ASD closure at an older age

A Case Study

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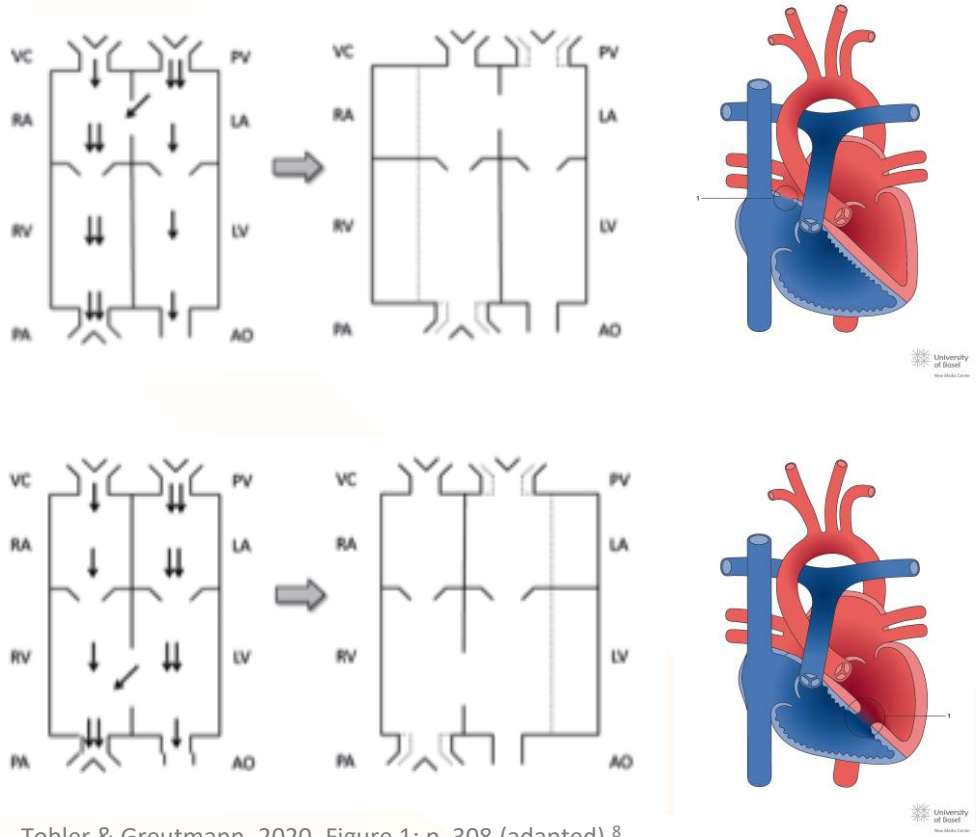
Patient details

- 77-year-old female
- Congenital heart disease:
  - VSD (surgical repair at age 12)
  - Unrepaired ostium secundum ASD (12 x 17 mm)
- Valve disease:
  - Severe pulmonary regurgitation, and mild pulmonary stenosis
  - Moderate tricuspid regurgitation
- pAF (one documented episode 2015)
- HTN (2013)
- Normal BMI (19.4)
  - 150.5cm, 44kg
- Active: competes in masters level sport, works as a coach
- Medications:
  - Candesartan 8mg

Combined ostium secundum ASD + VSD

- Combination uncommon with a prevalence ~0.3/1000.[1]
- Occasionally present with coexistent pulmonary stenosis, and other non-cardiac malformations.[1-3]
- Often sporadic but genetic and maternal environmental risk factors documented.[4-5]
- VSD's → dilation of L heart.[6-8]
- ASD's → dilation of R heart.[6-8]



Tobler & Greutmann, 2020, Figure 1; p. 308 (adapted).[8]

Illustration taken from http://www.chd-diagrams.com.

Past interventions

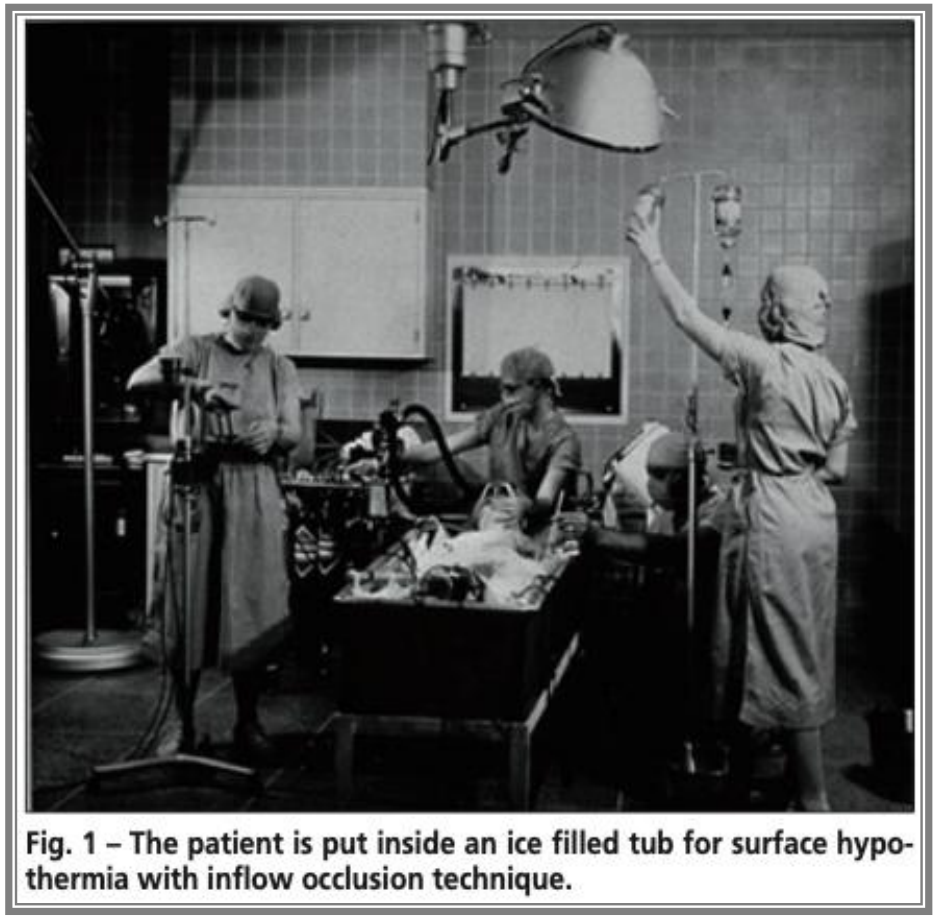


Fig. 1 – The patient is put inside an ice filled tub for surface hypothermia with inflow occlusion technique.

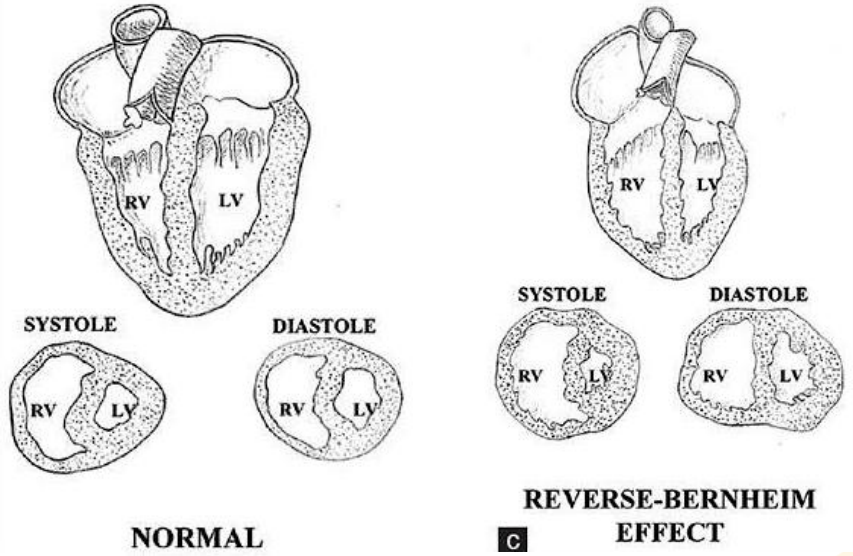
Hosain & Anisuzzaman, 2023.[9]

At age 12:

- Surgical VSD repair + some valve intervention (?pulmonary) in The Netherlands
  - Prior to cardiopulmonary bypass machines:
    - Induced hypothermia until heart arrests + inflow occlusion.[9]
    - Surgery performed in 6-10mins → body rewarmed.[9]
- ASD presumably known about at time of surgery, but not repaired due to time constraints

Combined physiology

- Severe pulmonary regurgitation → RV volume overload with diastolic septal movement towards LV → impair LV filling → increase shunt.[10]
- HTN and ↑age increases L → R shunt.[10]
- Moderate tricuspid regurgitation + mild pulmonary stenosis theoretically decrease shunt.[10]
  - But mild PS + large shunt resembles an uncomplicated ASD.[11]
- Long-standing atrial dilatation + TR → pAF



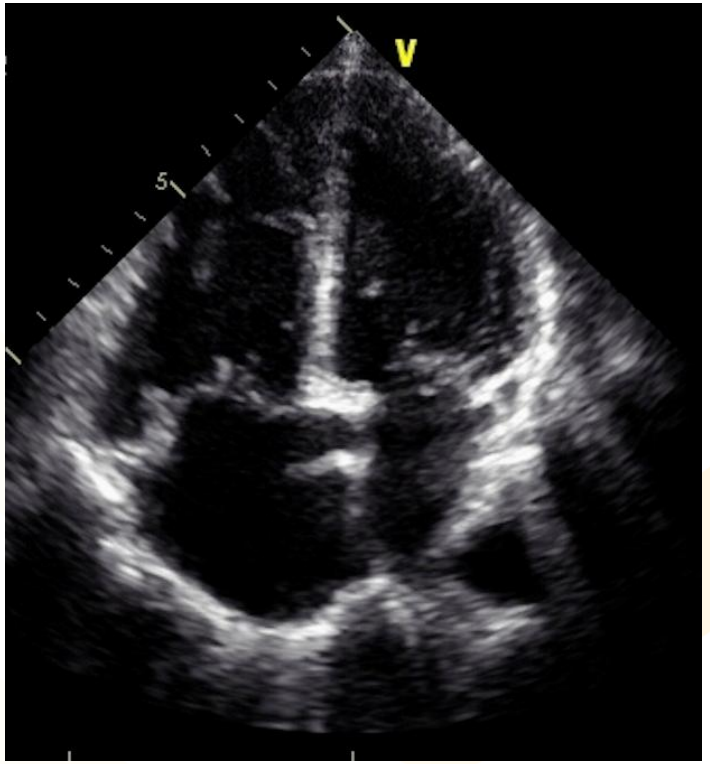
Magoon, Dey & Kashav, 2020, Figure 1; p.90 (adapted).[12]

Management

- Stable and minimally symptomatic with conservative management
- Regular FU every 1-2 years with TTE

2021:

- Normal LV size, D-shaped septal flattening in diastole, preserved systolic function
- Dilated RA and RV with normal systolic function
- Mildly elevated RV systolic pressure (44 mmHg) and pulmonary artery pressure (33mHg)
- Stable severe PR, mild PS, moderate TR



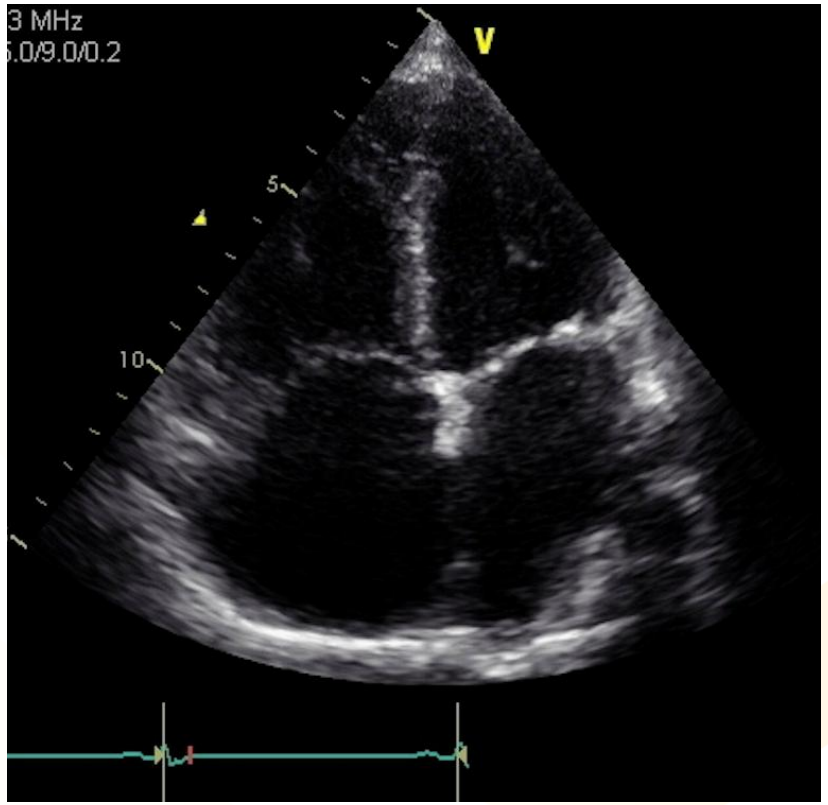
Presentation: May 2023

- Reports progressive increase in SOBOE past 6-12 months, neck/L-arm tightness OE and palpitations ~1x/month lasting hours
  - Stopped work and participation in sport due to SOB
  - Can perform ADLs but becoming increasingly limited
  - Betaloc 23.75mg briefly trialed (stopped due to fatigue, fluid retention and bowel symptoms)

- BP: 164/84 mmHg, HR: 84 bpm, SpO_2: 97%
- 4/6 systolic murmur

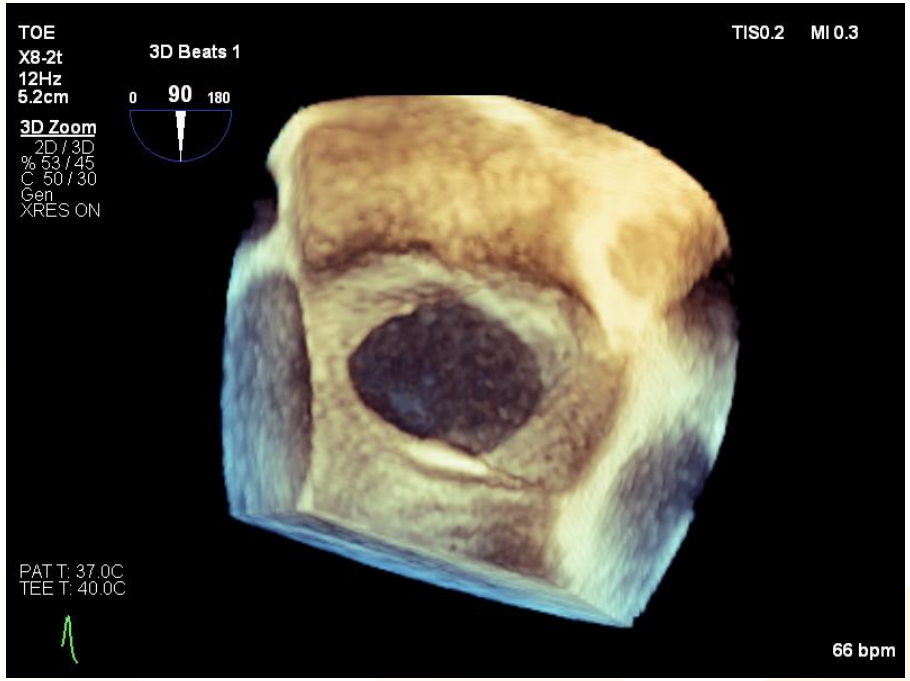
Work-up: TTE June 2023

- Marked RV dilation with mild systolic dysfunction
- Increased RV systolic pressure (44 → 59.5 mmHg)
- Stable severe PR and mild PS. Dilated main PA and branch PA's.
- Stable moderate TR
- Developed mild MR
- IVC now dilated, with respiratory collapse



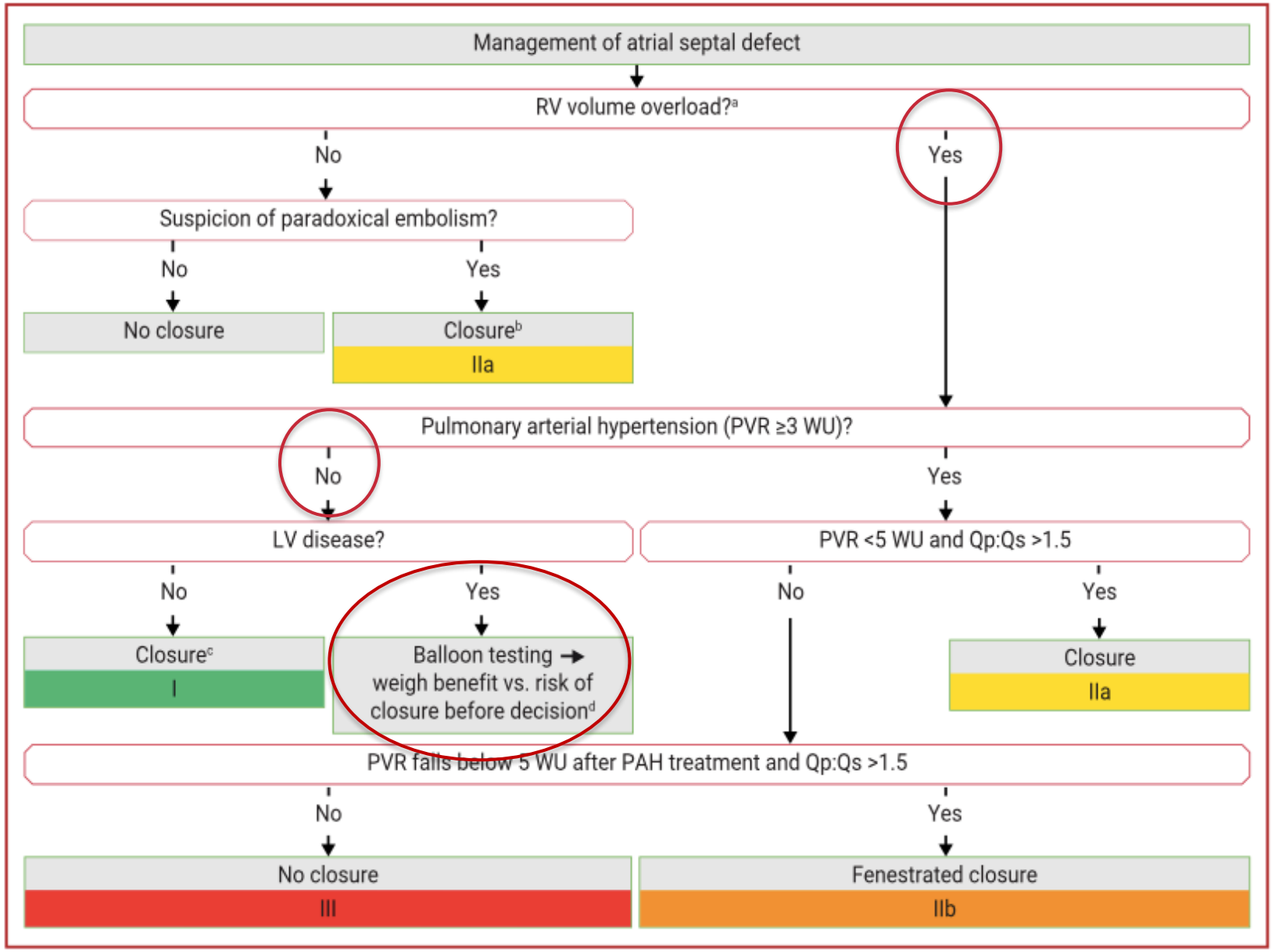
Work-up: TOE September 2023

- Large secundum ASD 19 x 23 mm (enlarged since 2005)
  - Appropriate large tissue rims, well away from pulmonary veins.[13]
  - No evidence of anomalous pulmonary venous drainage or sinus venosus ASD.[13]
- Severely dilated atrial and LAA with low emptying velocity
  - CVA risk w/ AF
- Dilated RV w/ impaired systolic function
- Dilated tricuspid annulus, structurally normal valve with moderate central TR
- Thickened pulmonary valve leaflets with retracted tips. Mild PS, severe PR. Dilated main and branch PA's



Work-up: Right Heart Study October 2023

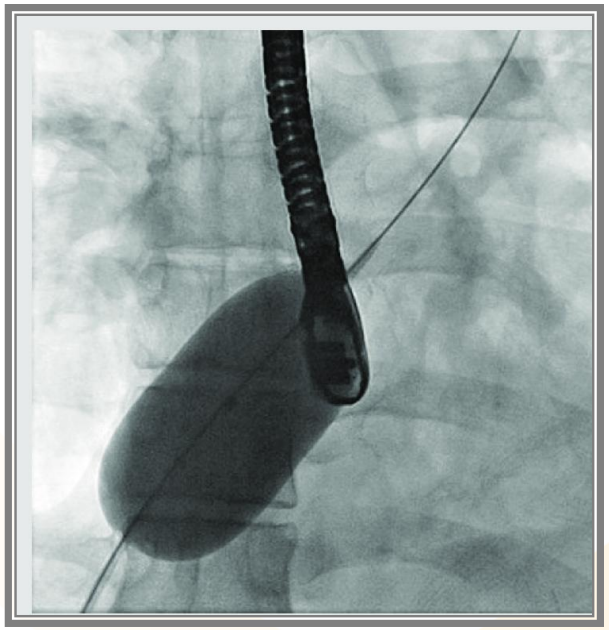
- To assess degree of pulmonary HTN and pulmonary vascular resistance:
  - Elevated left and right filling pressures (PCWP mean 15mmHg, RA mean 14 mmHg)
  - Mean PA pressure = 24 mmHg (>20 mmHg = elevated).[14]
  - PVR ~ 2 wood units (<3 = normal).[14,15]
  - With exercise (HR up to 100bpm):
    - Significantly increased mean PA pressure (24 → 41mmHg) and mean PCWP (15 → 25 mmHg)
    - Increase in transpulmonary gradient (12 → 16 mmHg) and diastolic gradient (6 → 7mmHg)
      - Disproportionate pulmonary hypertension with mild pulmonary vascular remodeling.[16-17]
  - Increased shunt since 2013: Qp/Qs: 2.7 (>1.5 haemodynamically significant)[13]



Baumgartner et al, Figure 2; p. 593.[13]

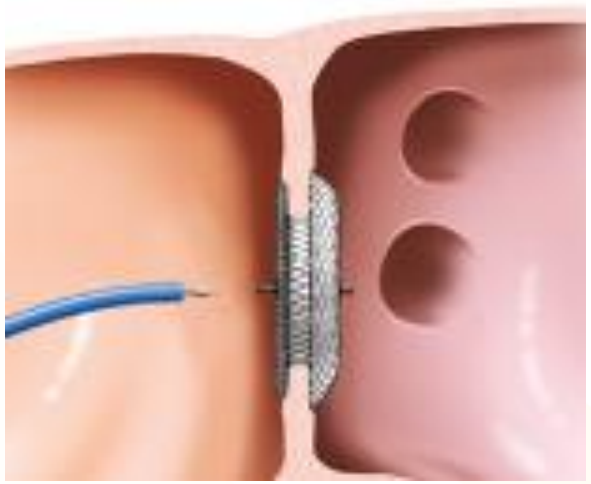
Balloon test / ASD closure: Feb 2024

- Performed under GA with TOE guidance
- 7Fr sheaths into R and L femoral vein, proglide partially deployed in left femoral vein
- Swan Ganz catheter into R femoral vein → PA and PCWP measured:
  - PA: 30/16 (mean 21mmHg)
  - PCWP: 14/10 (mean 12 mmHg) / remeasured: 22/15 (mean 18 mmHg)
- ASD crossed with multipurpose catheter via left femoral vein
- Exchanged for Amplatzer sizing balloon advanced over Amplatzer wire
- Sizing balloon inflated for 12mins. Direct LA pressure measured + compared to PCWP prior to inflation:
  - Mean pressure increased 2-8mmHg → 20 mmHg
    - >10mmHg change → high risk of pulmonary edema post-closure, >3-5mmHg elevated risk?[18-21]
    - PCWP/LA pressure > 20 mmHg → fenestrated device?[22]



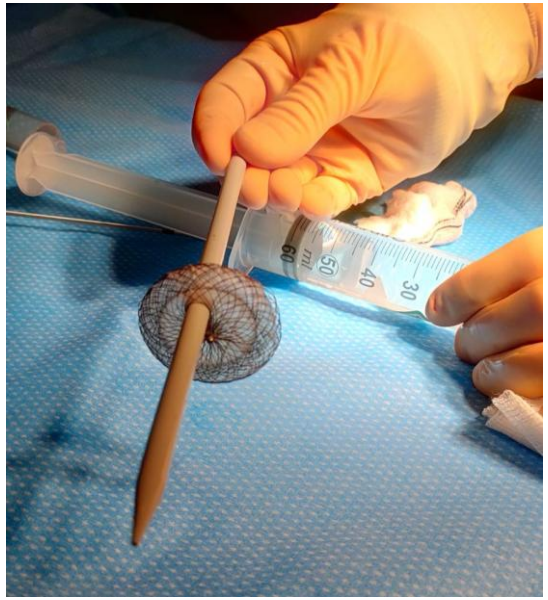
Decision: ASD closure with fenestrated device

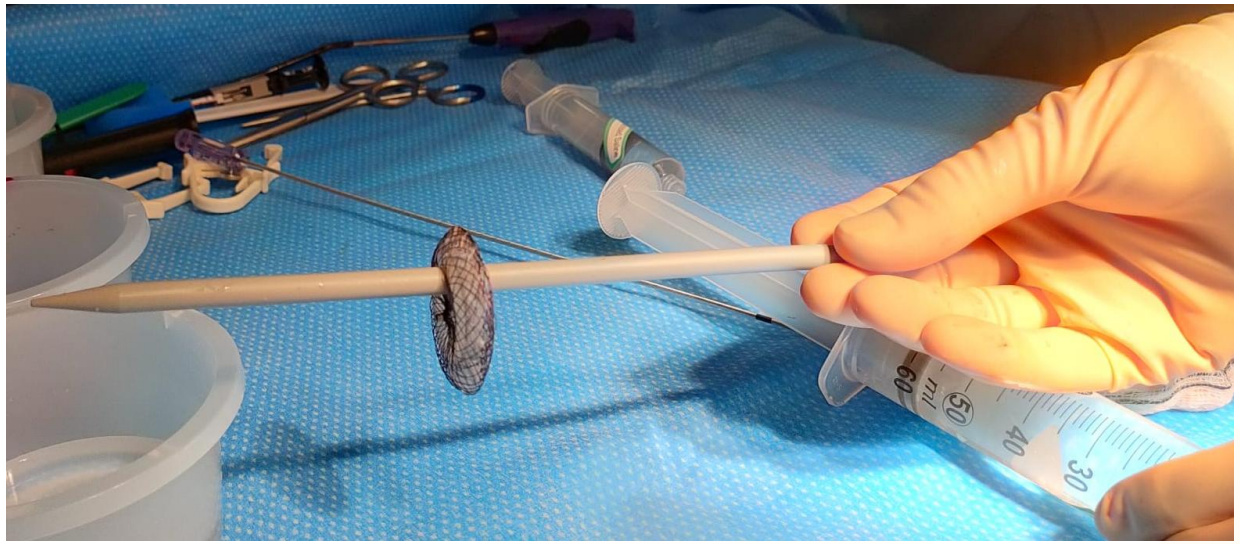
Amplatzer Septal Occluder



Abott. Amplatzer™ Septal Occluder [image on internet]. From: https://www.cardiovascular.abbott/us/en/hcp/products/structural-heart/structural-interventions/amplatzer-septal.html

Creating the fenestration…

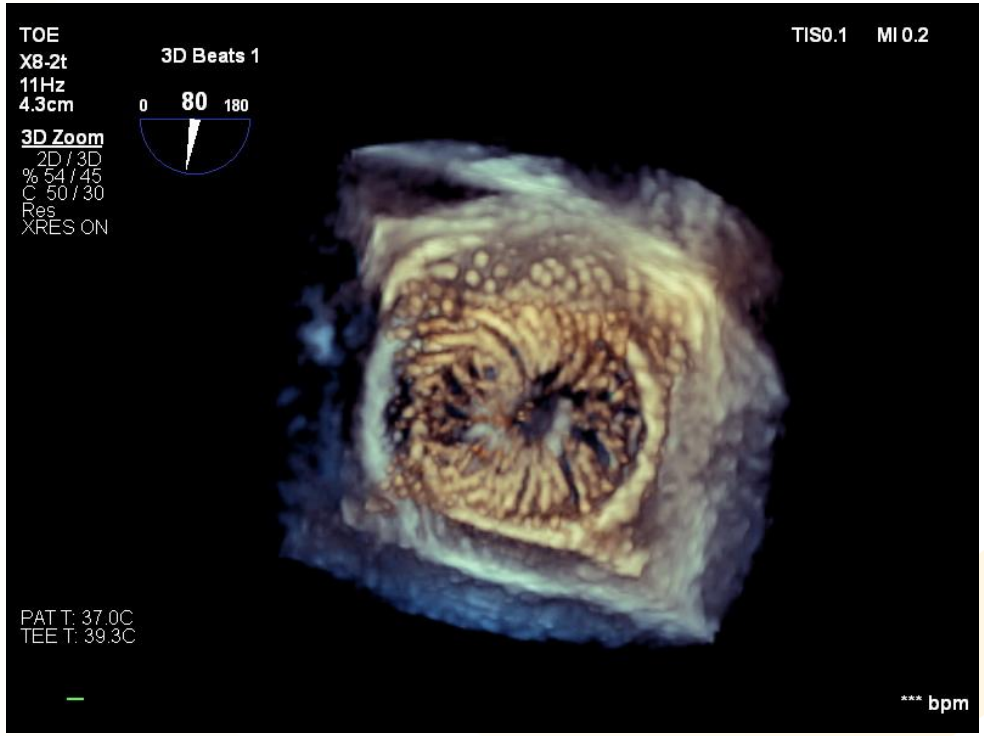




Checking patency with deployment…

Device deployment

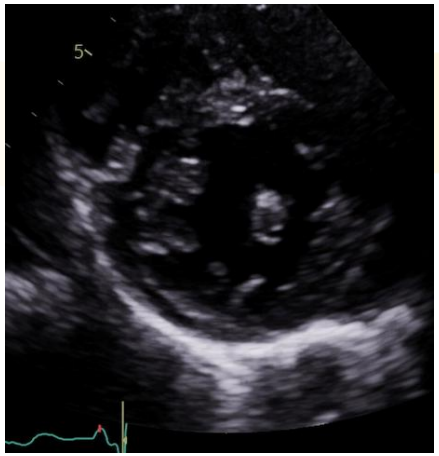
- 12Fr delivery sheath
- 28mm fenestrated ASD occluder deployed, position and patency confirmed with TOE:
  - Well-seated with good capture
  - Device patent: flow noted but no restrictive shunt
  - No effusion
- Proglide fully deployed in left femoral vein
- Handpress and closure device applied to right femoral vein

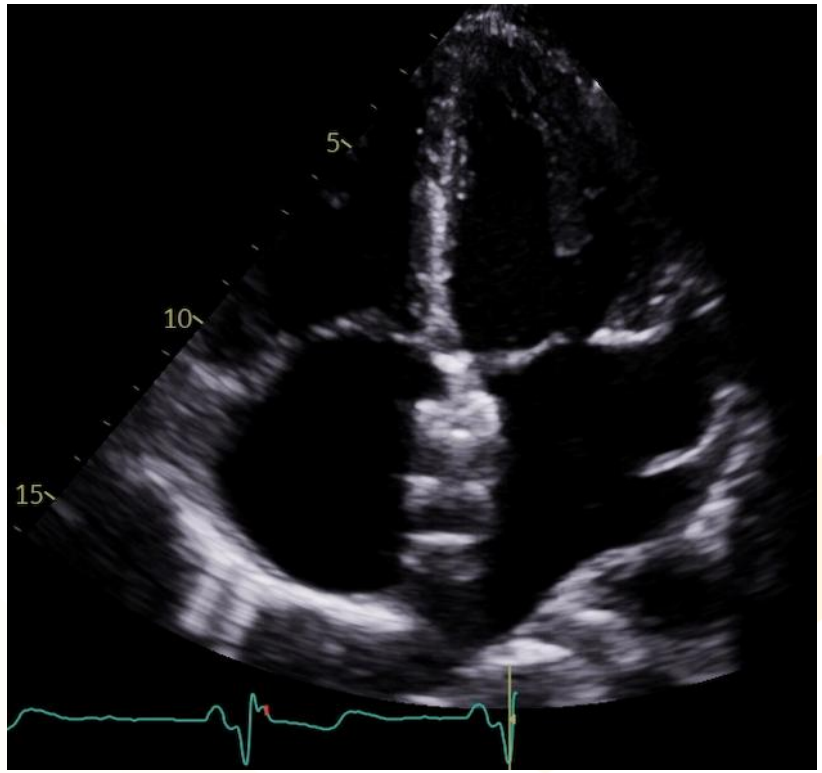


Post-procedure care

- Patient stayed overnight. Reported mild throat discomfort and nausea on ward → settled with simple pain meds.
- Discharged next morning
- Prescribed DAPT (aspirin and clopidogrel) for 3 months,[13,23] aspirin indefinitely.

6 week post TTE





- Mildly dilated RV with normal systolic function (improved)
- Elevated RV systolic pressure ~56mmHg >RA
  (59.5 mmHg prior to closure)
- Normal LV size and systolic function, developed restrictive filling pattern (E/A ratio 3.35 [>2], 104% increase)
- Dilated atria (LA > RA). Mild L→ R flow seen within device
- Mildly thickened MV leaflets, moderate MR – not associated with worse outcomes.[24]
- Moderate TR.[25]
- Severe PR, mild PS. Dilated MPA and branches

Outcome

- Seen 6 months post-closure:
  - Reports feeling much better (reduced SOB/improved exercise tolerance), considering resuming competitive sport
  - Vital signs: BP: 161/71 mmHg, HR 73, SpO_2 97%, 2-3/6 systolic murmur, sinus rhythm
- Stopped both anti-platelet medications on own accord.
  - Advised to restart aspirin
- Plan: repeat TTE + ECG in 1 year (not yet completed)

Conclusion

- Symptomatic improvement, normalized RV size and function (↓ R-sided volume overload)
- But persisting elevated RVSP (? LV diastolic dysfunction, pulmonary valve disease),[26-28] enlarged atria, and TR.[25]
- Worsening diastolic LV function and MR, but no LV failure (fenestration good choice).[20-21,29]

➢ Successful given age (improved cardiac function, and functional capacity)

➢ ? better outcomes with closure at a younger age (↓ LV diastolic dysfunction, valve disease [TR, MR], and pulmonary vascular remodeling)

→ Best results with closure <25 years (improved survival).[13]

→ >40-60 years does not reduce frequency of arrhythmias or reduce mortality,[13,30] PAP decreases with closure but often remains elevated in those >60 years.[27]

Questions…

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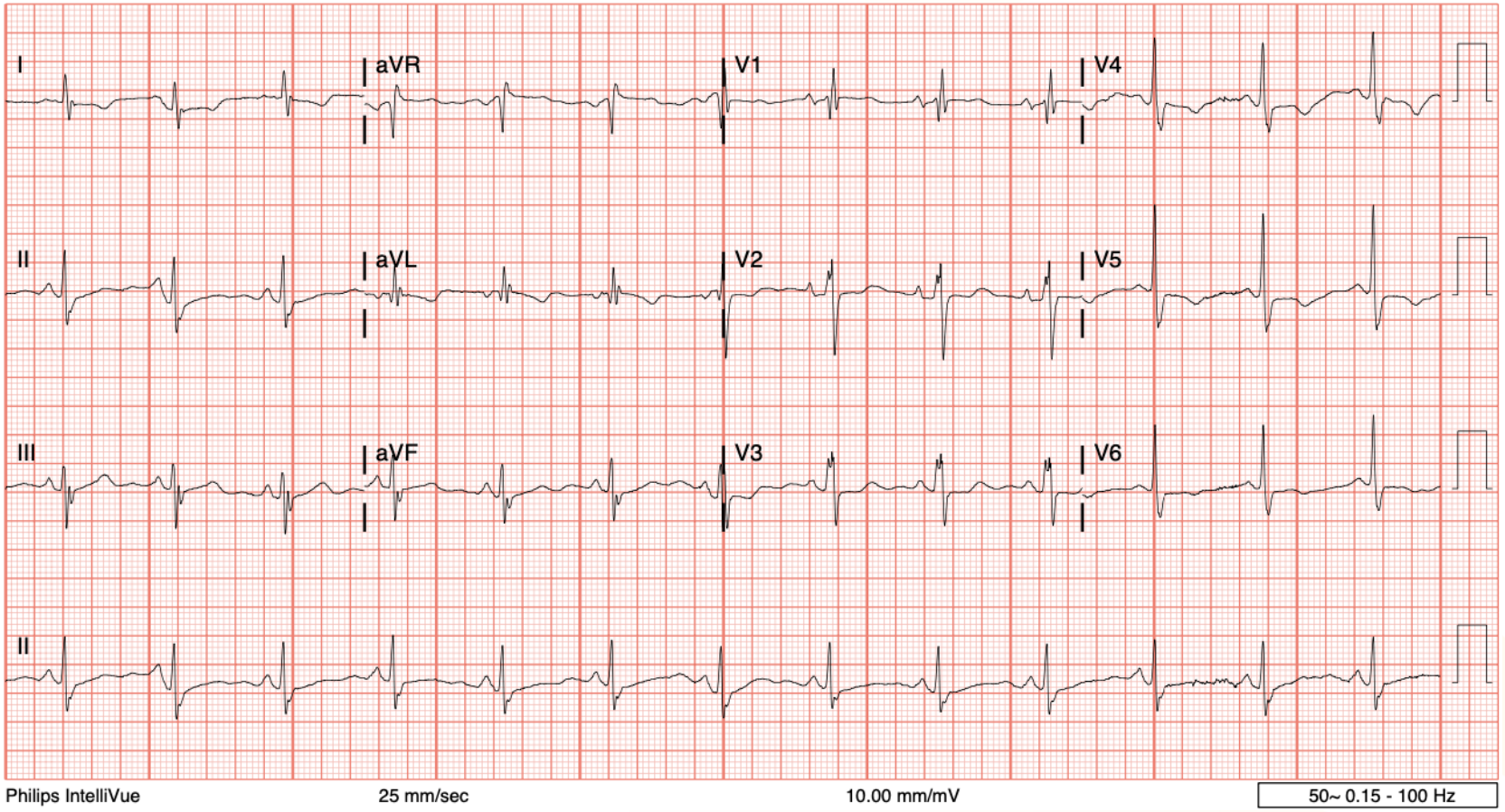
Appendix: ECG prior to presentation (2021)



Appendix: ECG post-op (2024)