Echocardiographic assessment of TGA after Atrial switch repair

Session 6. Transposition of the great arteries
Multimodality Imaging in ACHD and PH

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Transposition of the Great Arteries

- **Mustard** and **Senning** operations establish appropriate connection
  - between systemic venous pathways and subpulmonic ventricle
  - between pulmonary venous pathway and the systemic ventricle

- At the expense of a morphological RV support systemic circulation
Atrial switch operation

Mustard Procedure:
Uses baffles made from Dacron, GoreTex or pericardial tissue to redirect flow
Atrial switch operation

Senning Procedure:
Uses tissue from the right atrium and the atrial septum to redirect flow.

Diagrams from Popelova et al
Post-operative Sequelae

Baffle problems

- **Baffle obstruction**
  - SVC baffle obstruction more common following Mustard operation
  - PV baffle obstruction is more common following Senning operation
  
  5-10% superior, 1% inferior

- **Baffle leaks**
  - Small leaks are common and not haemodynamically important, except in the case of cryptogenic stroke
  - Large leaks are rarer but important due to associated volume overload

  25% 1-2 re-op%
Post-operative Sequelae

- **Systemic RV**
  - Hypertrophy
  - Dilatation (lack of reference values for systemic RV)
  - Systolic function invariably deteriorates over time

- **Tricuspid regurgitation**
  - TR is predominantly due to annular dilatation and is likely functional rather than due to primary organic abnormality.

In rare cases, structural tricuspid valve abnormalities also exist.
Post-operative Sequelae

- **LV outflow obstruction**
  - Produces PS and protects pulmonary arterial bed
  - Can be dynamic or fixed
  - 33%

- **Pulmonary hypertension**
  - Especially in those with prior VSD and those repaired later in life
  - Can cause LV dilatation and loss of usual sub-pulmonary LV crescent shape
  - 7%
### Table 6 Standard protocol for postoperative echocardiographic evaluation after the AtrSO (transthoracic and transesophageal imaging)

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*MR, Mitral regurgitation.*

(J Am Soc Echocardiogr 2016;29:571-621.)
Baffles - Pulmonary venous return:

Posterior of the superior tunnel and anterior of the inferior tunnel
Baffles - Pulmonary venous return

Pulmonary venous atrium (PVA) = RA
Can be used as landmark
What is What?

Diagram showing the heart with labeled parts:
- RV (Right Ventricle)
- LV (Left Ventricle)
- RA (Right Atrium)
- LA (Left Atrium)
- Right PV (Right Pulmonary Vein)
- Left PV (Left Pulmonary Vein)

Text box: Pulmonary venous atrium
How can we visualise the inferior baffle?

Inferior baffle:

Angulation of the transducer to posterior
How can we visualise the inferior baffle?

Apical view: Inferior tunnel

Inferior baffle = Systemic venous return

PSSAX view: Inferior tunnel
Inferior baffle obstruction

No collaps of IVC
How can we visualise the superior baffle?

PSLAX: Superior tunnel
Superior baffle evaluation
Pulmonary venous pathway

- Elevated flow velocity >1.0m/s but flow still returns to baseline suggests mild stenosis.
- Continuous flow which never returns to the baseline suggests significant stenosis.
- The waveform is the most important indicator of obstruction rather than velocity.
What is this?

What happens with exercise?
Biplane imaging for baffle leaks
RV of two layer myocardial fibers

Longitudinal and circumferential contraction
RV is a volume pump

Change of shape

- RV becomes spherical

Contraction pattern changes

- Contraction pattern looks more like a LV contraction pattern

Pettersen et al, JACC 2007
RIMP (Tei index)

- RIMP = TCO – ET / ET
- Isovolumetric contraction, Isovolumetric relaxation time and ejection time
- Systemic RV: there is a relation between Tei-index and prognosis
Systemic RV systolische function

Global systolic RV function
- RIMP
- RV FAC
- 3D echo EF

Longitudinal RV function
- TAPSE
- DTI
- RV strain en strain rate
Systemic RV systolische function

Global systolic RV function
- RIMP
- RV FAC
- 3D echo EF

Longitudinal RV function
- TAPSE
- DTI
- RV strain en strain rate?
Small LV

- Small crescent shaped LV
- A dilated LV suggestive of LV pressure or volume overload
- Parallel relationship of the great vessels
Small LV

- Small crescent shaped LV
- A dilated LV suggestive of LV pressure or volume overload
- Parallel relationship of the great vessels
LVOT obstruction
Pulmonary hypertension

- Vmax velocity of MR
- All other parameters to assess pulmonary pressures can be used
Summary

- Atrial switch is very rarely used for TGA in this era
- Imaging is challenging
- There is still ventricular-arterial discordant
- Potential complications occur with Senning or Mustard operation, such as
  - Venous pathway stenosis and/or leaks
  - RV dysfunction and TR
  - Pulmonary hypertension
Thank you for your attention