Role of CT and MR in Fallot disease

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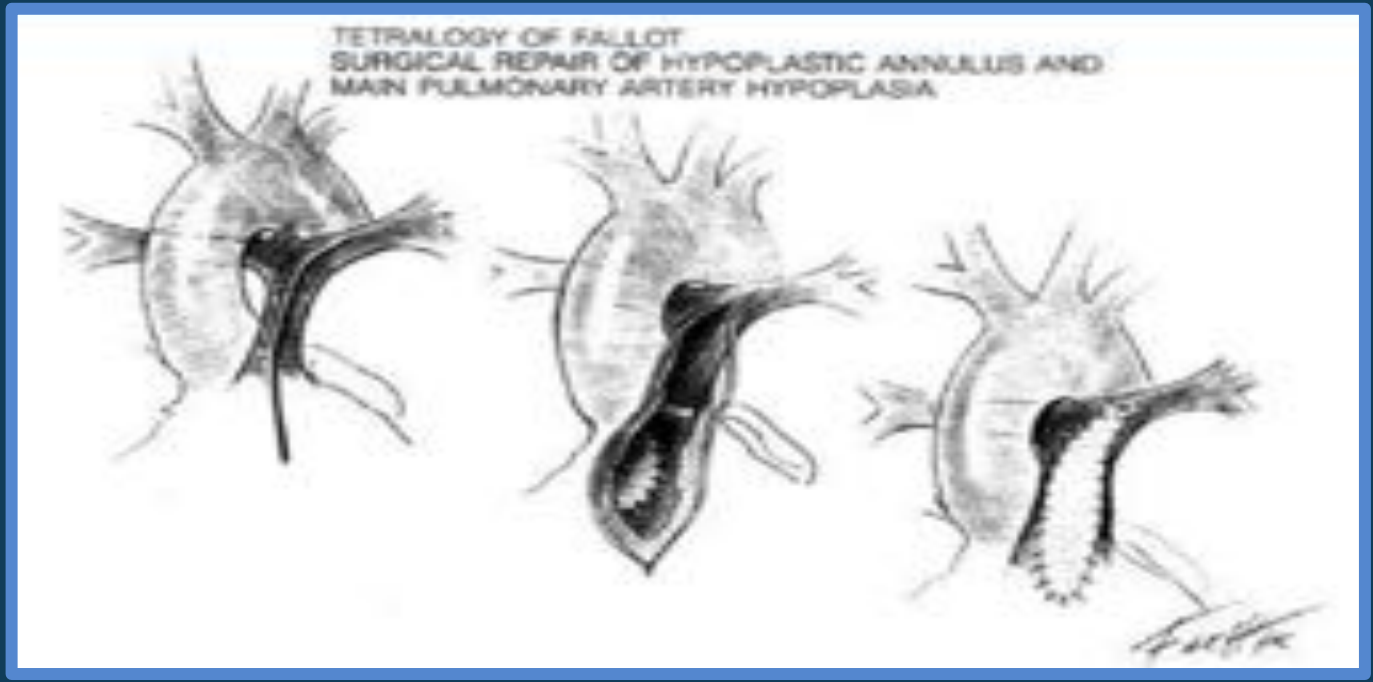
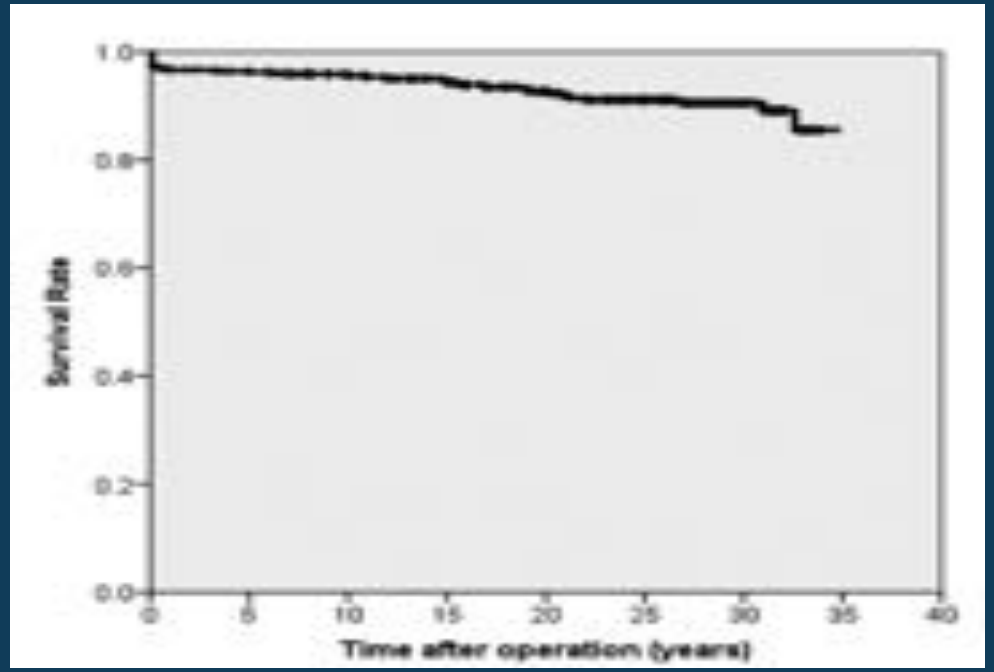
Conflict of Interest from 2014 to 2018

Elie Mousseaux

No link or conflict with the following presentation

Background





Chiu et al. Circ Cardiovasc Qual Outcomes 2012

Background

- ESC 2010 guidelines Class IIa/Level C

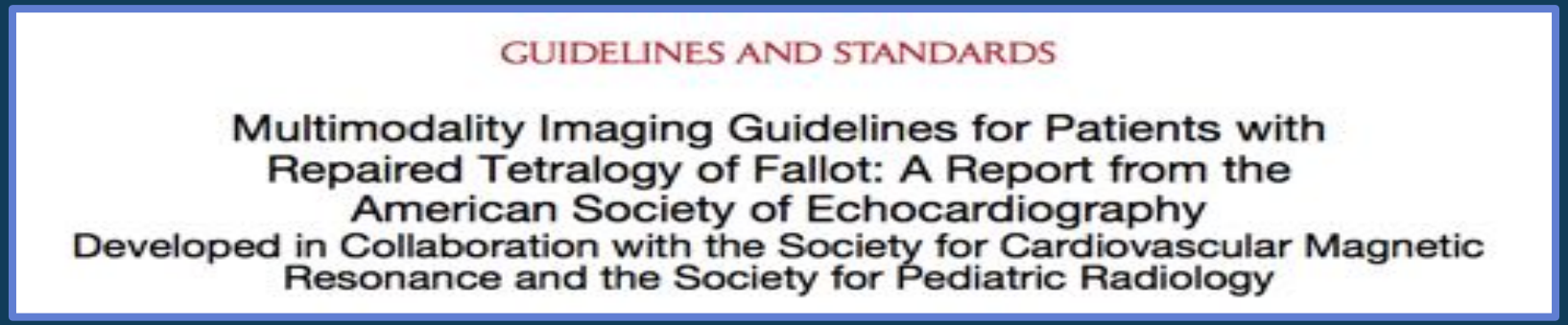
  PVR should be considered in asymptomatic patients with severe PR when at least one of the criteria is present:

  - Decrease in objective exercise
  - Progressive RV dilatation
  - Progressive RV dysfunction
  - Progressive tricuspid regurgitation
  - Sustained atrial/ventricular arrhythmias

- Predictors of outcome:
  - RV hypertrophy
  - RV dysfunction
  - LV dysfunction
  - Atrial tachyarrhythmia

Valente et al. Heart 2014

Role of CMR

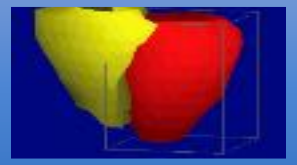

GUIDELINES AND STANDARDS

Multimodality Imaging Guidelines for Patients with Repaired Tetralogy of Fallot: A Report from the American Society of Echocardiography
Developed in Collaboration with the Society for Cardiovascular Magnetic Resonance and the Society for Pediatric Radiology

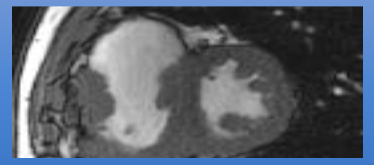
- Role varies according age and clinical circumstance
  - First decade: TTE is almost sufficient. CMR is not recommended routinely
  - After, CMR is recommended for RV size, function and pulmonary regurgitation.
    - Echography windows more restricted
    - Adverse clinical outcome increases
    - No sedation for CMR in adolescents and adults

Valente et al. JASE 2014.

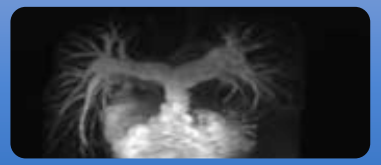
MR Scanning/Reports elements



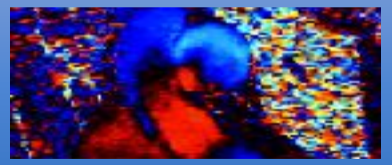
RV and LV volumes, mass, SV and EF



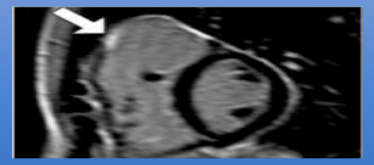
Wall motion abnormalites



Anatomy of RVOT, PA, aorta

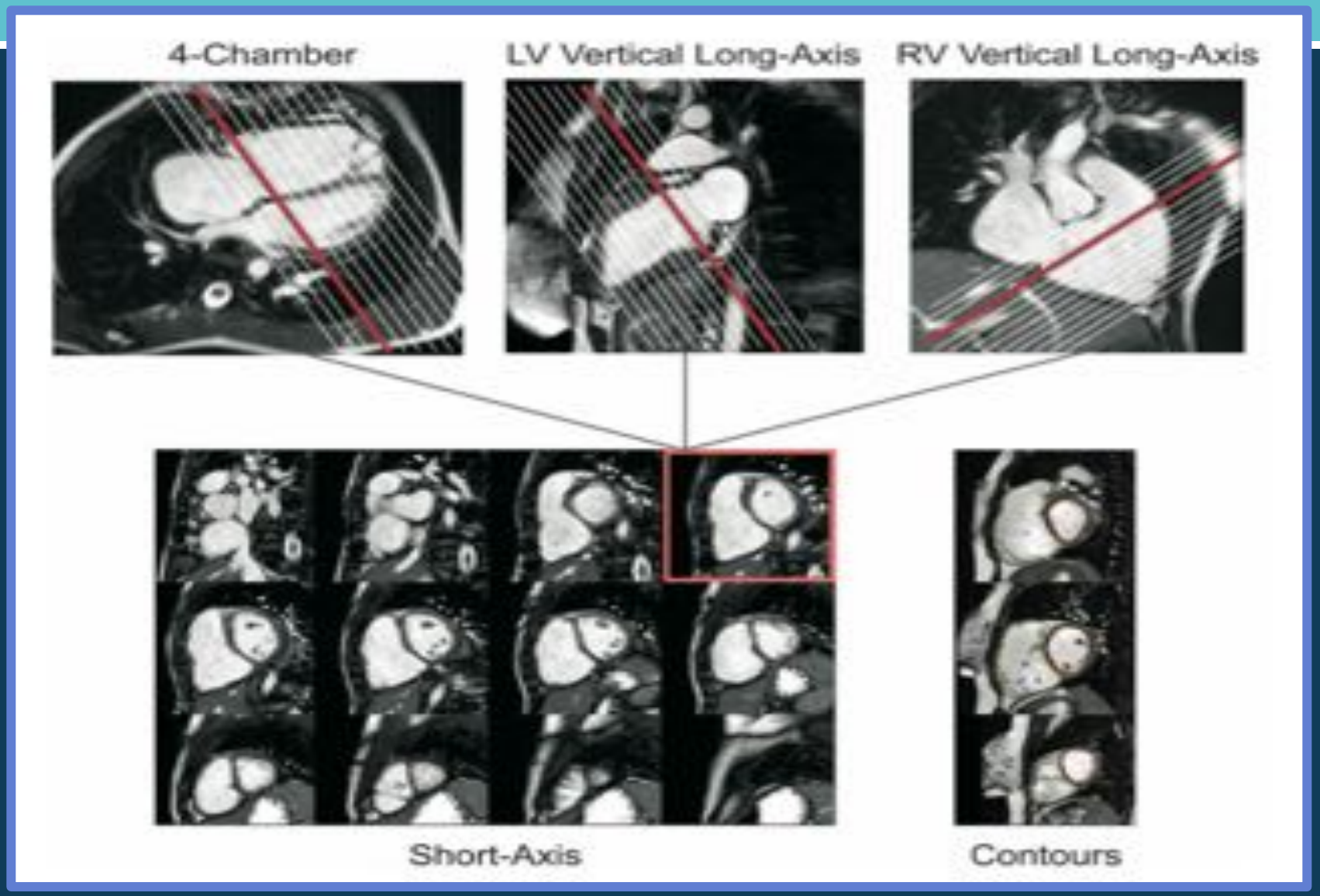


Quantification of PR, TR, Cardiac output an QP/QS



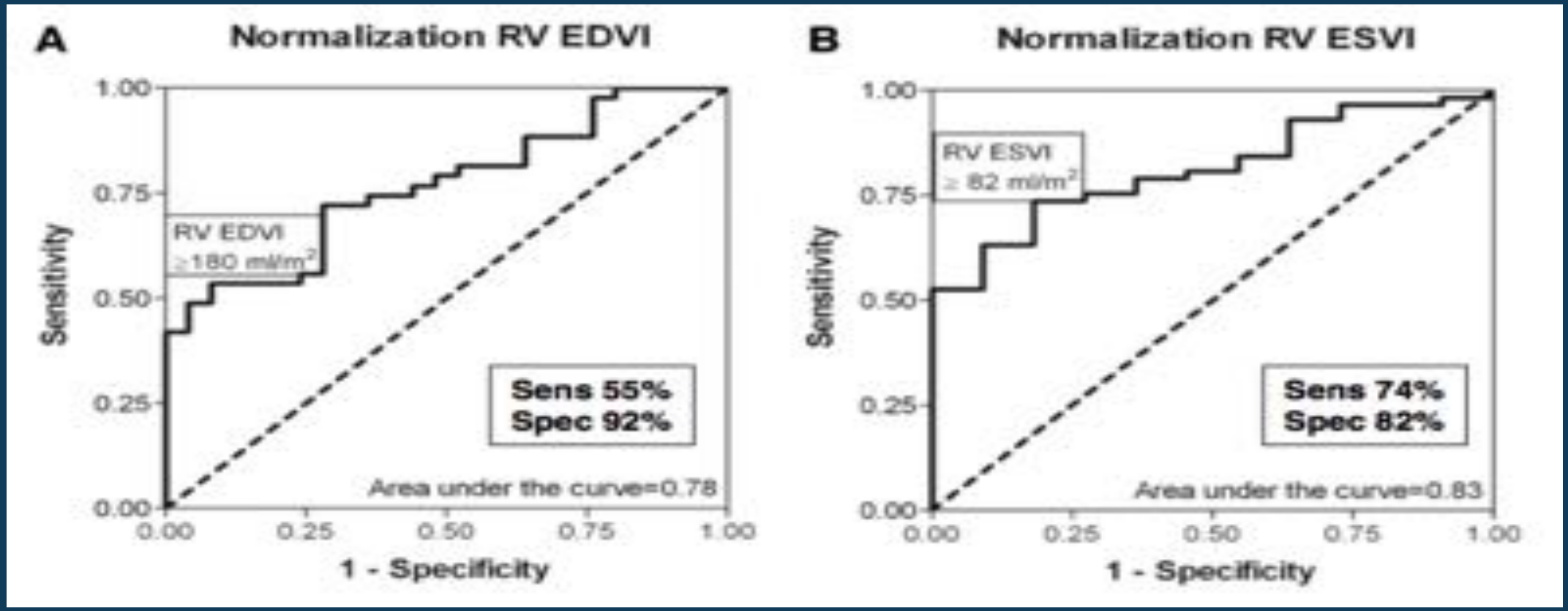
Viability

RV size and function



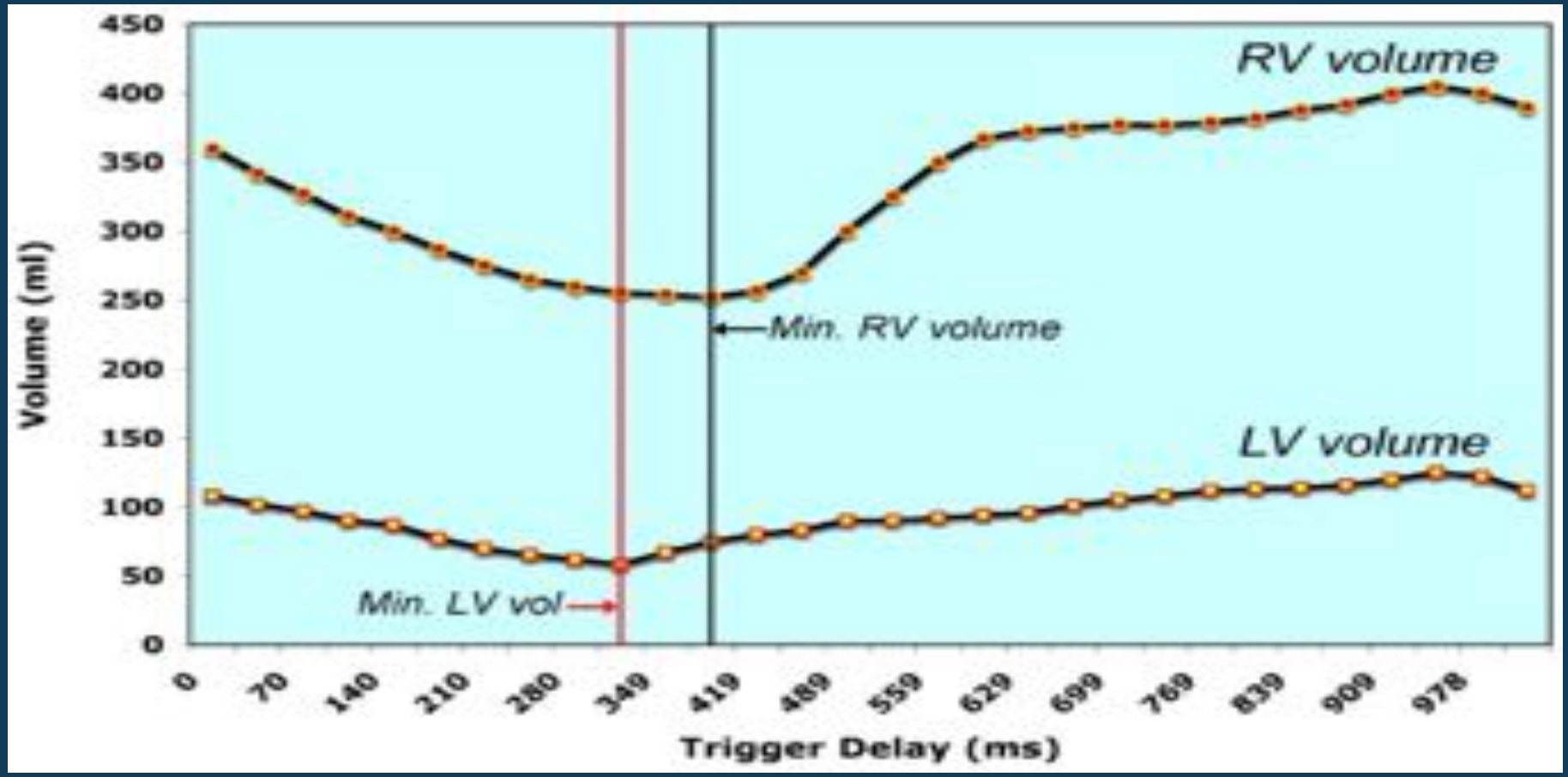
Geva et al. JCMR 2011

Background



Oosterhof et al. Circulation 2007

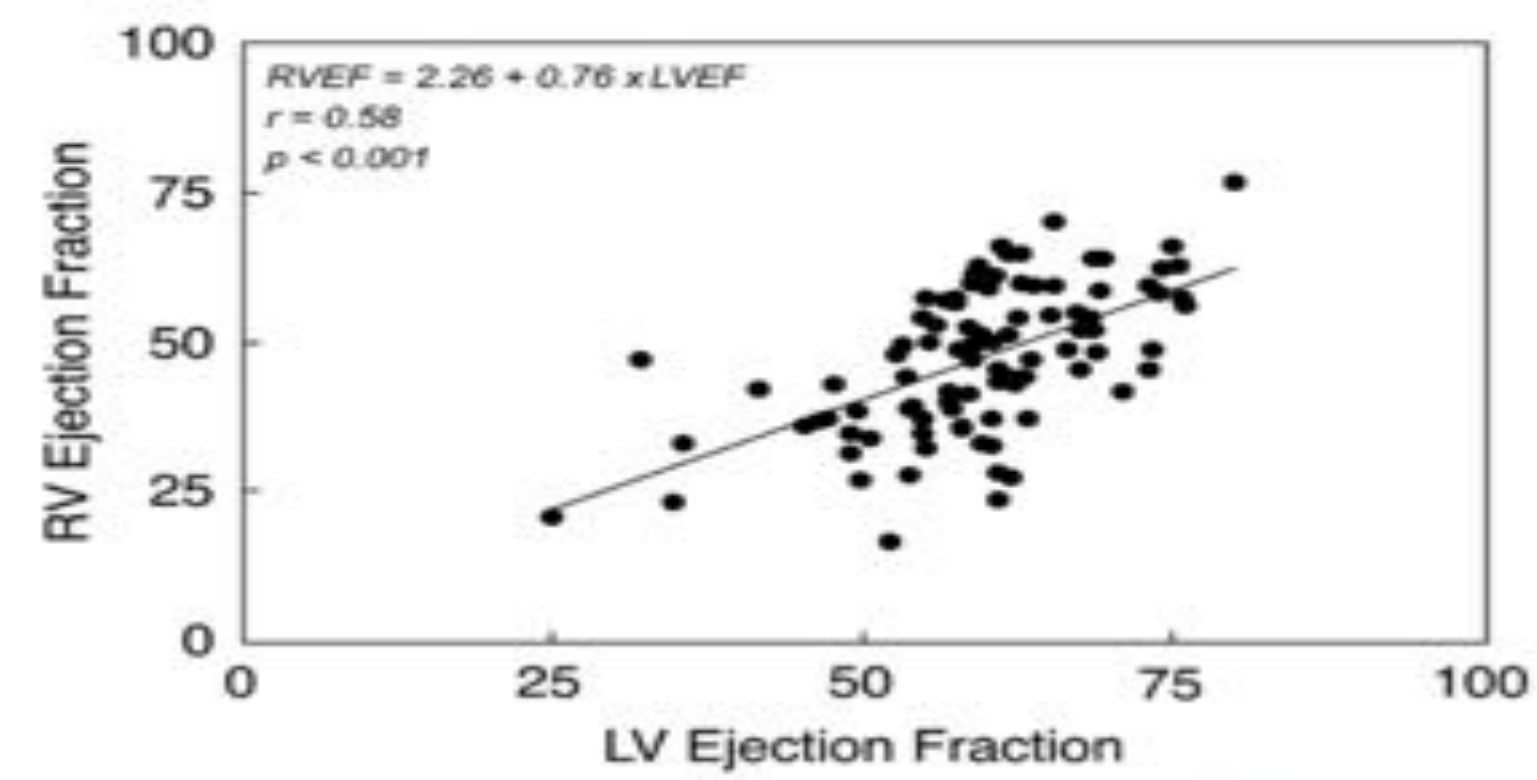
RV size and function



Geva et al. JCMR 2011

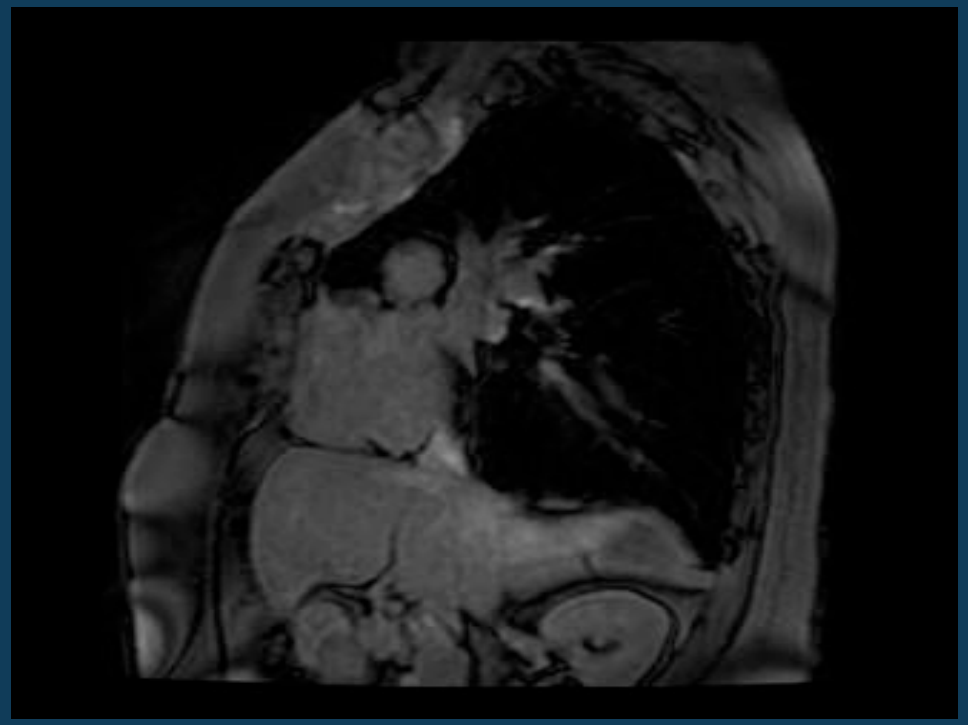
LV function

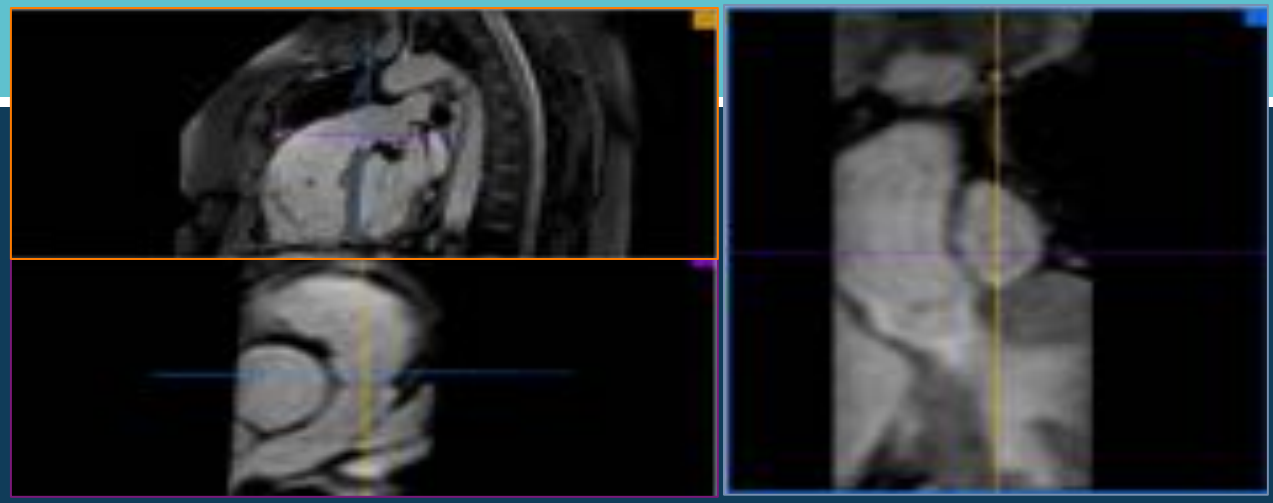
- Impaired in 20% of Fallot disease. Strong prognostic factor.

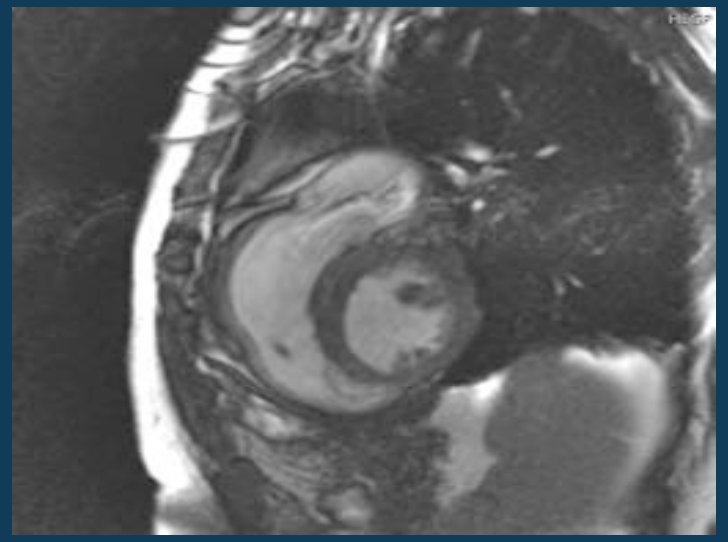


Geva et al. JACC 2004

Anatomy of RVOT



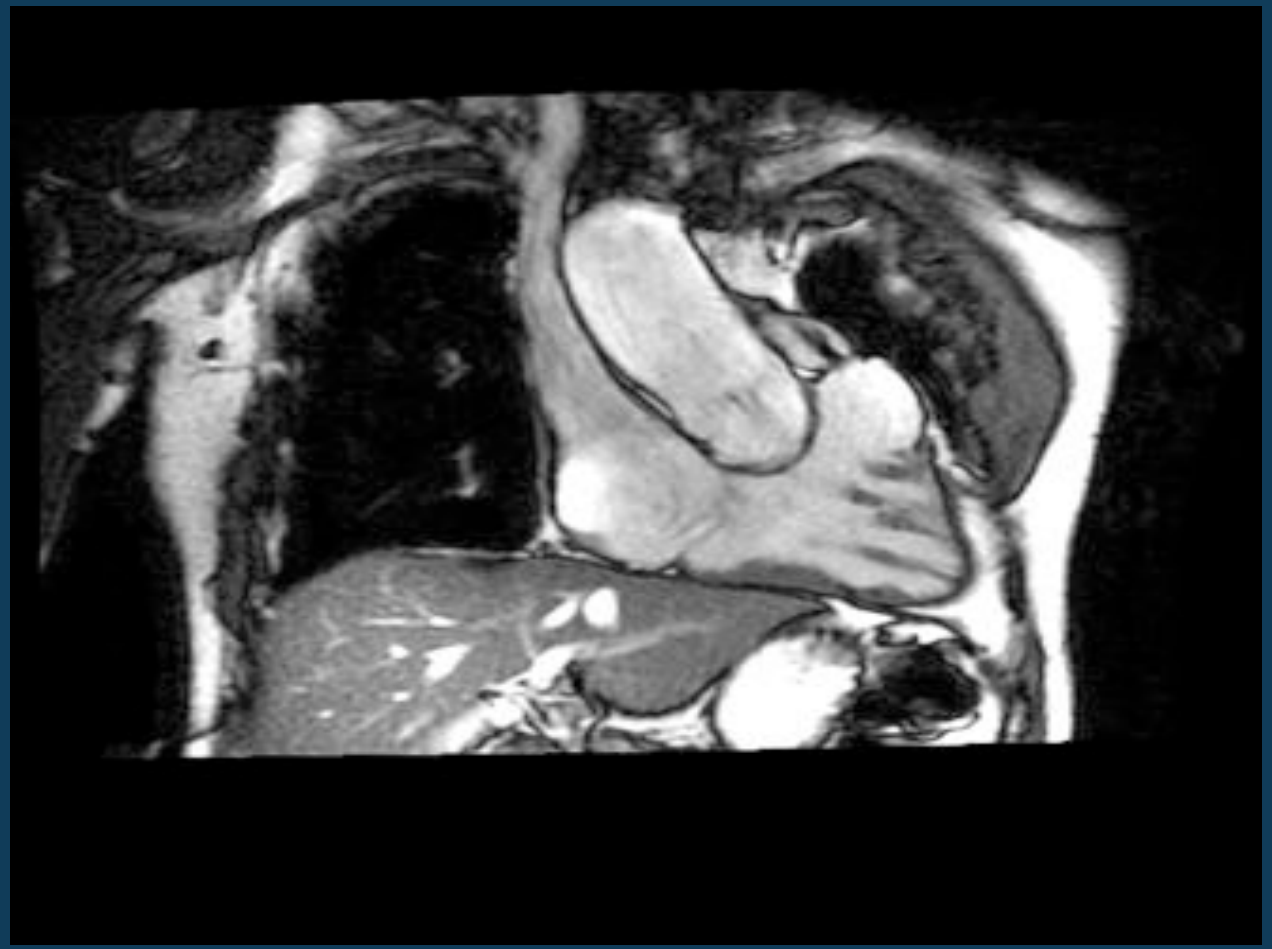


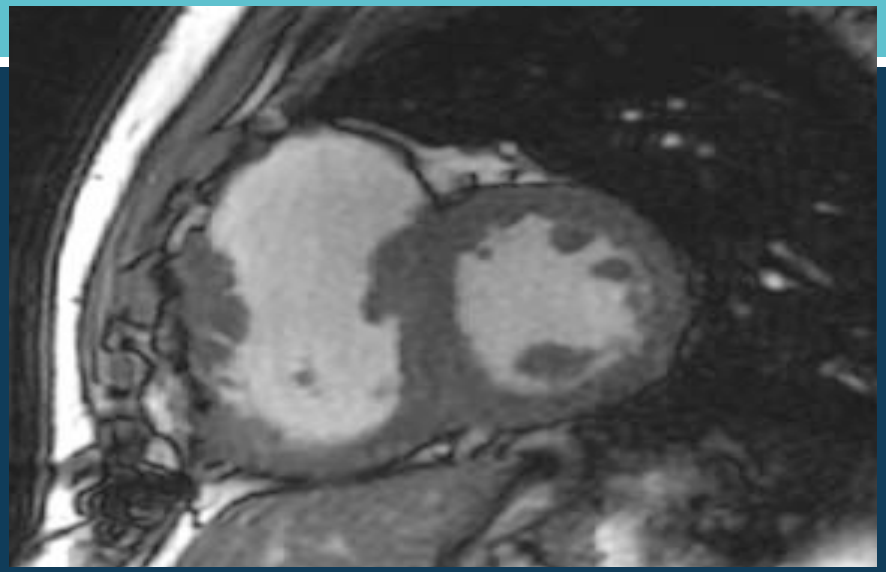


3D SSFP Sequence: ECG gated, and MPR possible.
2D SSFP: useful for wall motion assessment
3D MRA: non synchronized: motion artefact.
TSE: less sensitive to metallic artifact.

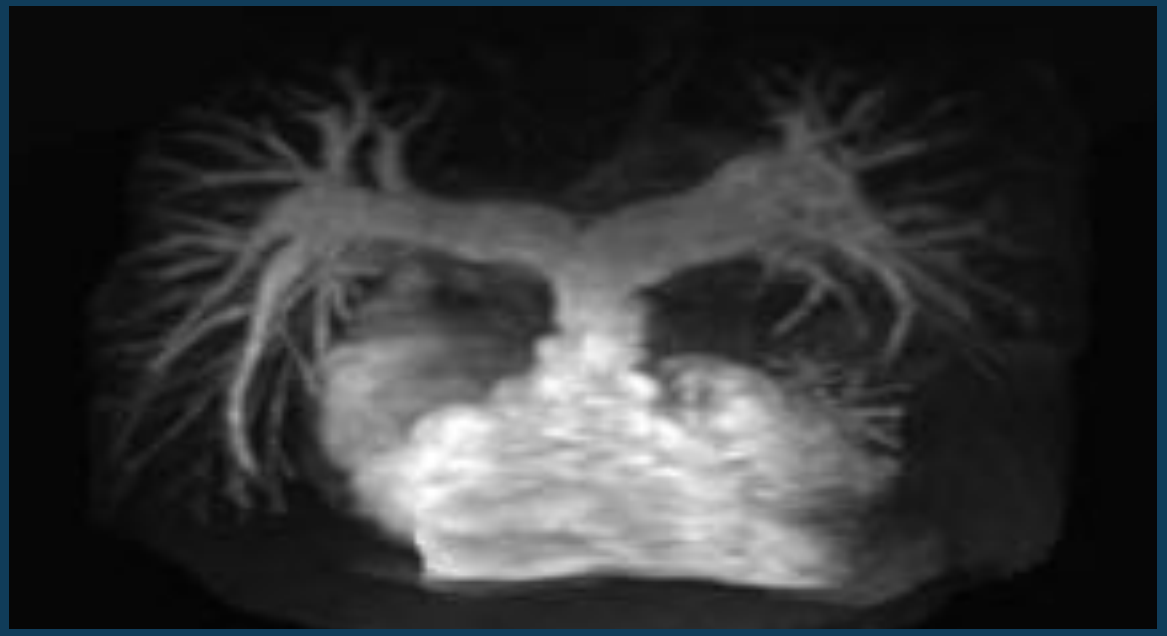
Important element for planning percutaneous implantation

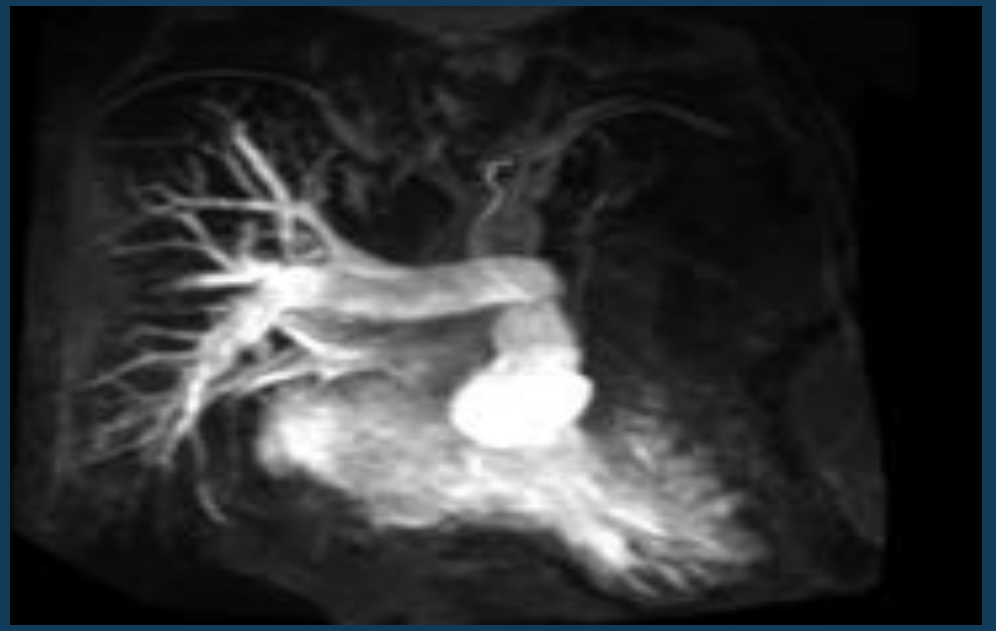
RVOT





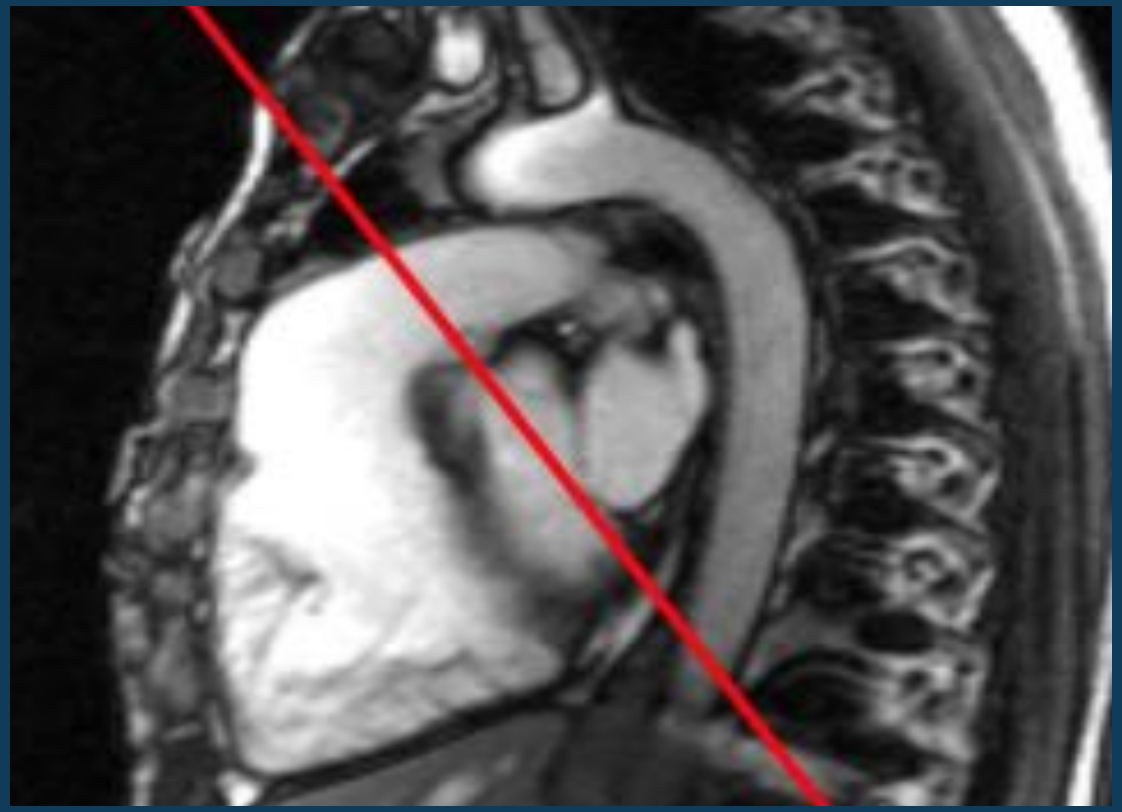
Anatomy of PA

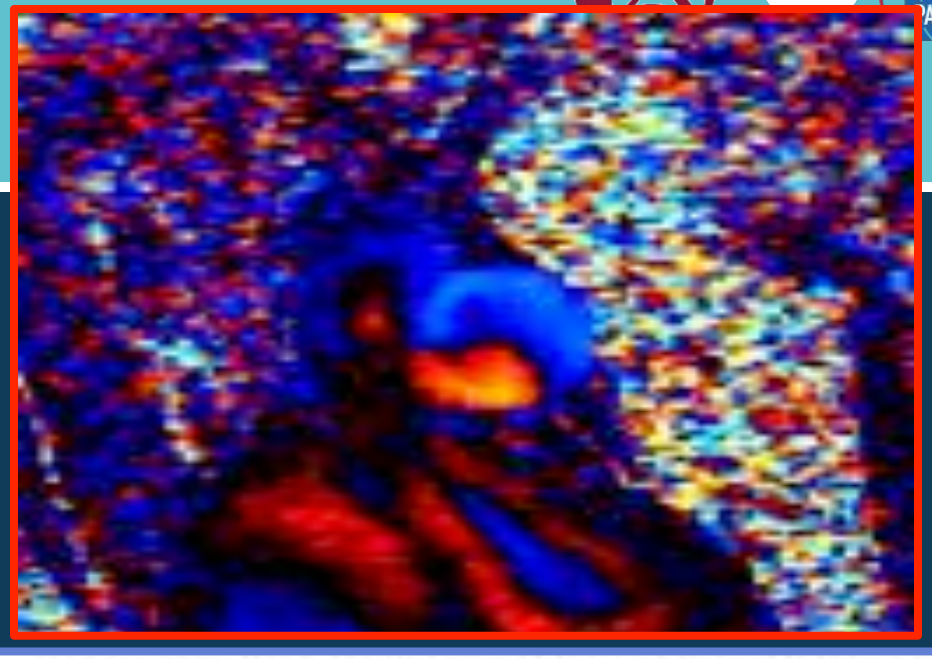


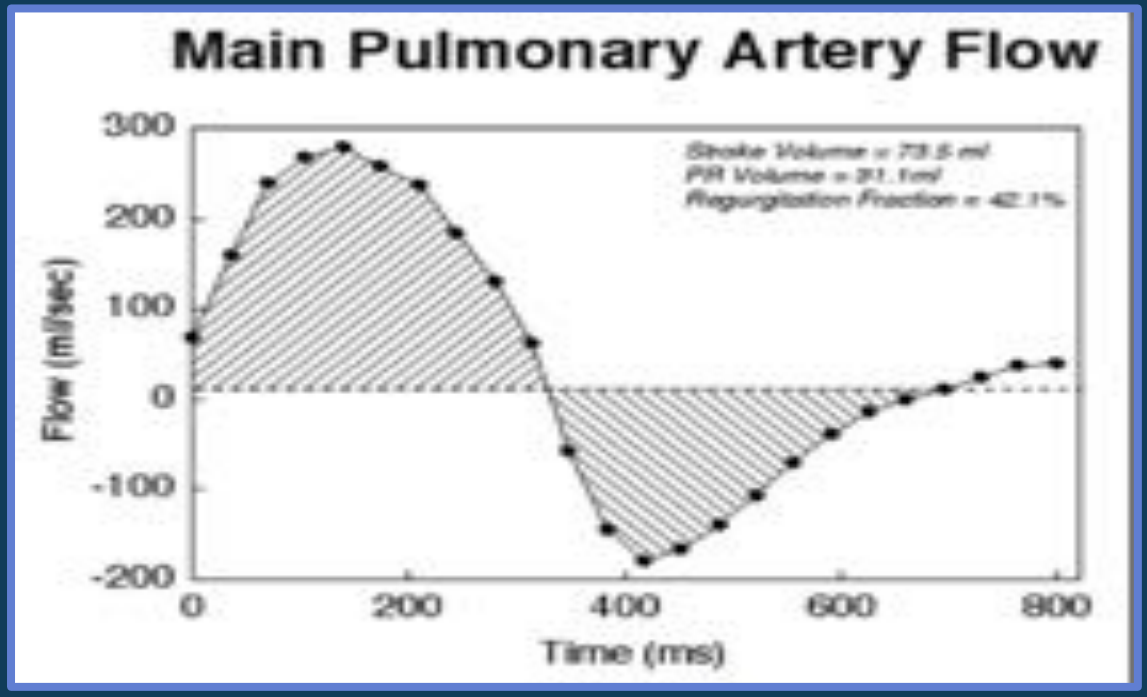


- Magnetic resonance angiography
- Evaluation of branch stenosis

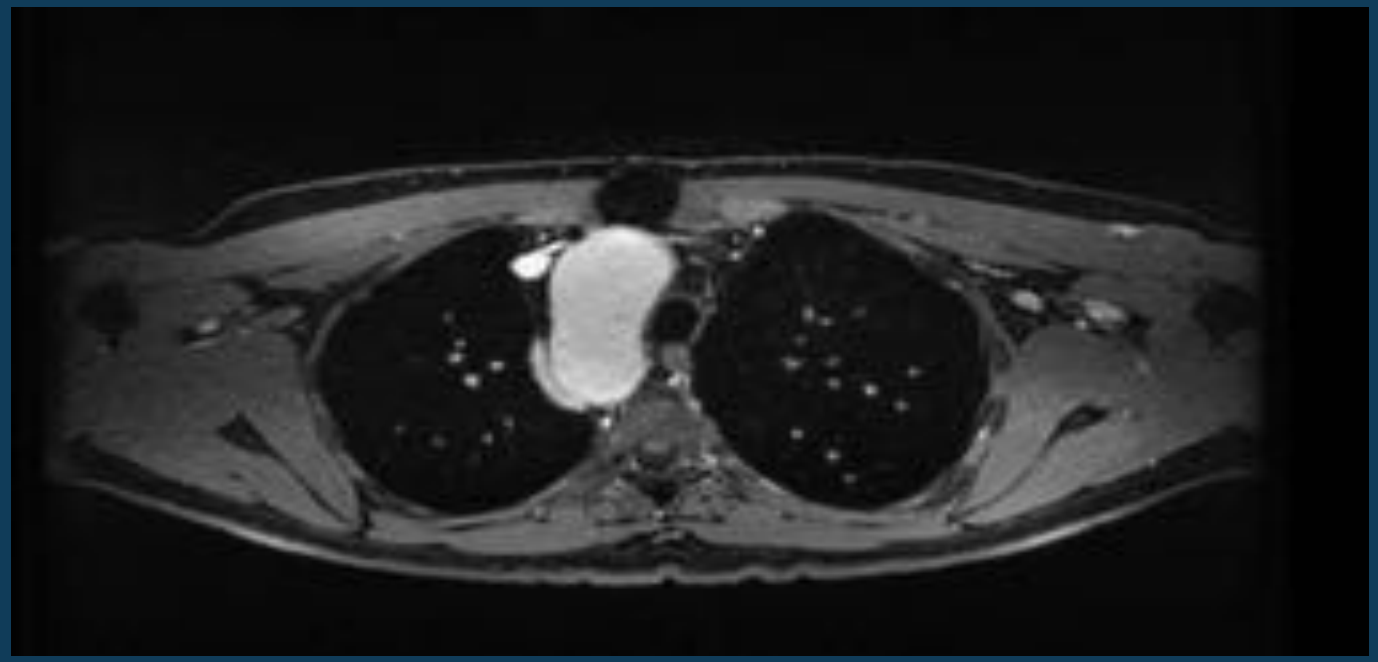
Quantification of PR

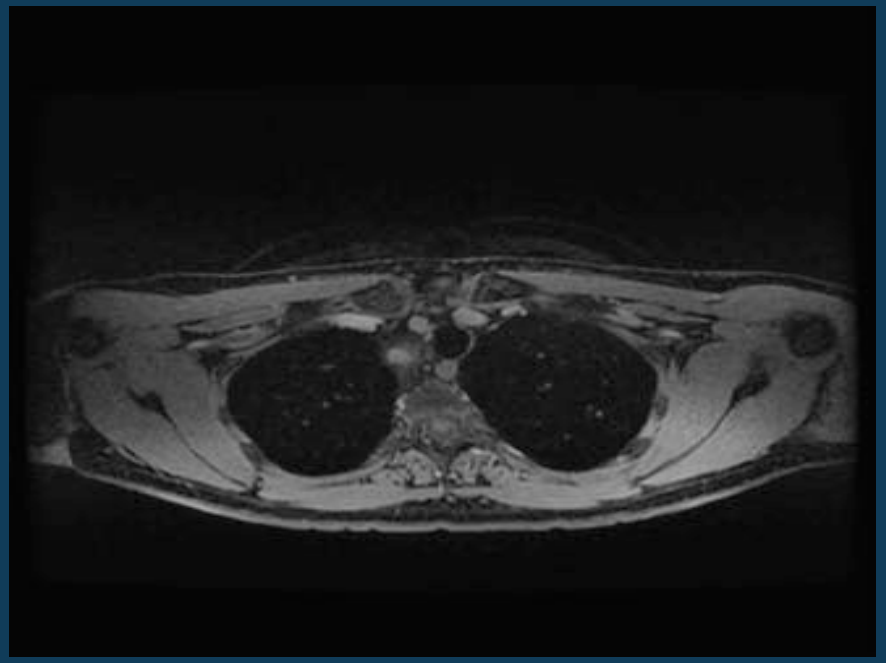






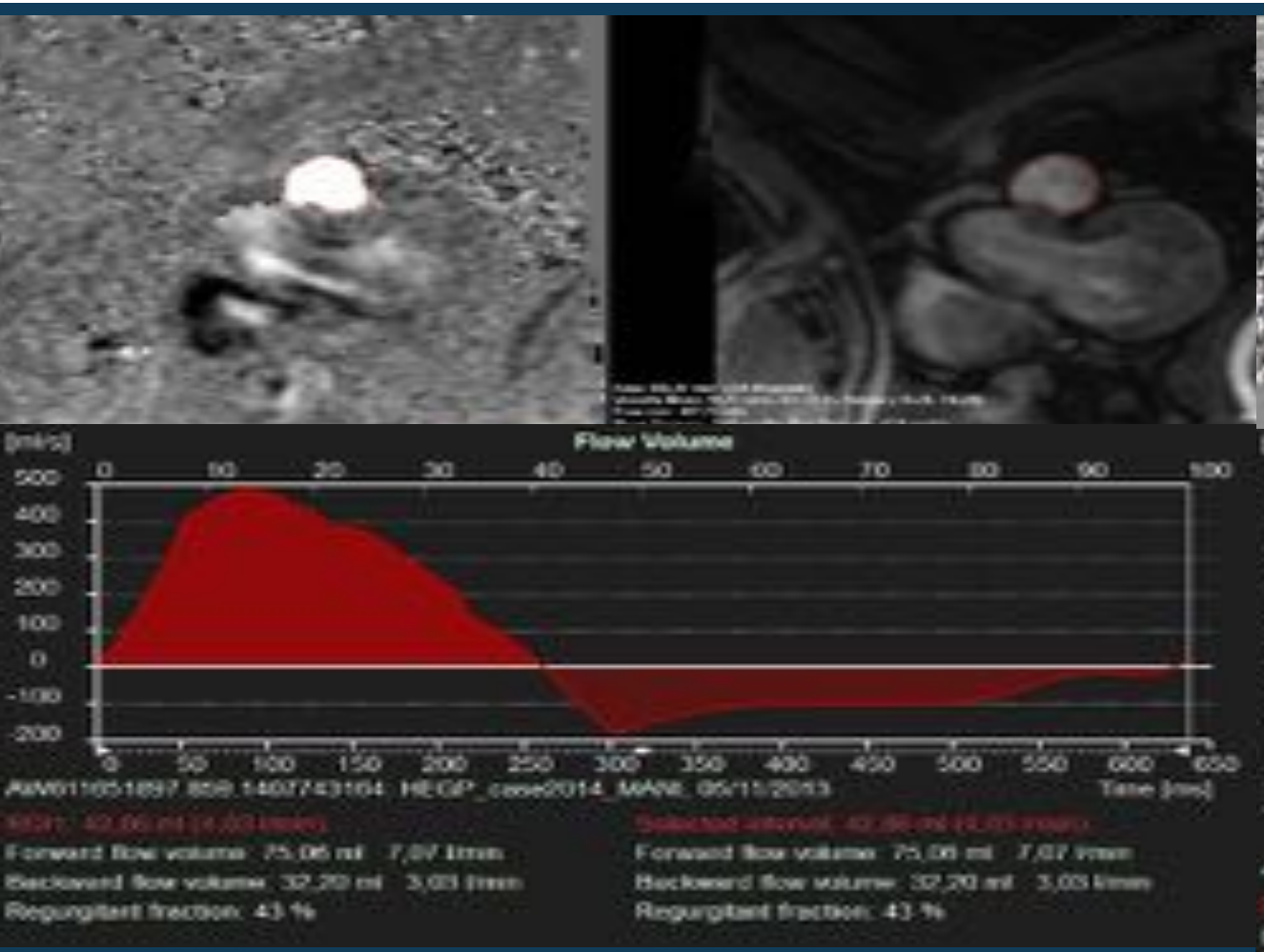
Anatomy of aorta

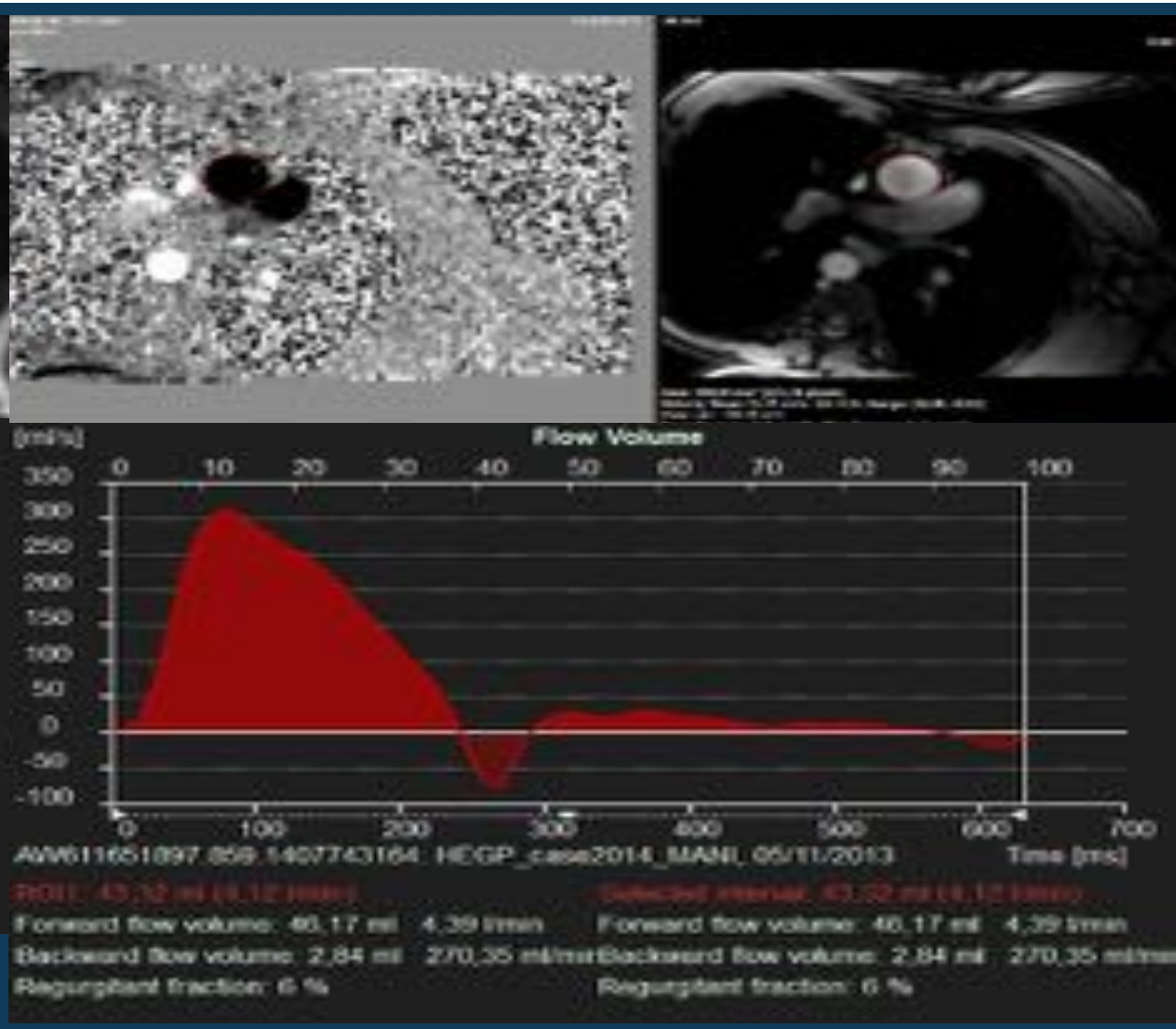




- Right aortic arch in 25% of patients

Cardiac output and QP/QS

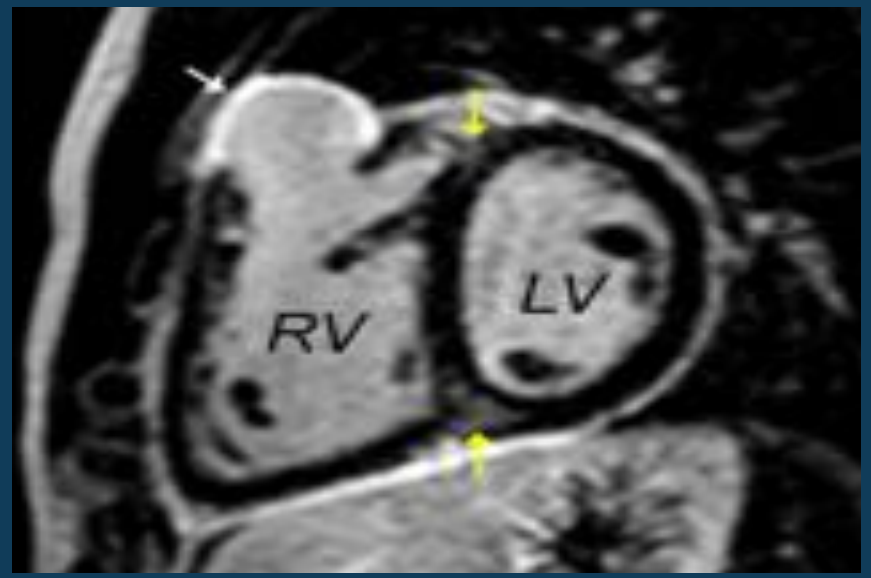




QP=4.03ml; QS=4.12ml

Late Gadolinium Enhancement

- Proposed recommendation for LGE evaluation:
  - First CMR examination
  - >3 years since last LGE evaluation
  - Deterioration in clinical status
  - Worse regional or global ventricular function



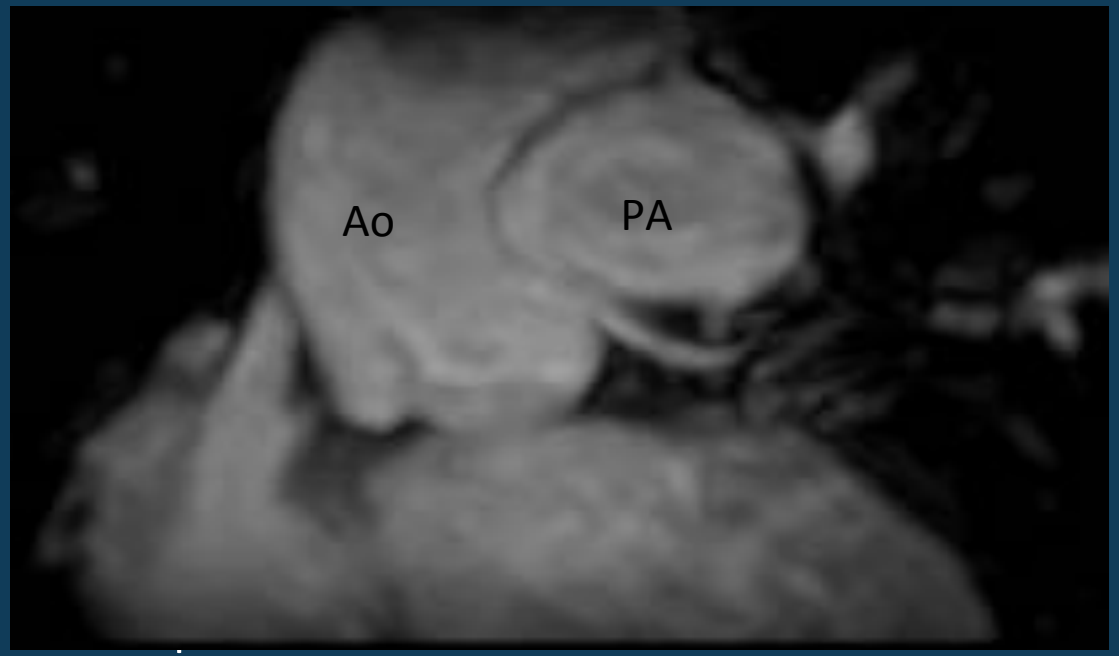
Occurs in
- Location of prior surgery
- Ubiquitus in superior and inferior junction

Relation with mortality remains unclear

Valente et al. JASE 2014.

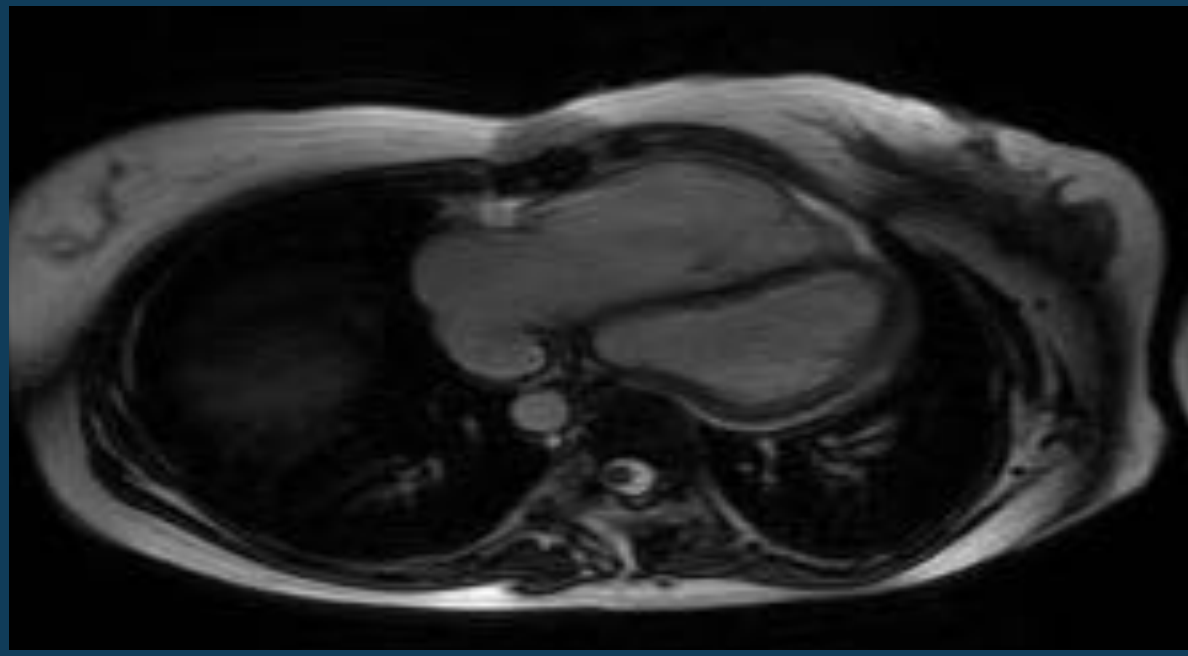
Other issues in CMR

- Coronary anatomy

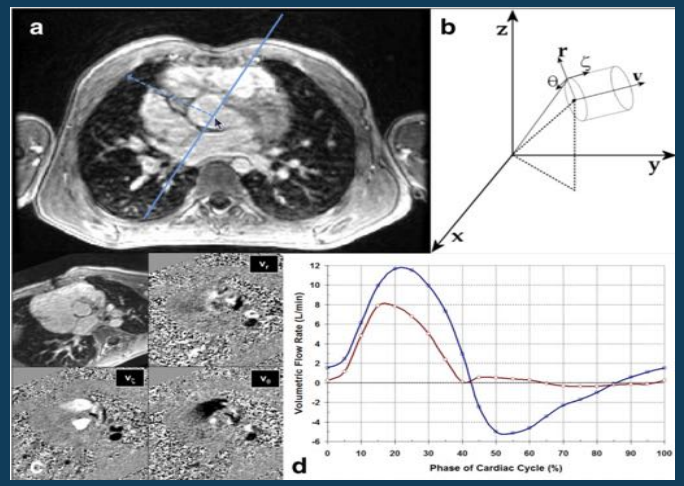


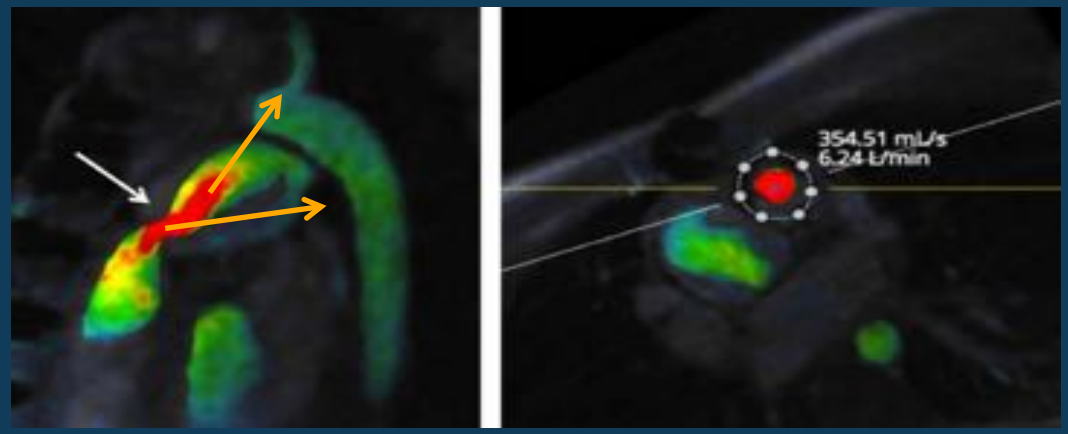
- CT in case of suspected abnormal origin and/ or tract

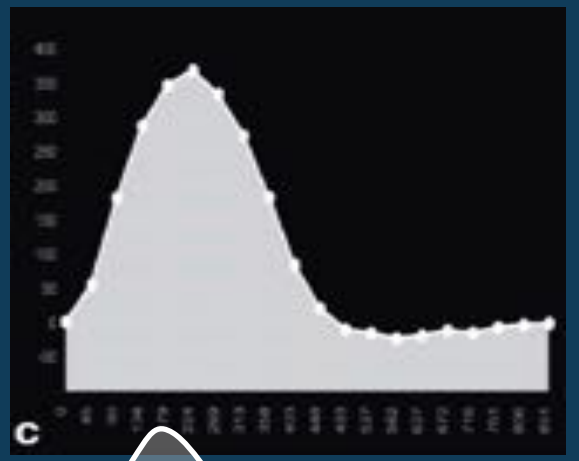
- Relationship with sternum



Advantages of 4D vs 1D



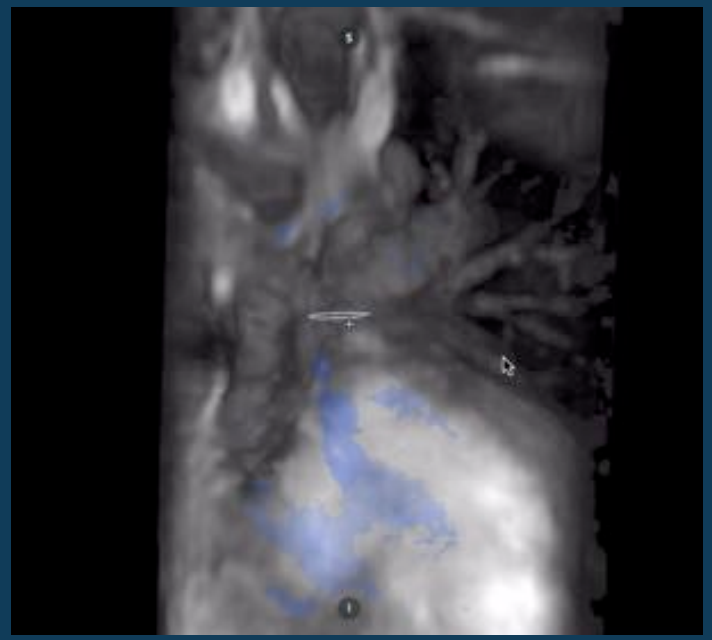


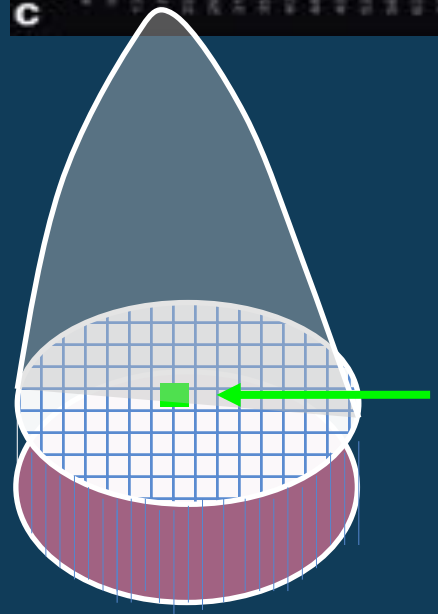


V Max

Fonction de son orientation

Fonction du débit sous jacent



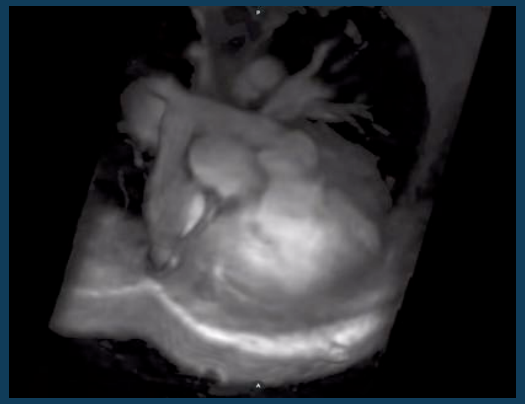


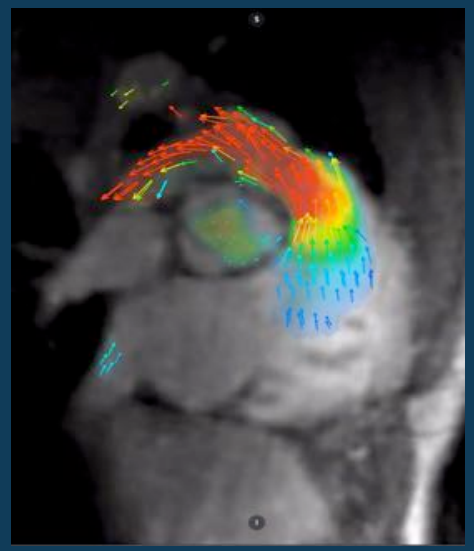
Congenital Heart Disease Assessment With 4D Flow MRI

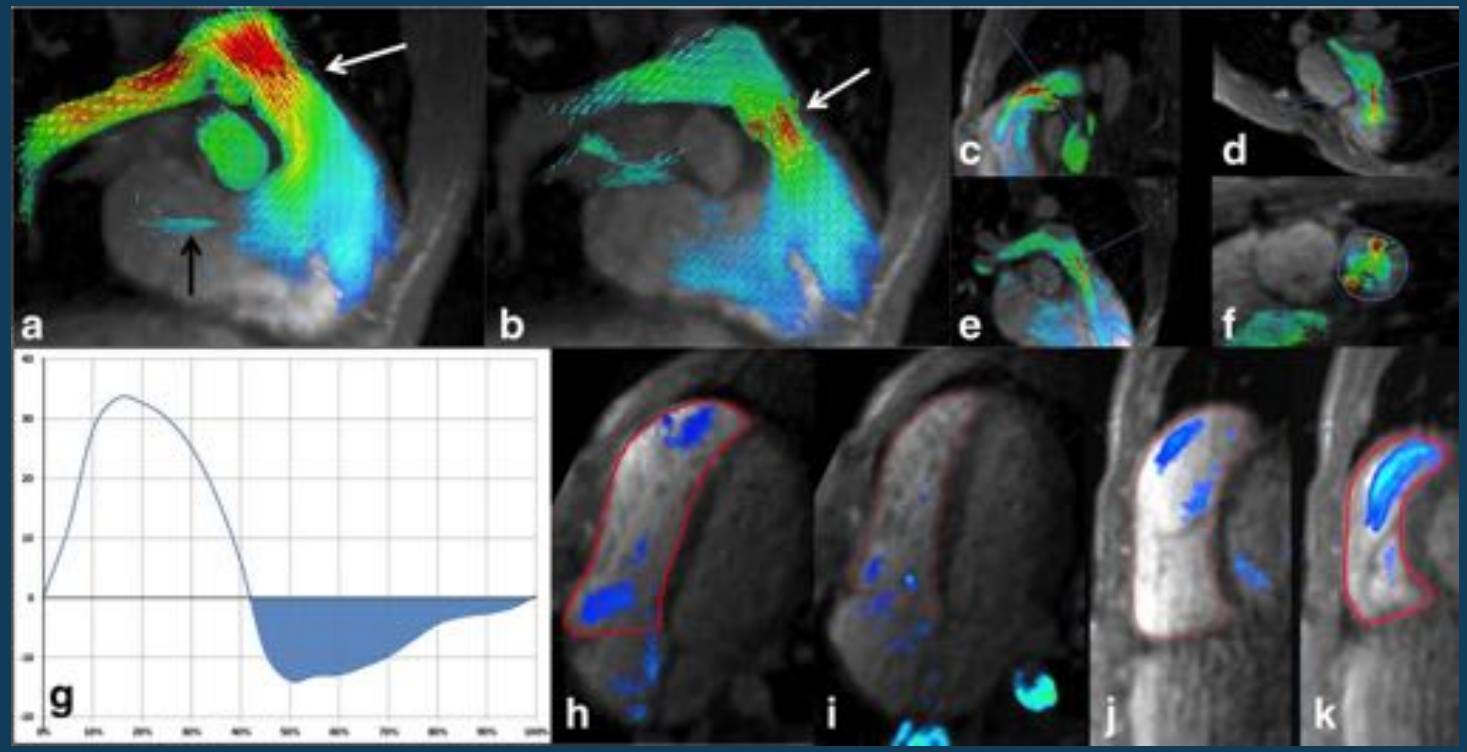
Shreyas S. Vasanawala, MD, PhD,[1]* Kate Hanneman, MD,[2] Marcus T. Alley, PhD,[1] and Albert Hsiao, MD, PhD

JMRI 1015

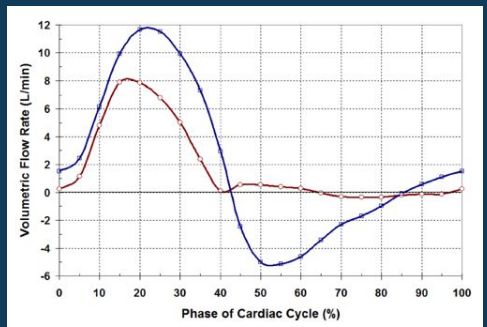
Tetralogy of Fallot with 4D f







RF = 45%
No shunt Qp/Qs = 1



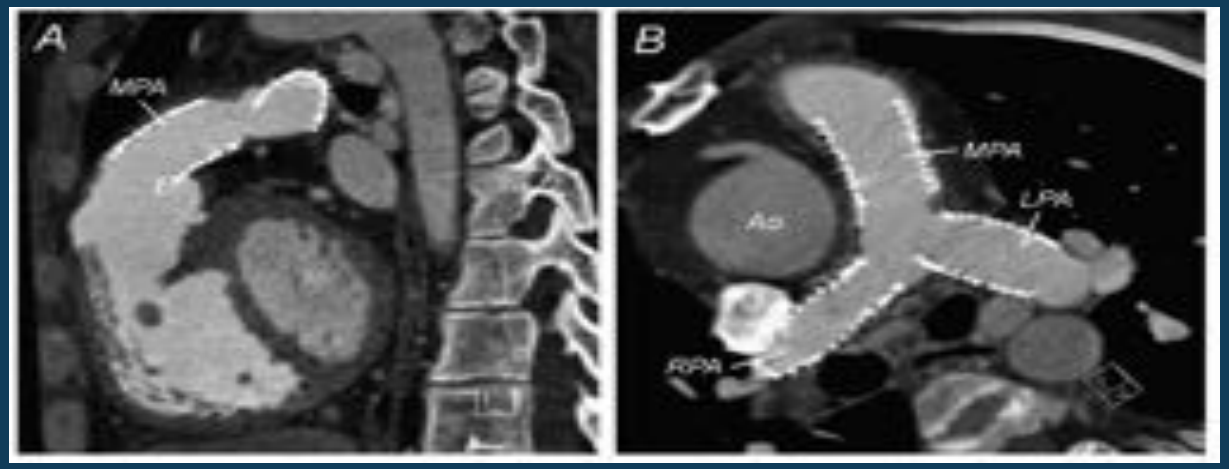
CMR limits / Role of CT

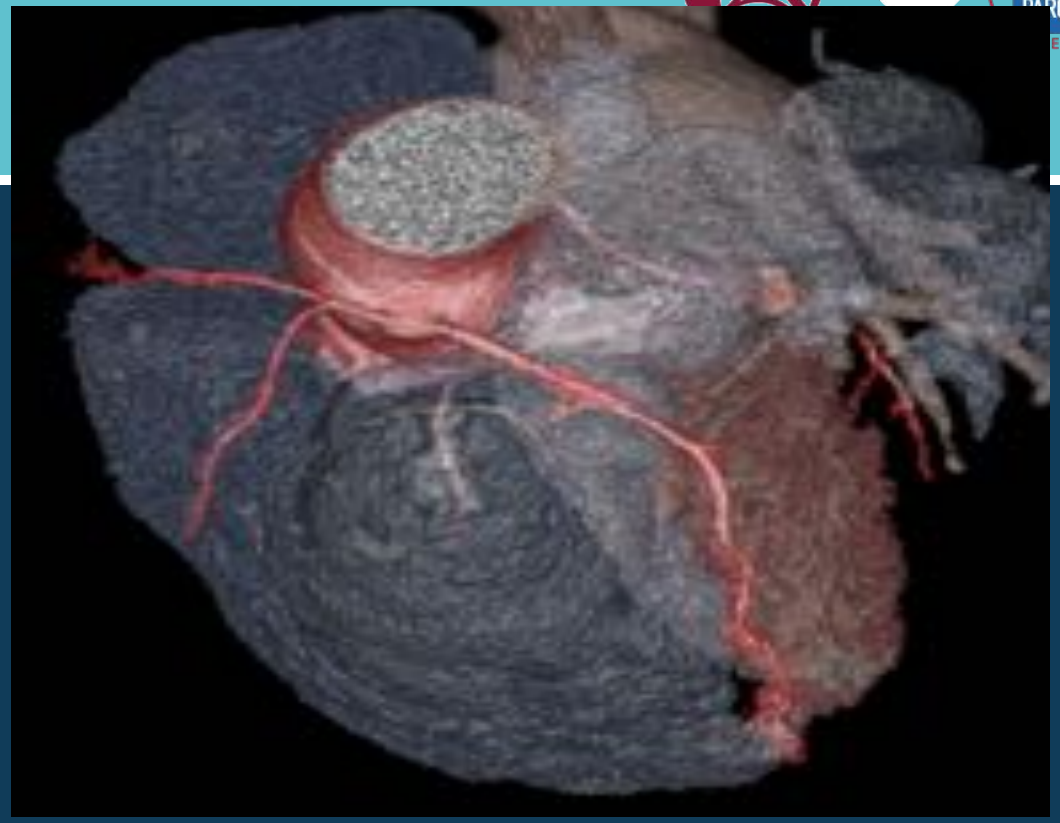
- Limits of CMR
  - Cost (comparison with TTE)
  - No portability
  - Availability
  - Artifact for implants with stainless steel
  - Contraindication for PM and defibrillator

Role of CT

Excellent spatial resolution: coronary artery and distal pulmonary branches

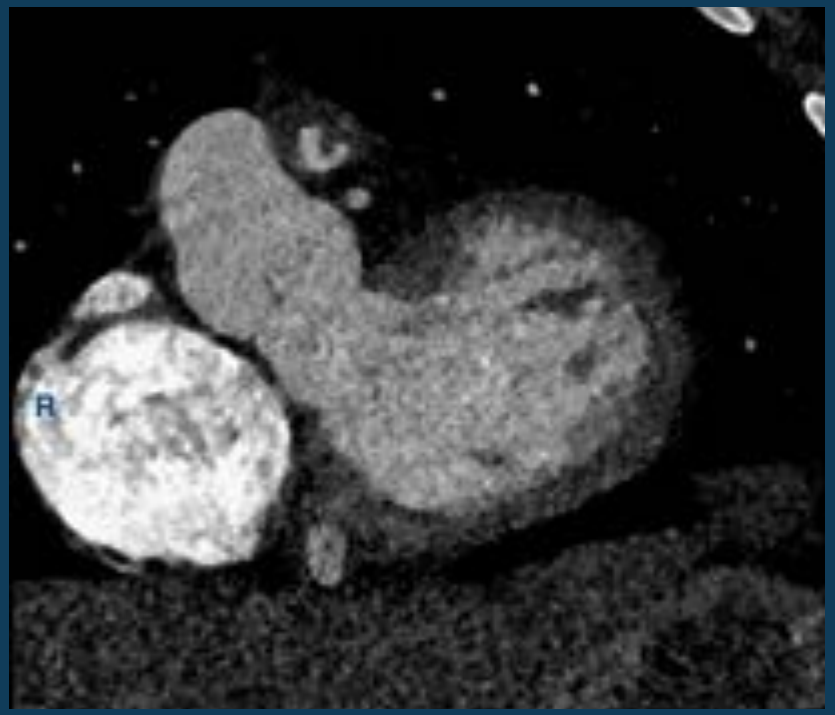
CT

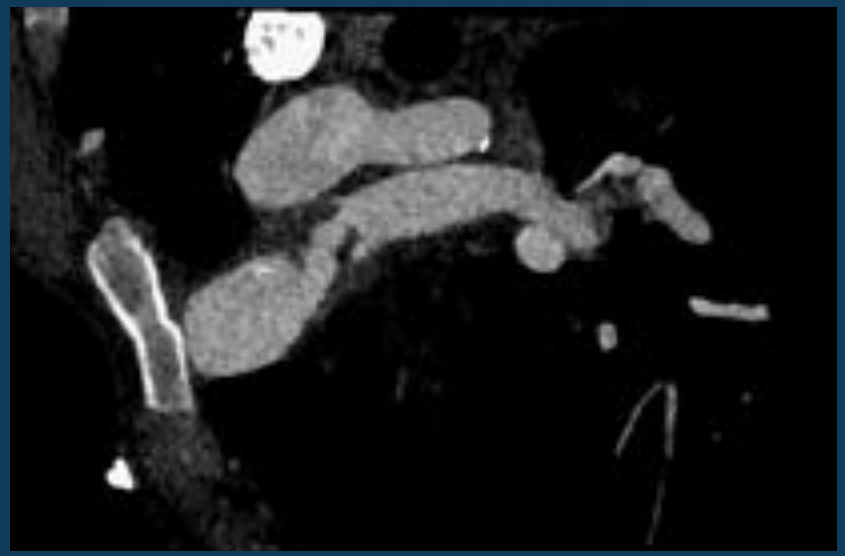




- Limits of CT
  - Ionising radiation
  - Lower temporal resolution
  - Non hemodynamic information on flow rate and velocity
  - Risk of contrast in patient with impaired renal function.
- Given the young age of this population, MDCT should be reserved in patients with absolute contraindication to CMR
- Specific TASK = endocarditis after Pulmonary Valve Replacement

Endocarditis in Fallot Disease and CT





Take home messages

- In Fallot disease, CMR is the reference standard for quantification of
  - RV size
  - RV function
  - Pulmonary regurgitation

- Other information provided by CMR: LV function, myocardial fibrosis, Anatomy of pulmonary tree and aorta.
- CT should be reserved in patient with CI to CMR, and is notably useful for stent visualization and coronary anatomy