The Fetal Heart – above and beyond the Four Chamber View!

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Learning objectives

• Screening protocols
• Improve detection
• Counselling
• Referral of cases
• Manage CHD
Screening protocol – 5 transverse planes
5 Planes

1: Abdominal Situs
2: 4 chamber
3: Aortic root
4: Pulmonary Artery
5: 3 vessel and tracheal

Yagel et al.
Ultrasound Obstet Gynecol 2001; 17(5):367-369
First step - which way is the baby lying?
5 Planes
Plane 1: Normal Situs
Plane 1: Normal Situs
Plane 2: Four chamber View

- Cardiac size
- Pericardial effusions
- Regular rhythm
- Apex to left – axis
- Chamber identity
- Left atrium posterior
- RV anterior
- FO to left
Plane 3: Aortic valve

Aortic valve lies in the centre of the heart
Plane 4 a: Crossover to Pulmonary artery

Pulmonary trunk goes from anterior chest wall to spine and divides
Plane 4 b: Pulmonary artery branches

Pulmonary trunk divides to form right and left branches and arterial duct
Plane 4 to 5: 3 VV to 3 VT view
Plane 5: 3VT view

svc
trachea
Ao
Duct
What constitutes a normal aortic arch?

1. **Size of duct to aorta**
   - Symmetrical arches
   - Isthmial:duct ratio >0.75

2. **Side of arch (trachea)**
   - Should pass to left of trachea
   - A right arch may be normal
   - Cardiac malformations & 22q11

3. **Is there a Left SVC?**
   - If present, CHD or important extra-cardiac malformations more likely

4. **Direction of flow**: same direction, without areas of continuous flow
Pulmonary and systemic veins
Producing excellence in CHD screening

• Use an expert team to set standards
• Develop an effective training programme for primary screeners in their hospitals
• Audit – good IT support to produce reports
• Rolling educational programme
• Interested multi-disciplinary team
• Motivators for improvement
Plane 1: Normal Situs

Infers left atrium on fetal left and right atrium on fetal right.
Other vessel arrangements are abnormal

Mirror image  Left isomerism  Right isomerism
Steps to improve detection of CHD

- Distinguishing right from left structures
- Gain confidence in assessing cardiac connections
- Assess direction of arch blood flow to spot duct-dependent lesions
- Refer suspicions to fetal medicine/cardiology
- Understand the feedback!
- Train colleagues
Plane 2: Atrial Identity

Coronary sinus - left atrium
Pectinate muscles
Shape of appendages
Plane 2: Four chamber view

- Foramen flap LA
- MV attaches to LV free wall
- TV has RV septal attachments
- Off-setting of the inlet valves
- Moderator band in RV
What is wrong with this 4 chamber view?
Characteristic features

- Foramen flap LA
- MV is bicuspid
- TV is tri-leaflet
- RV is anterior in the chest
- Aorta lies centrally
Abnormal spatial relationships

MV on fetal right
Plane 3: Critical aortic valve stenosis

Left atrial enlargement
Mild LV dilatation
Left heart disease – 4 chamber alone

Normal

Foramen flap to right
Normal Foramen flow

Right to left flow – assess 4 chamber or coronal views
Foramen flow

Bidirectional flow – assess pulmonary vein Doppler
Septal defects: ventricular components

3 components to a ventricle:
- Inlet portion (valves)
- Trabecular portion (muscular and apical part)
- Outlet portion (supporting Aortic and Pulmonary valves)
AVSD

Common atrioventricular junction
Common AV valve
Variable size of septal defects
Tetralogy of Fallot

4 chamber view may look normal
Planes 3-5: sweep from aorta to 3VT

Aorta sweeps to fetal right – ballerina’s foot
Pulmonary artery crosses over aorta and runs from sternum to spine, continuing as arterial duct
Tetralogy of Fallot: PA<Ao
No arterial cross-over - TGA

No spiral relationship of arterial trunks
Discordant VA connection
No arterial cross-over: cTGA or double discordancy

No spiral relationship of arterial trunks
Discordant VA connection
No arterial cross-over: DORV

AV concordance with DORV and anterior aorta
CoA suggested by 4 chamber disproportion

Other non-cardiac causes include: aneuploidy, anaemia
Coarctation - arches

Normal

CoA
What is a Duct Dependent lesion?

Aortic arch

Ductal Arch
Understanding the isthmus and coarctation
Challenges of screening

• Trained team
• Equipment – proper cardiac settings
• Short time to perform the examination
• Experience in malformations – feedback from a cardiac centre
Conclusions

5 transverse views will suggest abnormalities

Specific features may help detect CHD at screening

Close collaboration between obstetricians and technicians, MFM and cardiology will improve education and screening performance