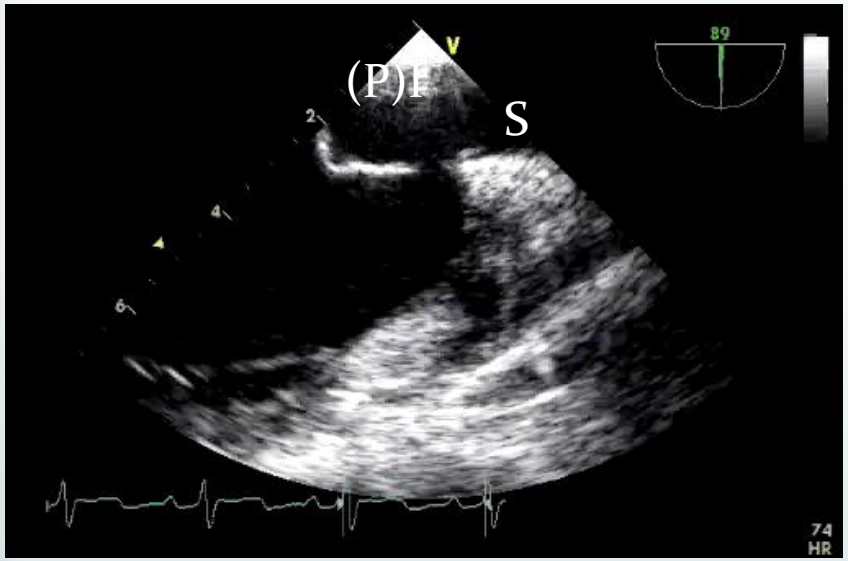
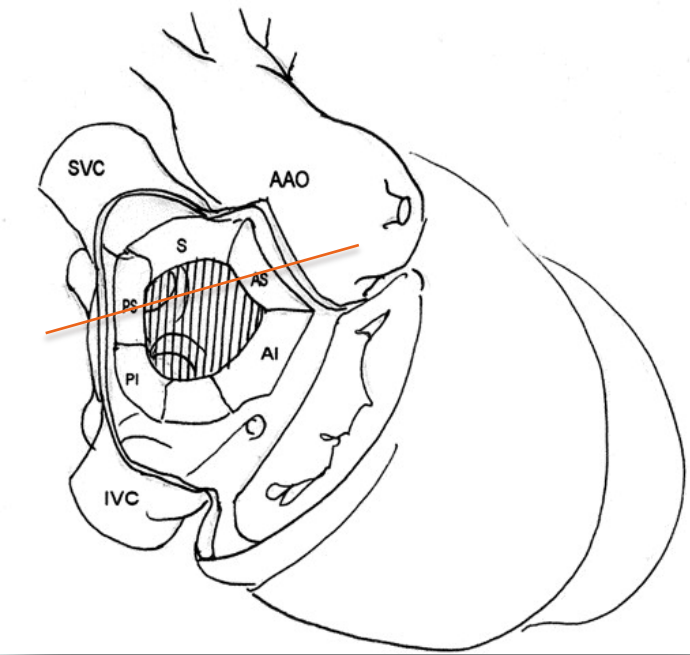


Bicaval view

Select the right patient

- Evaluate all rims (and measure corresponding diameters)
  - *Posteroinferior rim* needs to be sufficient



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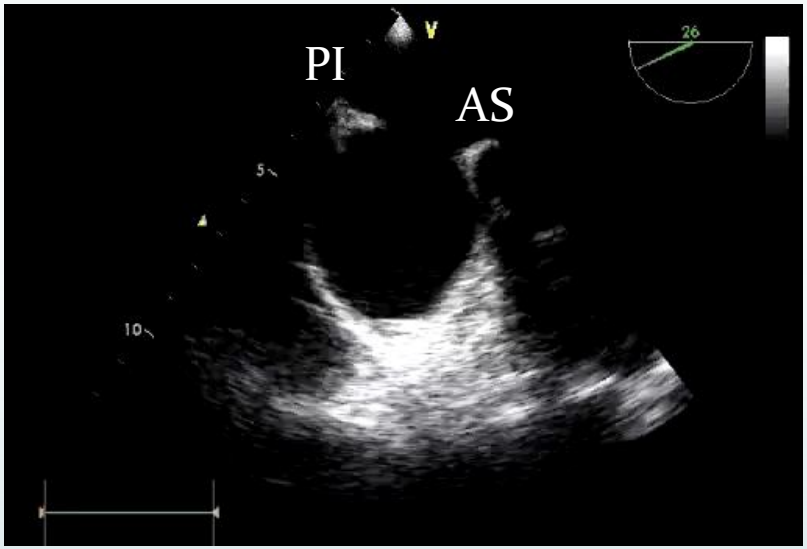
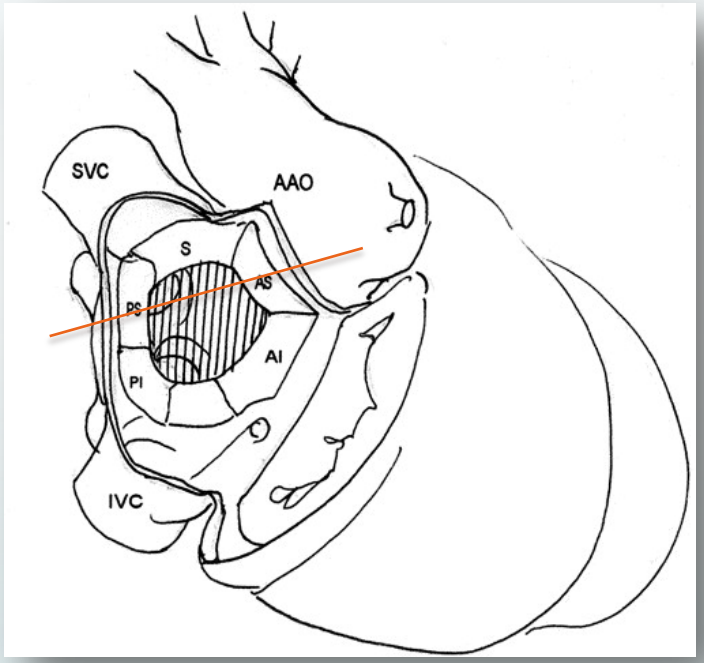


Anteroposterior view

Select the right patient

- Evaluate all rims (and measure corresponding diameter
  - *Anterosuperior rim* is the only rim which is not needed



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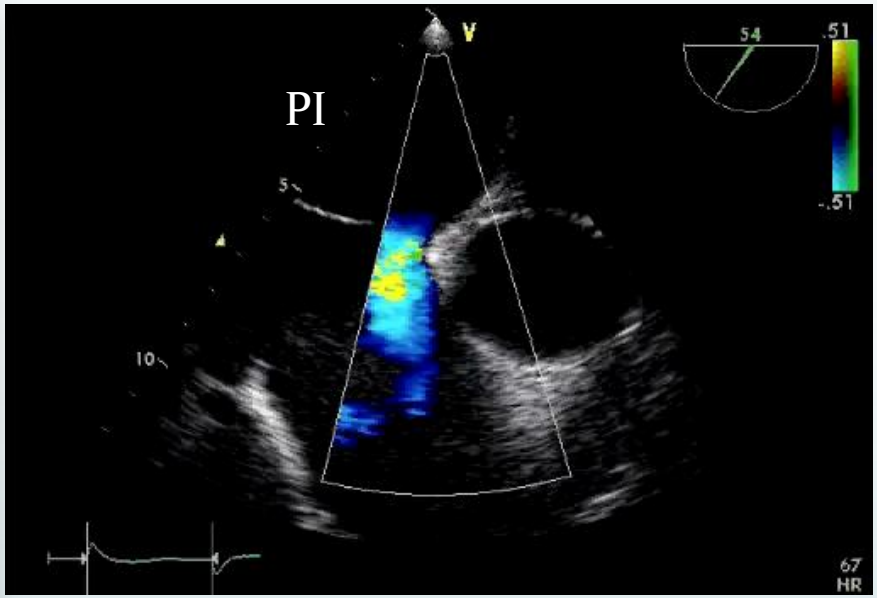
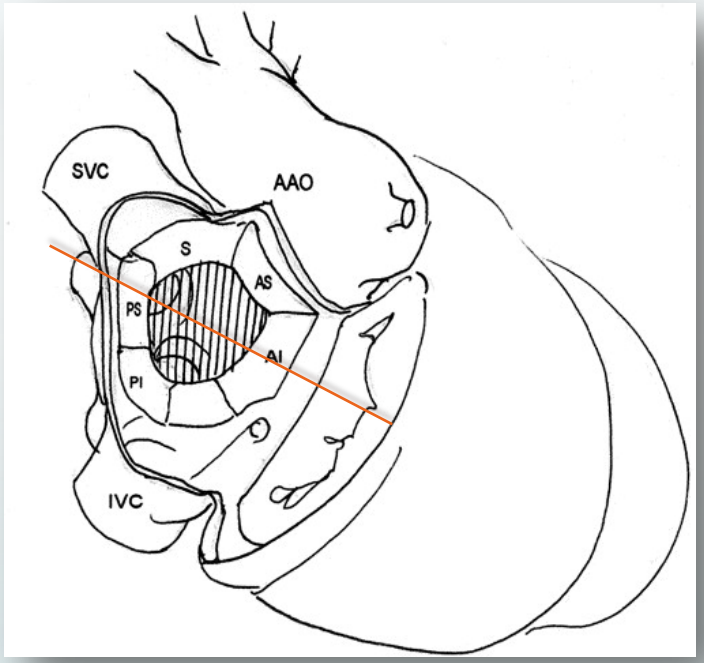


Anteroposterior view

ASD

Select the right patient

- Evaluate all rims (and measure corresponding diameters)
  - *Posterosuperior and anteroinferior rims* need to be sufficient



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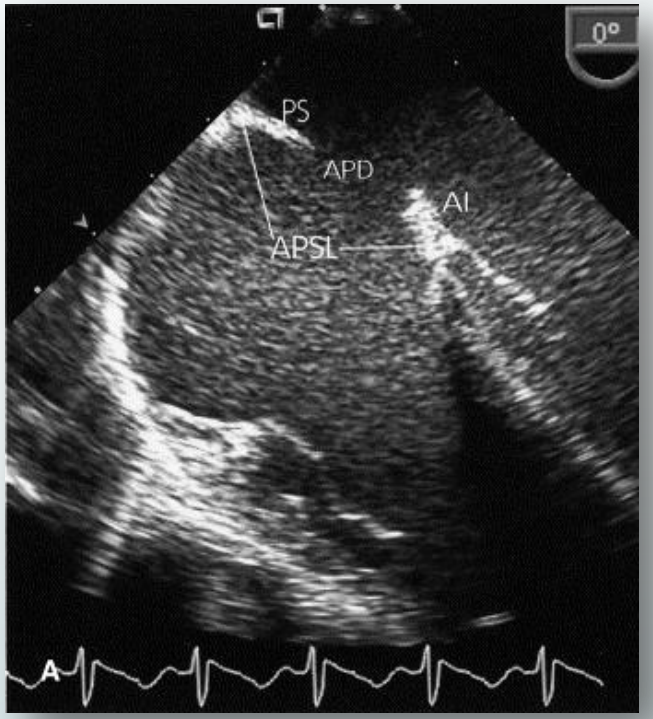
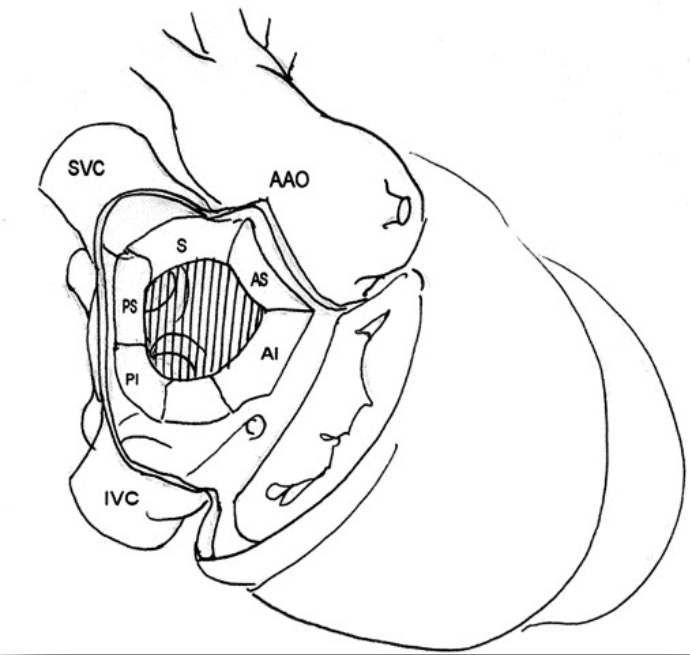


Four chamber view

Select the right patient

- Evaluate all rims (and measure corresponding diameters)
  - No sufficient rims = do not send for percutaneous close!!



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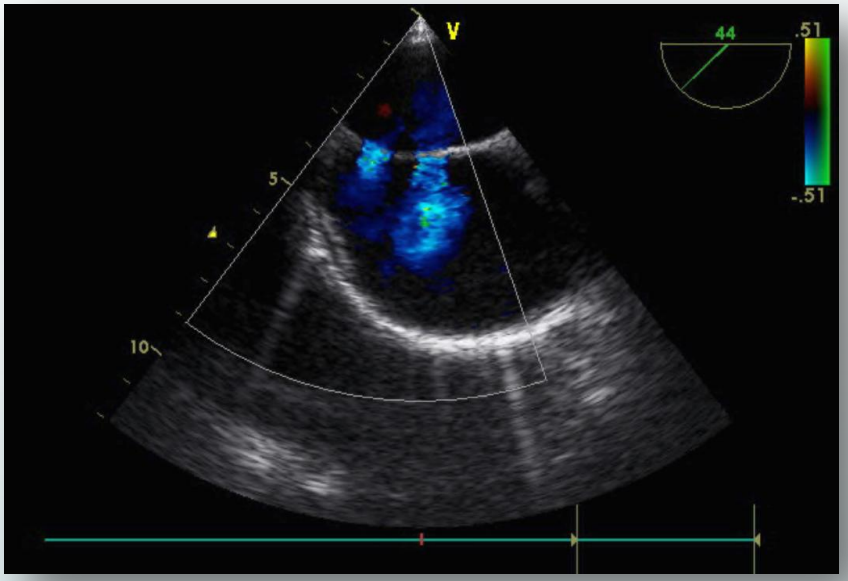
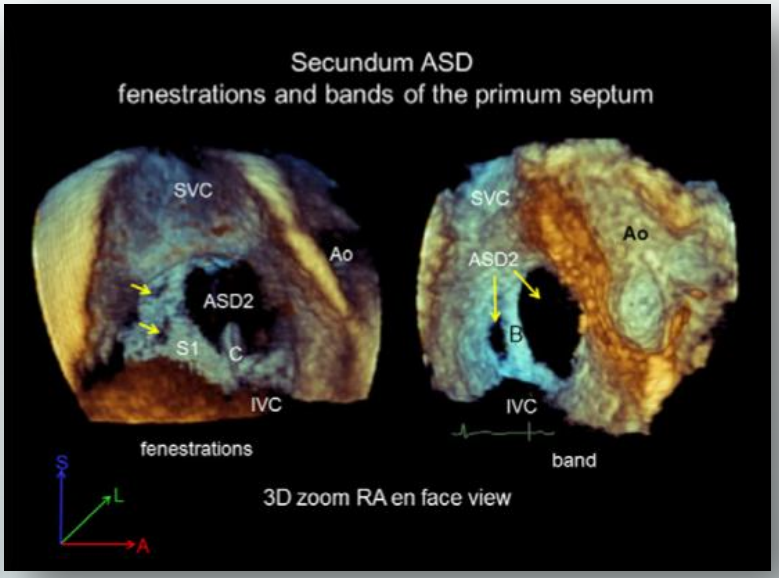
No septum

Select the right patient

- Count the number of defects and describe the location and sizes of all defects seperately
  - Largest defect: preferred location of single device



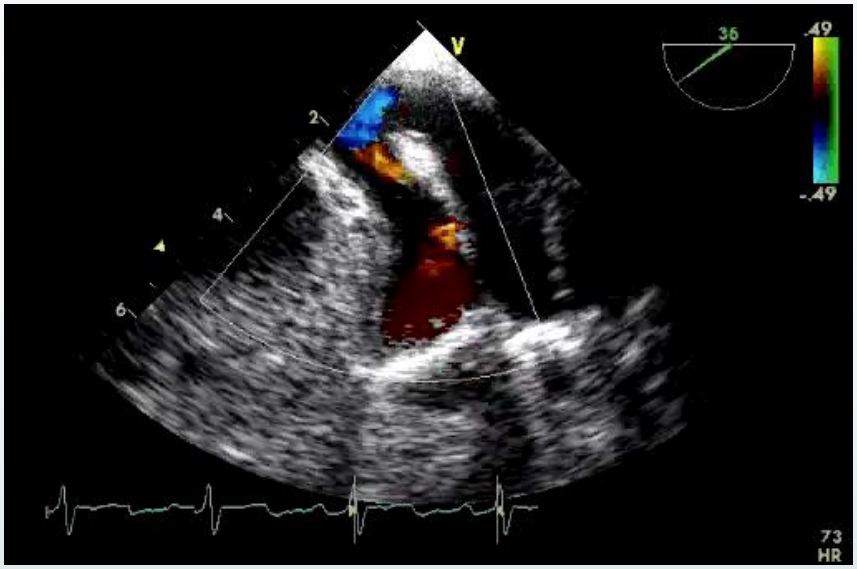
Bicaval view



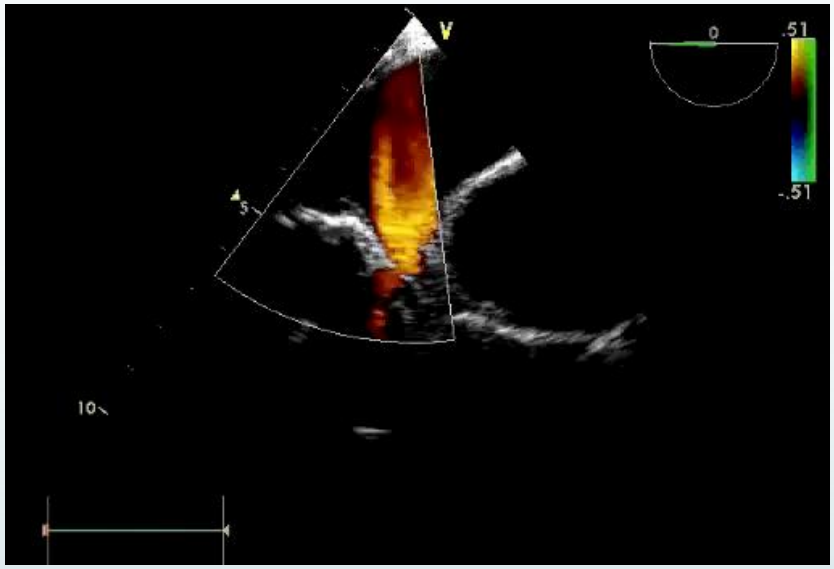
ASD2 with multiple orifices. (Left) Fenestrations (arrows) of the S1. A large ASD2 is also present. (Right) A band of S1 (B) divides the ASD2 orifice (see Video 9). In the orientation icon, blue designates the y plane, red designates the x plane, and green designates the z plane. Roberson et al. J Am Soc Echocardiogr 2011.

Select the right patient

- Do not forget to exclude abnormal pulmonary venous return; all four pulmonary veins can be visualised by TOE



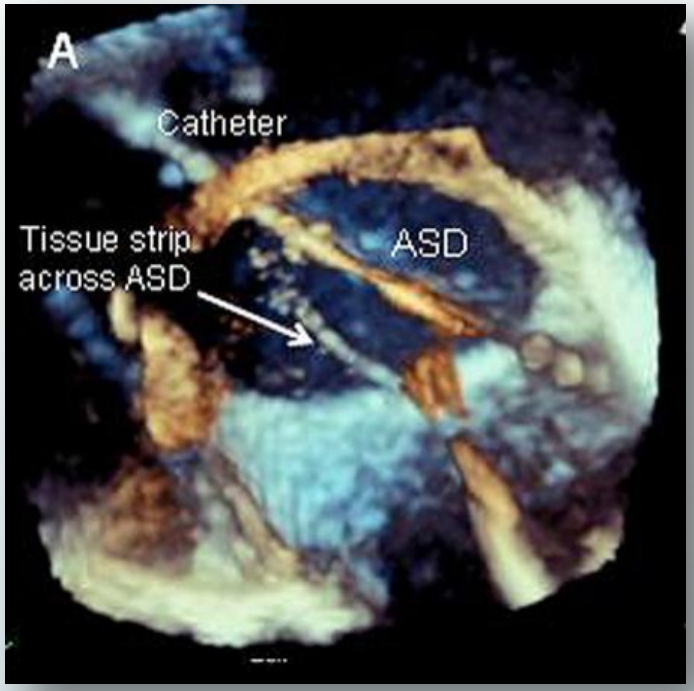
Left pulmonary veins



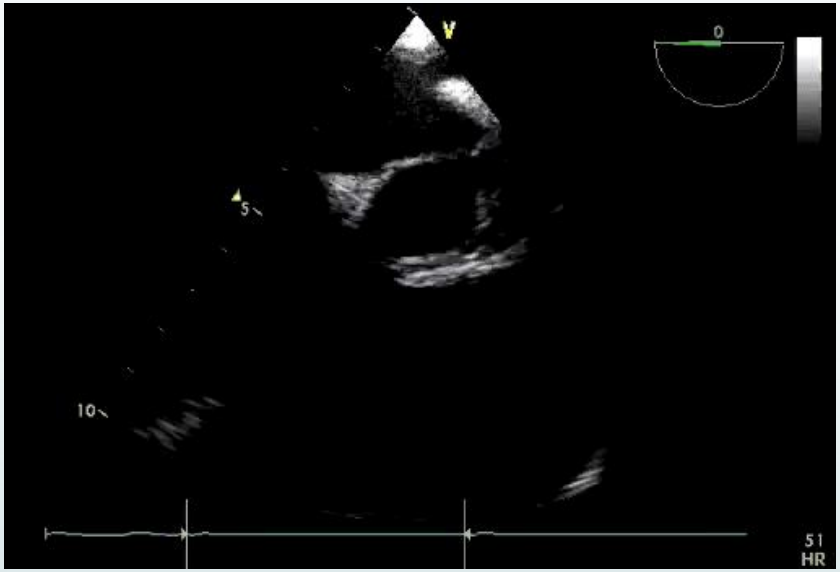
Right pulmonary veins

Guide the interventionalist

- *How to cross* the septum with the guide wire and *where to park* the wire (in the left upper pulmonary vein)
  - Largest defect: preferred location of the guide wire



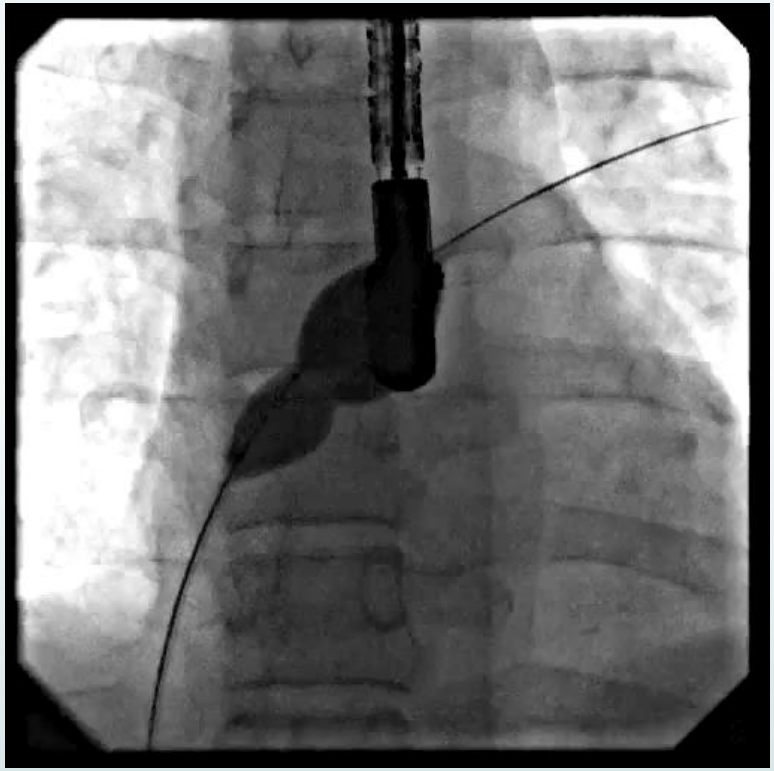
3D view from left atrium



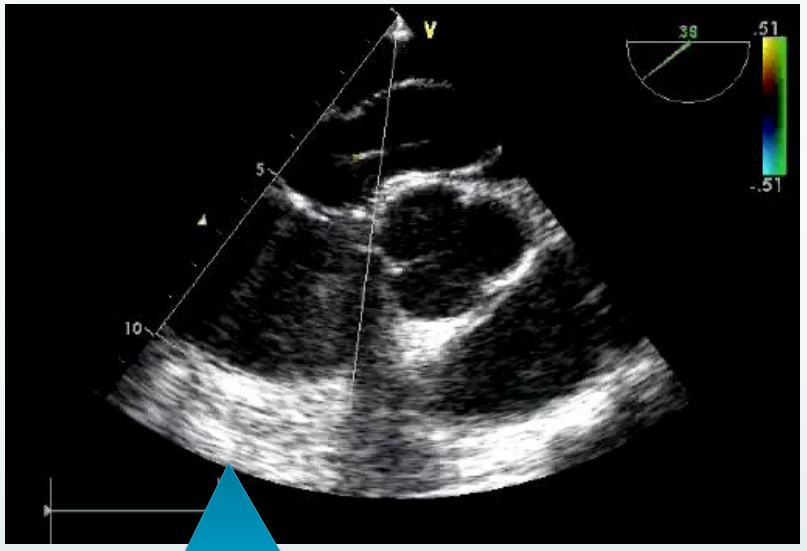
Guide wire in upper pulmonary vein

Help the interventionalist

- With balloon sizing of the defect to “stop flow”



Fluoroscopy

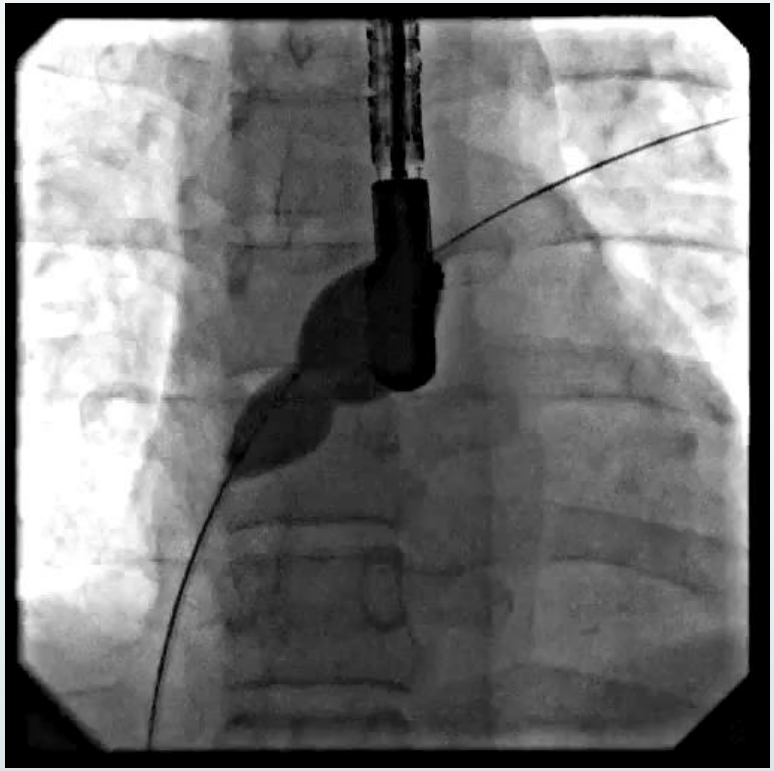


TOE

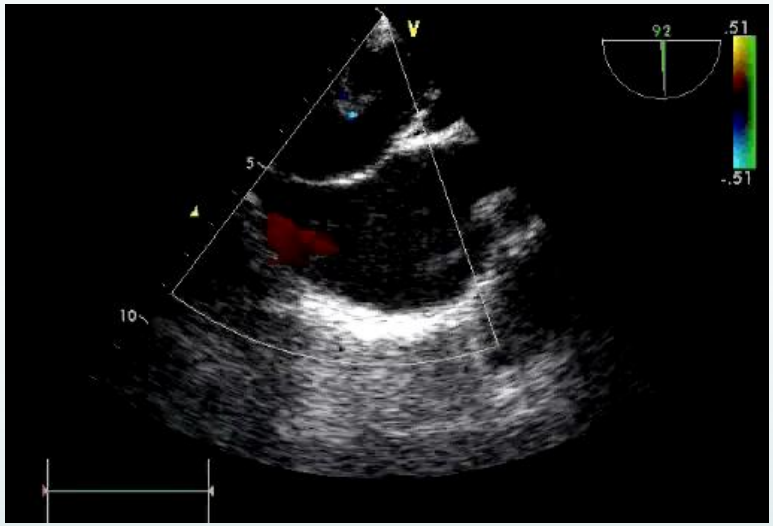
Waiste without color flow = stretched diameter

Help the interventionalist

- With balloon sizing of the defect to “stop flow”



Fluoroscopy

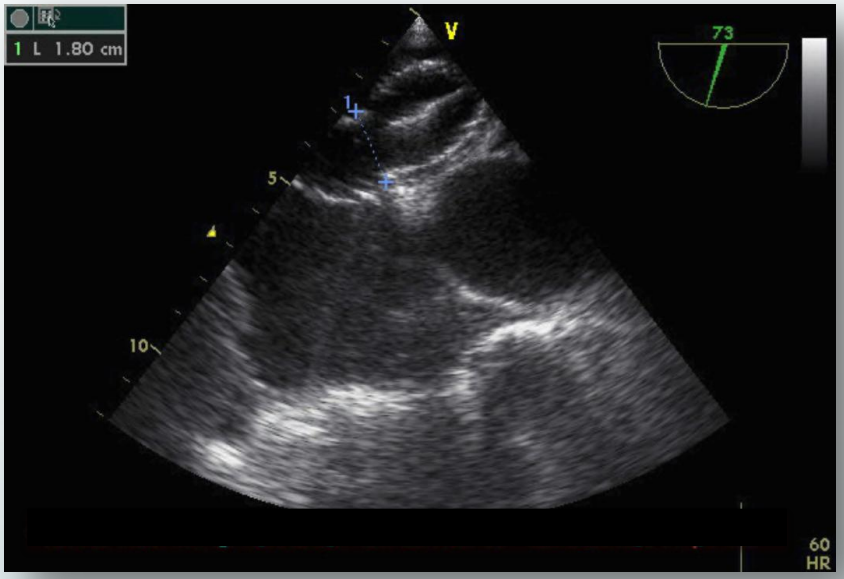


Color TOE
Persistent flow = second defect

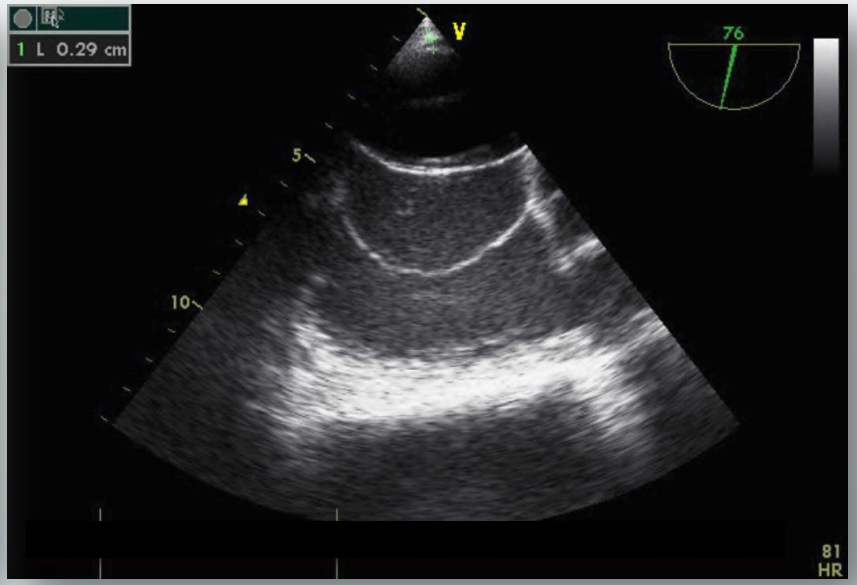
ASD

Help the interventionalist

- Evaluate the stability/quality of all rims



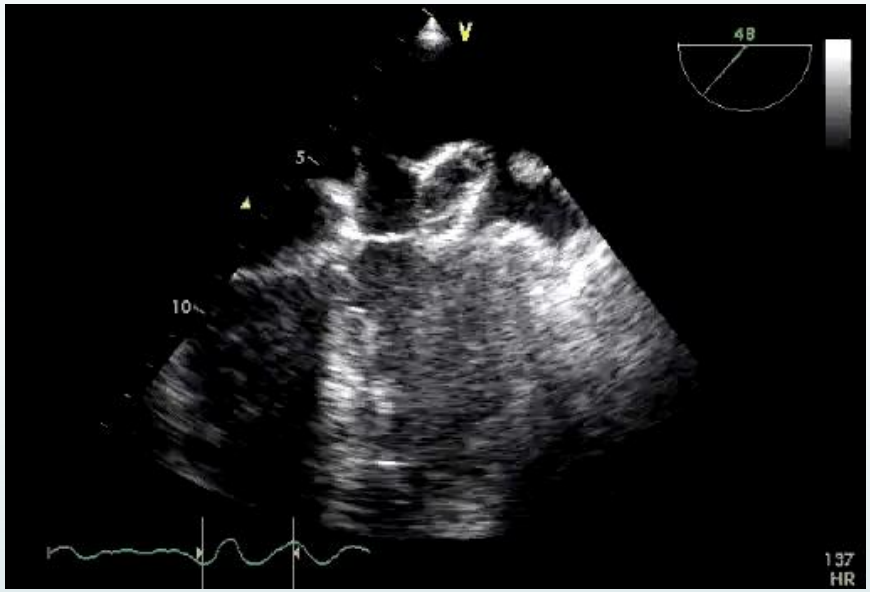
Stable rims (waiste)



No “strong” posterior rim = insufficient rim

Help the interventionalist

- Guide the deployment and positioning of the left sided disk

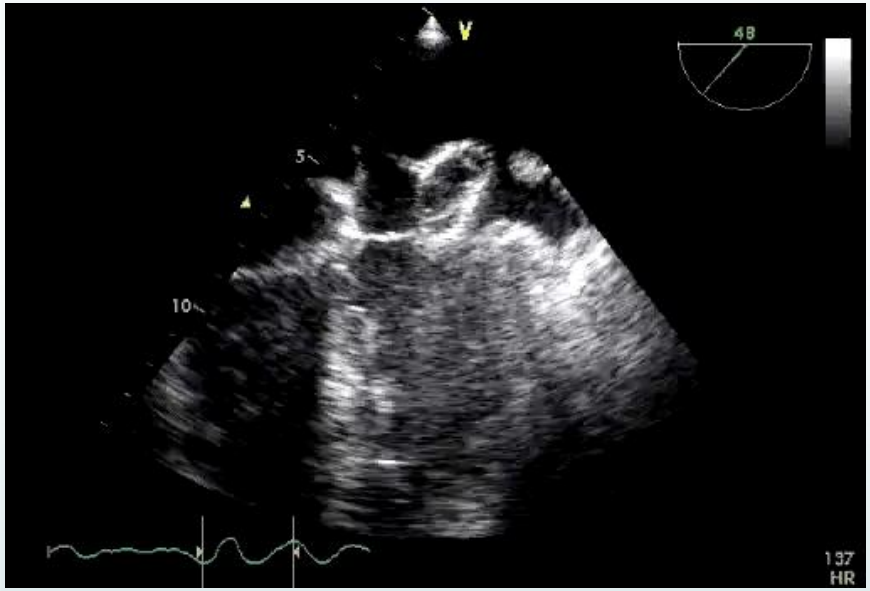


Warn for deployment in LAA and interference with mitral valve

Show relationship with the rims when the left sided disk is pulled against the septum

Help the interventionalist

- Guide the deployment and positioning of the left sided disk



Warn for deployment in LAA and interference with mitral valve

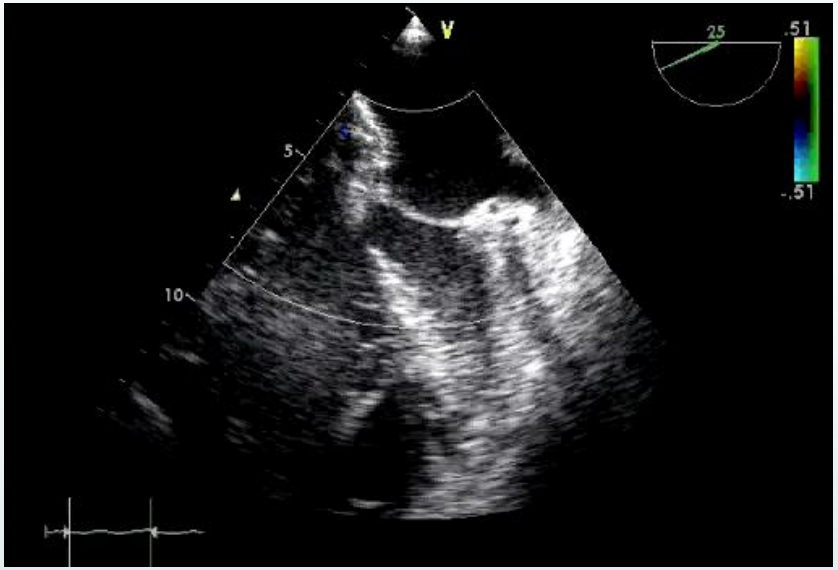
Show the axis of the left disk = Parallel with the axis of the septum

ASD

Help the interventionalist

- After deployment of the disks, confirm device stability

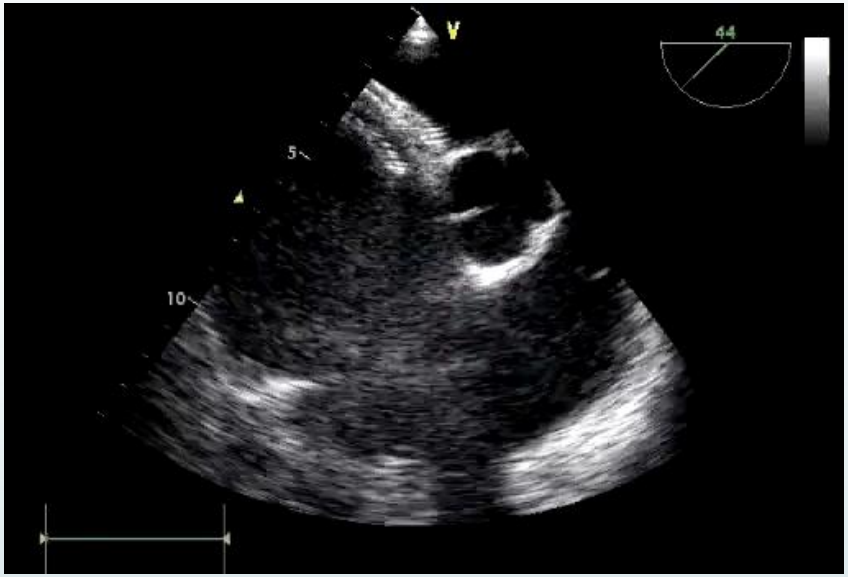
Posterior rim
Device may not touch the roof



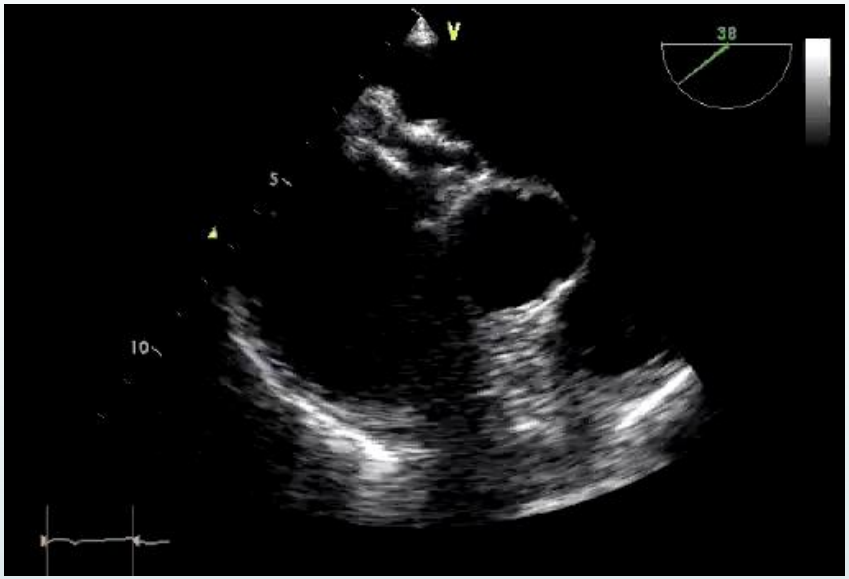
Anteroinferior rim
Device may not interfere with the mitral valve function

Help the interventionalist

- After deployment of the right sided disk, confirm device stability



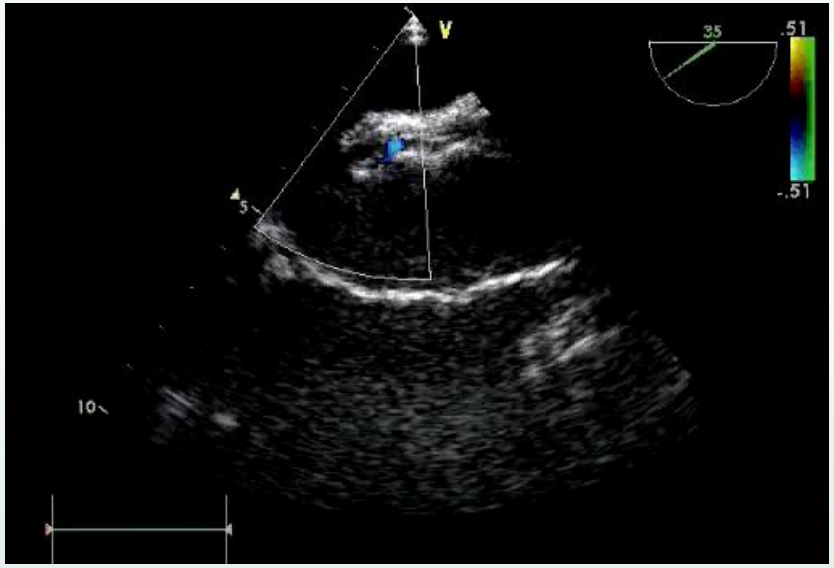
Anterosuperior rim



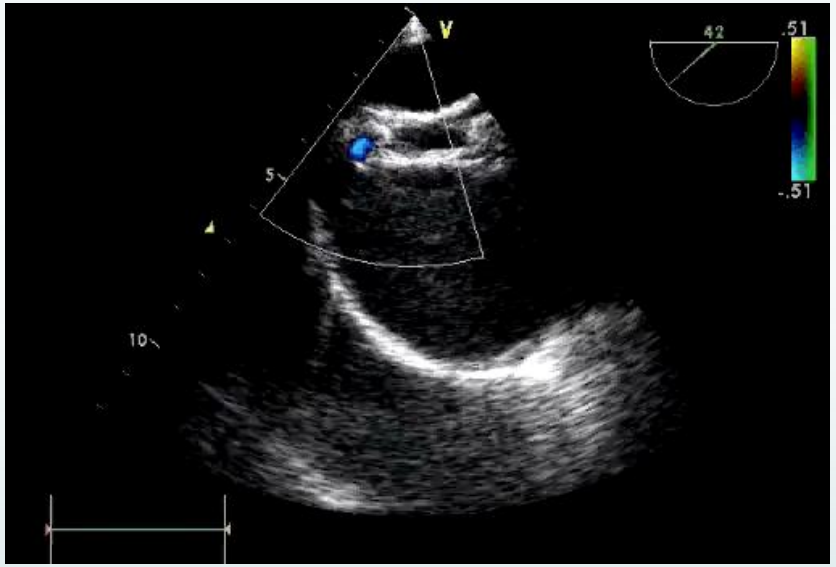
Insufficient anterosuperior rim

Ease the interventionalist

- Check for residual shunting



Through the device

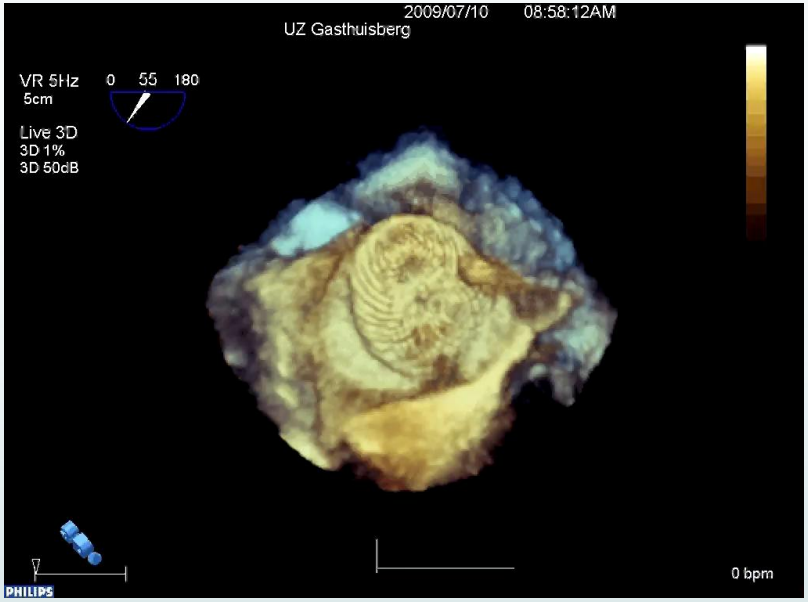


Through a second defect
Because of undersizing

Ease the interventionalist

- Show the final implant result

2D TOE

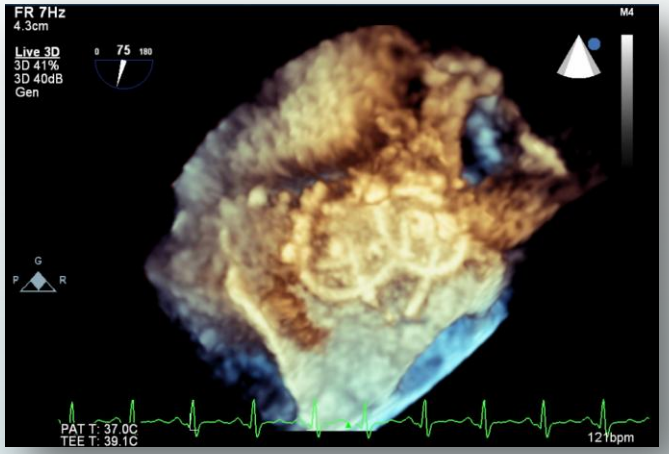


3D TOE

Follow-up

- Evaluate
  - Device position
  - Device structure
- Exclude
  - Residual shunting
  - Pericardial effusion
  - Thrombi on the device
  - Endocarditis on the device
  - Interference with valve function

Solysafe



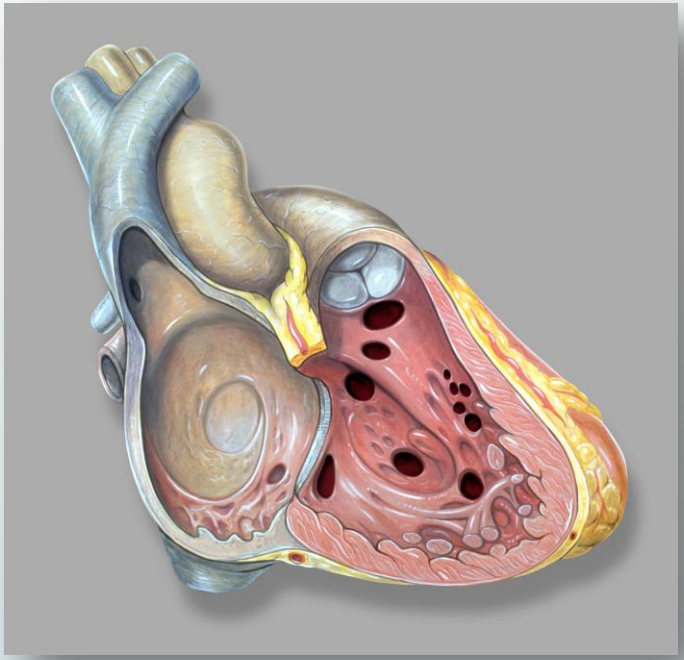
Wire fracture

Same story

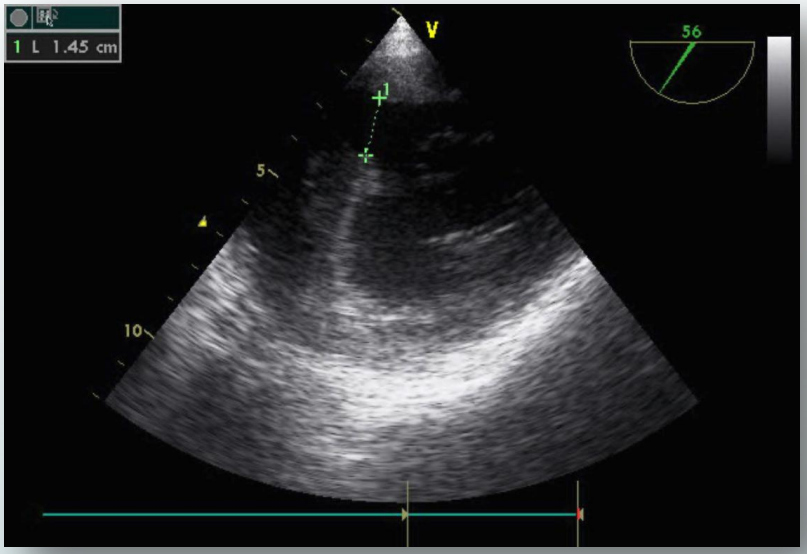
VSD

Select the right patient

- Muscular (congenital / post-infarction) and peri-membranous VSDs are feasible for percutaneous closure
  - Exclude *large inlet* and *doubly committed VSDs*



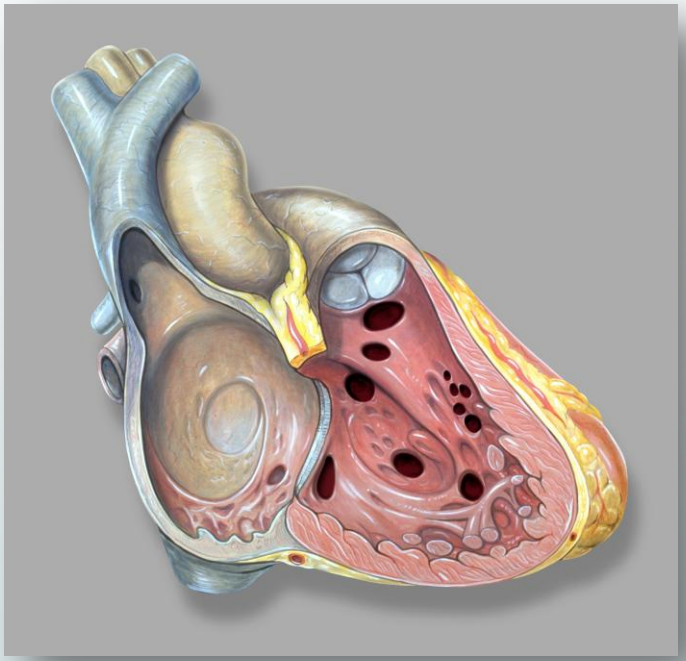
Different types of VSD



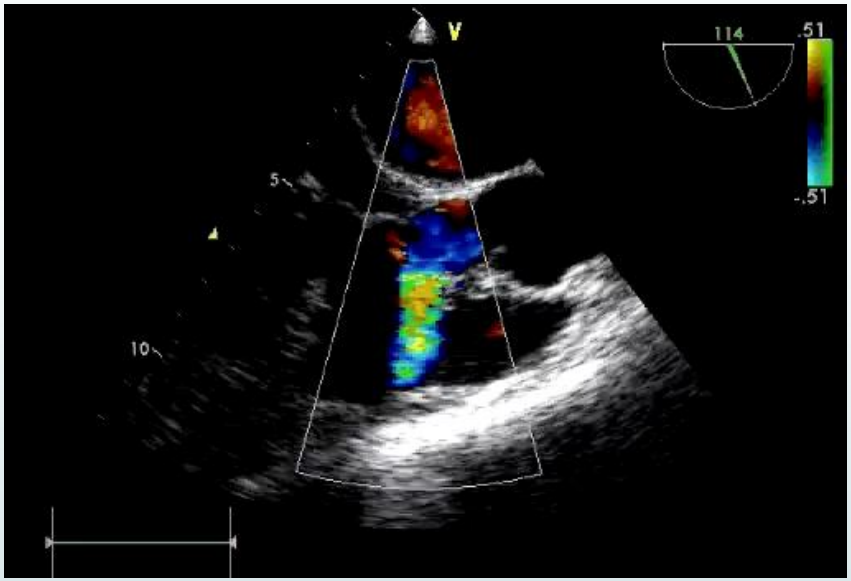
Muscular VSD up to 24 mm

Select the right patient

- Muscular (congenital / post-infarction) and peri-membranous VSDs are feasible for percutaneous closure
  - Exclude *large inlet* and *doubly committed VSDs*



Different types of VSD

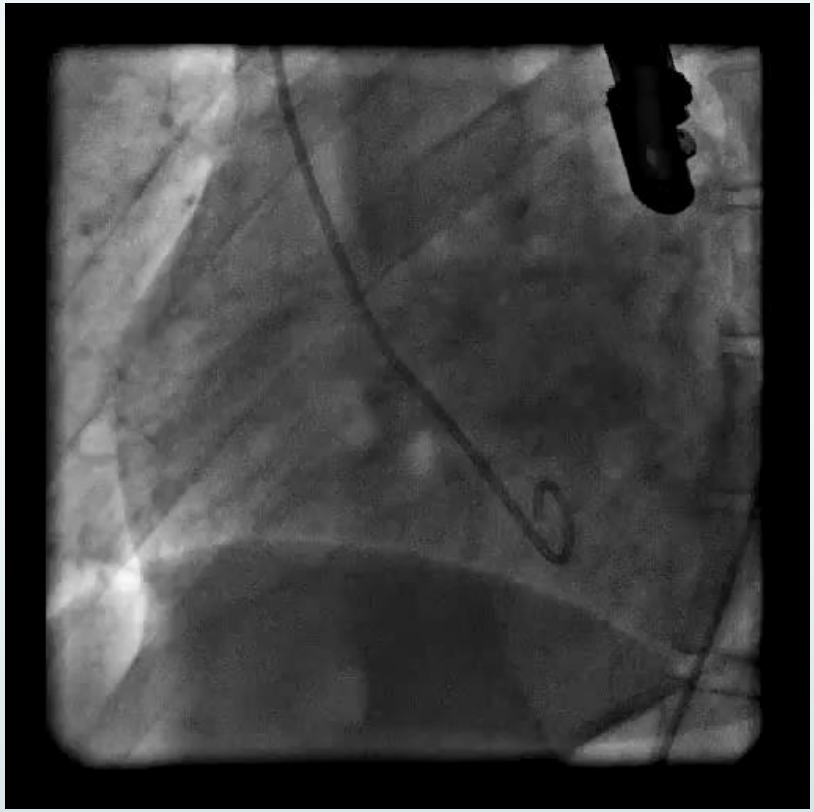


Membranous VSD up to 18 mm

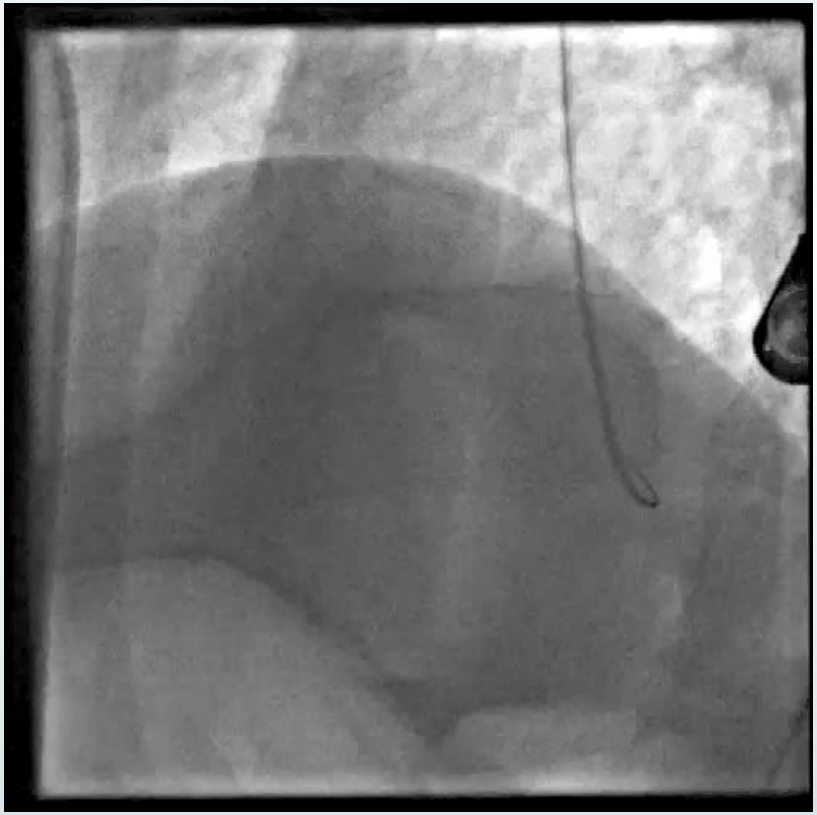
VSD

Guide the interventionalist

- How to cross the septum with the catheter and the wire



Angiography left ventricle



Fluoroscopy

Guide the interventionalist

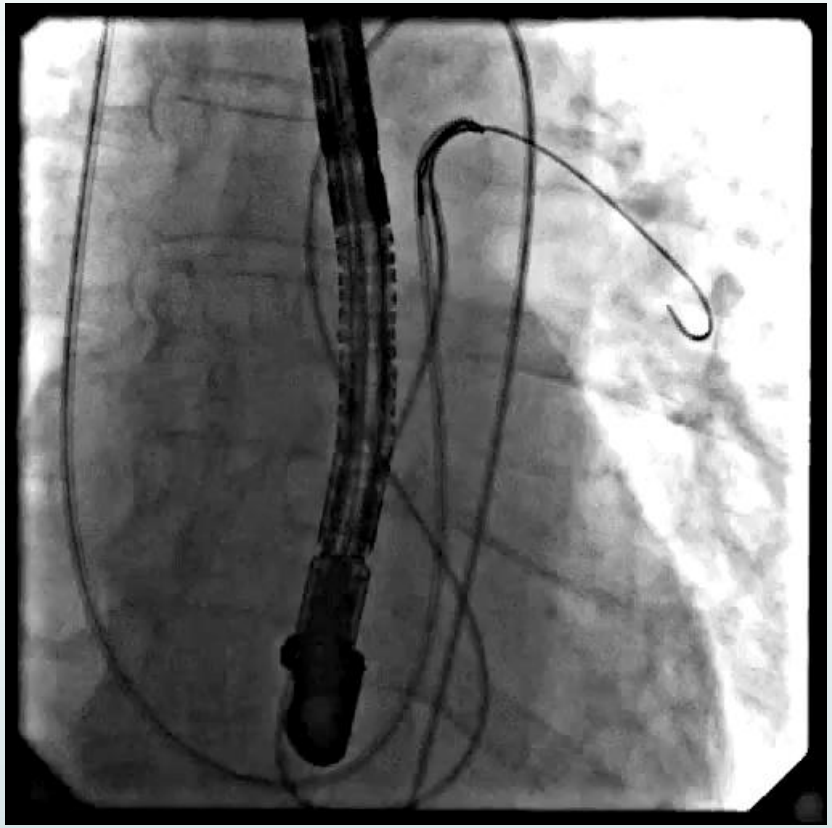
- How to cross the septum with the catheter and the wire

Catheter through the aortic valve

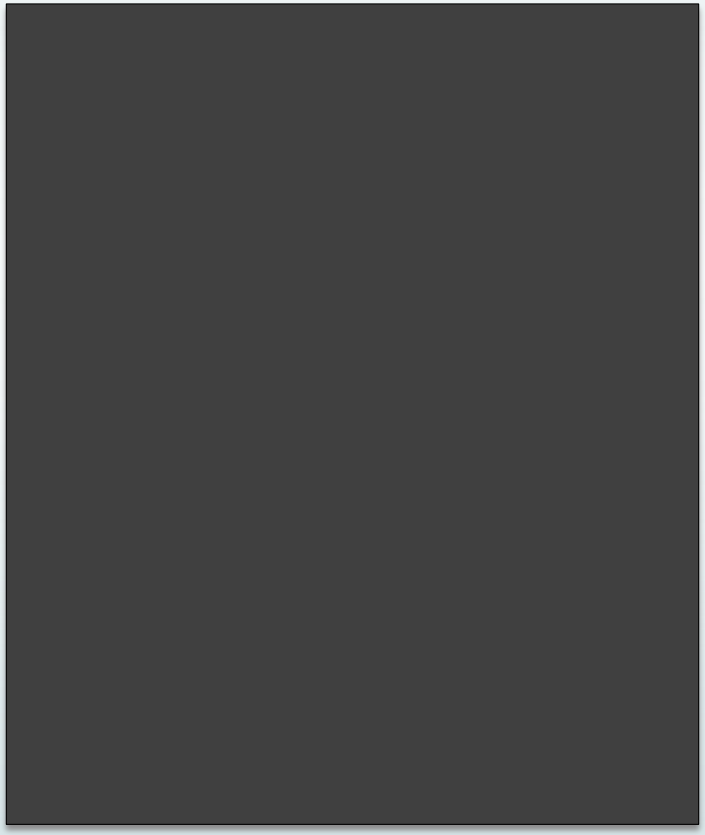
Catheter through the PM VSD into the pulmonary artery

The interventionalist alone

- To complete the veno-arterial rail (femoral/jugular-femoral)



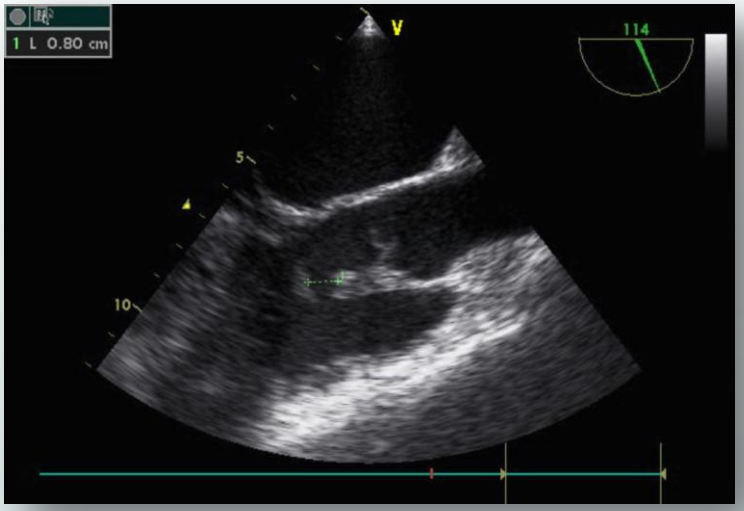
Fluoroscopy



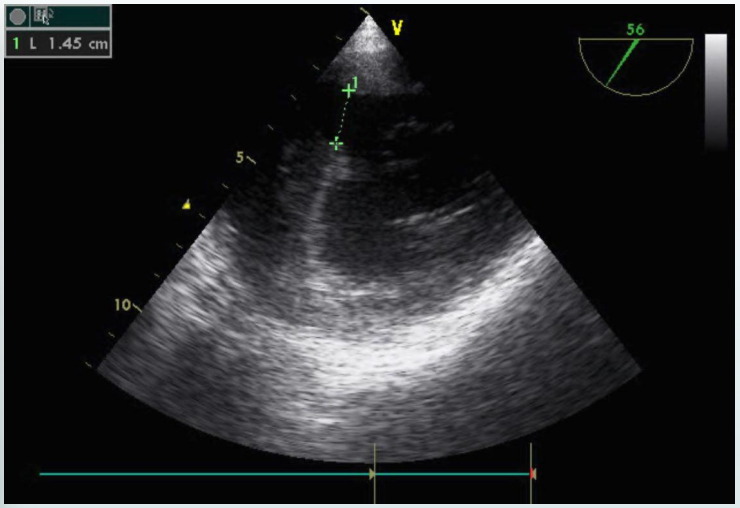
No image: outside the echo field

Guide the interventionalist

- Measure the diameter of the defect and help to choose the size of the device
  - Before or after wire positioning
  - With or without balloon sizing



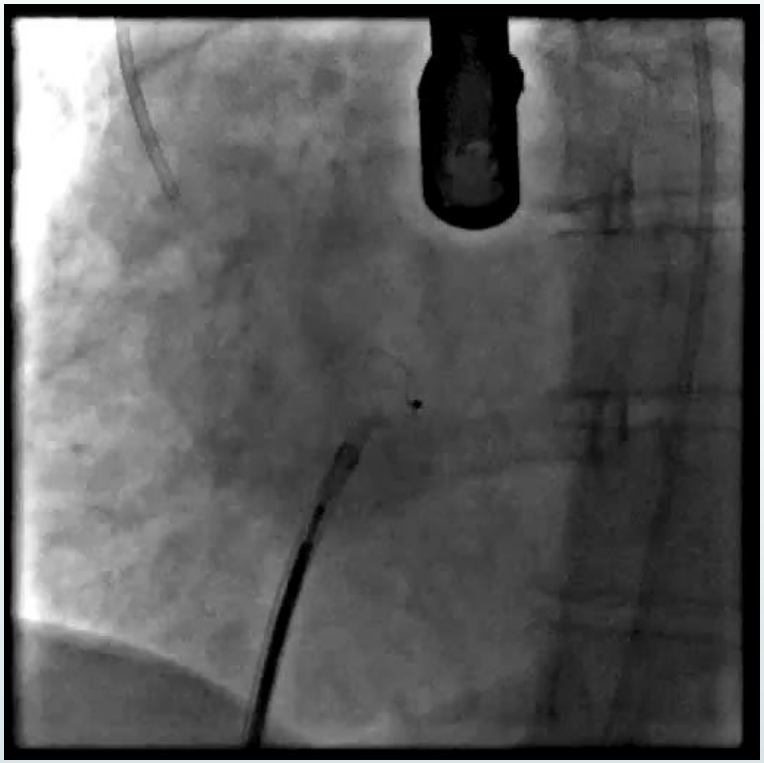
Perimembranous VSD



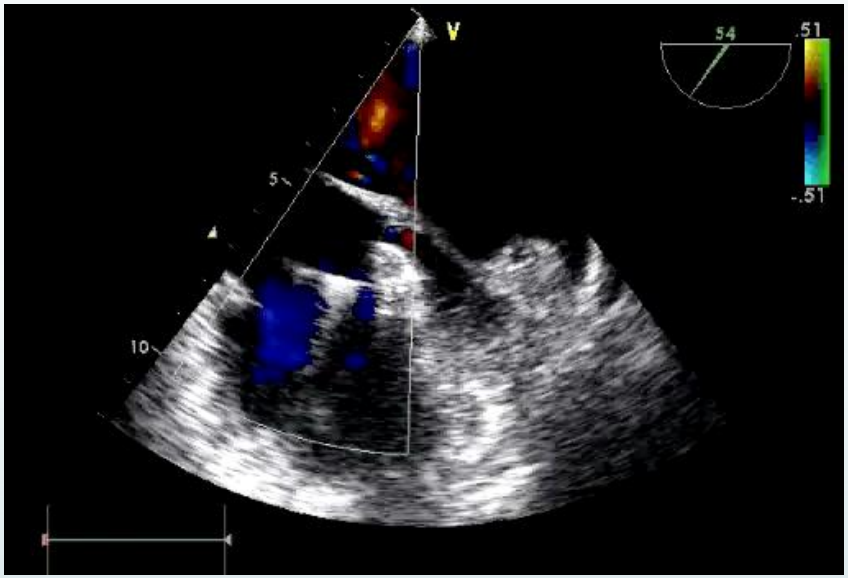
Muscular VSD

Help the interventionalist

- Guide the deployment of the left and right sided disk of the device; reassure device position



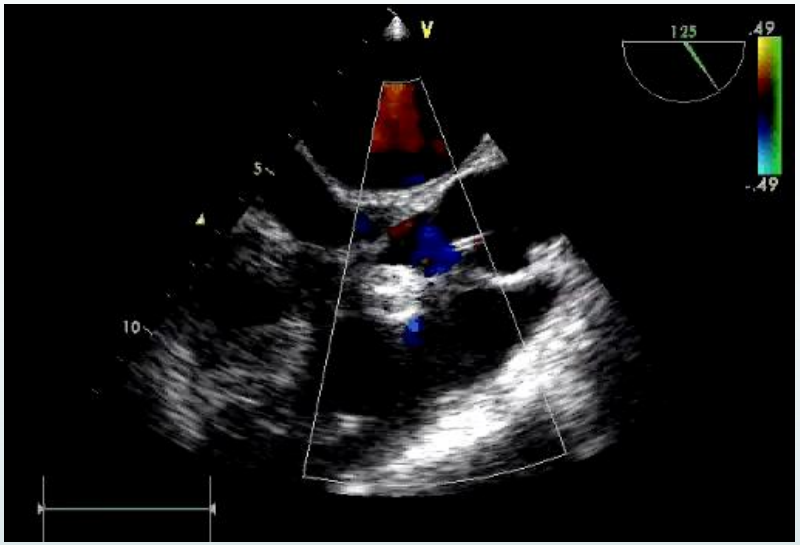
Fluoroscopy



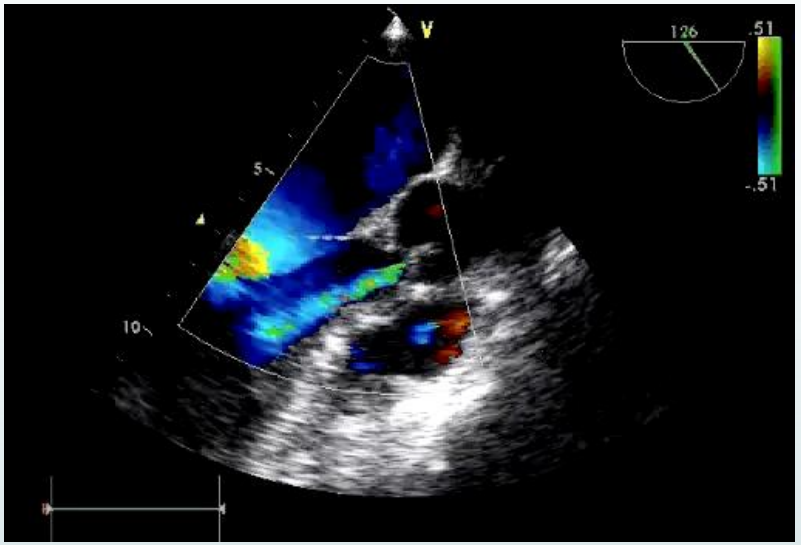
TOE: device still attached

Ease the interventionalist

- Confirm correct device size and exclude interference with surrounding valves (aortic valve, tricuspid valve); give green light to release the device



Too small

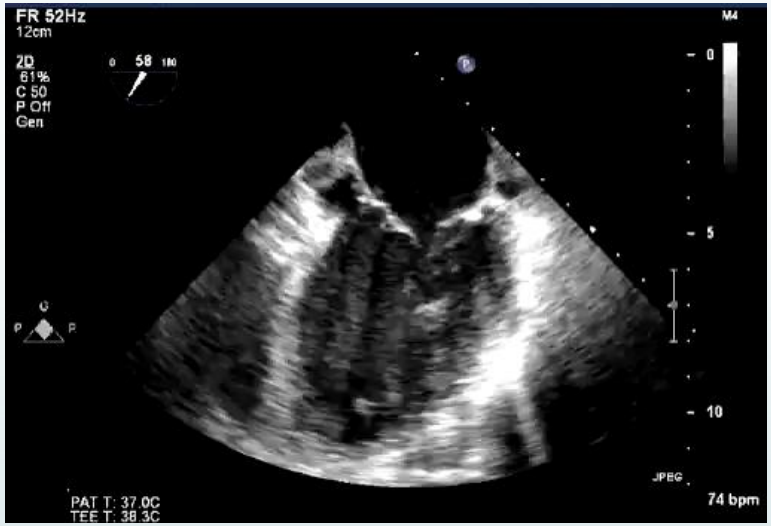


Aortic valve regurgitation

Ease the interventionalist

- Show nice images…

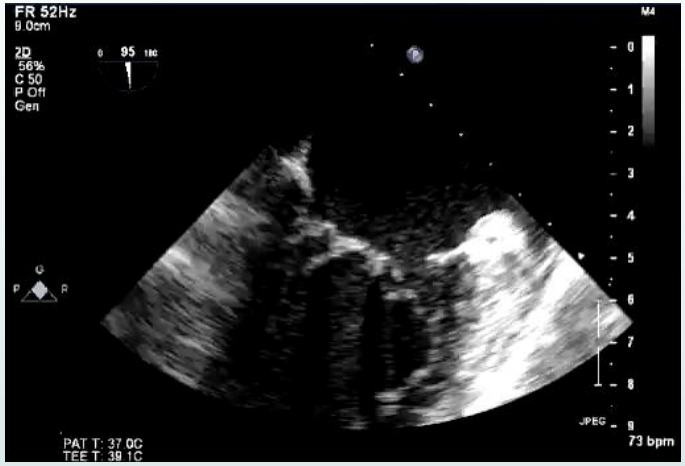
TOE device in PM position



TOE device in muscular position

Follow-up

- Evaluate
  - Device position
  - Device structure
- Exclude
  - Residual shunting
  - Pericardial effusion
  - Thrombi on the device
  - Endocarditis on the device
  - Interference with valve function



Thrombus on device

Conclusions

- The help of a sonographer during a percutaneous septal closure procedure is extremely useful
  - To increase feasibility
  - To increase efficiency and efficacy
  - To lower complication rates

- The sonographer must have knowledge of the procedure and must think in the same way as the interventionalist

- Teamwork = the idea