Objectives

- Fetal cardiology pre-test
- Introduction
- Embryology and Physiology of fetal heart
- Timing of procedure
- Indications
- Basic fetal echo procedure/technique
- Cases
- Conclusions

Introduction

- CHD is the most common birth defect
- Incidence is about 8 to 9/1000 live births
- Most neonates with CHD have no pre-identified risk factor, but several risk factors are known to cause cardiac defects (indications for fetal echo)
- Screening test required for all pregnancies (basic 4 chamber & extended basic 2nd trimester OB ultrasound)
- Overall better outcome has been found with pre-natal detection of CHD
- Early pre-natal diagnosis needed for possible fetal cardiac surgery
Embryology of the heart

- Human heart is morphologically complete by 8wks post conception. Heart beat starts at 4wks

Cardiac Size

20 week fetus’ heart compared with an American quarter
Usual HR 120-160/min

Physiology — Fetal Circulation

Essential pathways of fetal circulation:
- Fossa ovalis (PFO)
- Ductus (PDA)

NEVER TRUST A NEONATE
Physiology- cont.

Timing & Indications for Fetal echo

- Timing: Optimum time 18 to 22 wks. (>30 wks difficult as fetus crowded in the amniotic cavity)
- Reasoning: Heart large enough to see details, ribs not as dense, varied positions
- Indications: Maternal risk factors
  - Fetal risk factors
  - Familial risk factors

Maternal risk factors

- Maternal congenital heart disease
- Cardiac teratogen exposure eg, lithium, folate antagonists, organic solvents, thalidomide, anticonvulsants, isotretinoin, paroxitene
- Maternal medical illness eg, diabetes, phenylketonuria, anti Ro/SSA or anti La/SSB antibodies (lupus)
Maternal risk factors, cont.

- Exposure to prostaglandin synthetase inhibitors (can cause premature closure of the ductus arteriosus in the third trimester)
- Rubella infection in the first trimester
- In vitro fertilization

Fetal risk factors

- Suspected cardiac anomaly during basic sonogram
- Extracardiac anomaly, Hydrops, Abnormal fetal situs
- Arrhythmia
- Chromosomal anomalies
- Increased nuchal translucency
- Monochorionic twins, with or without twin to twin transfusion syndrome

Familial risk factors

- Previous child with congenital heart disease
- Paternal CHD
- Syndromes that have CHD eg. Noonans, tuberous sclerosis, Digeorges & other autosomal dominant syndromes)
### Standard Fetal Heart Procedure
- Evaluate Heart Rate and Function.
- Evaluate the Abdominal and Atrial Situs.
- Evaluate the Atrial-Ventricular Connections.
- Evaluate the Ventricular-Arterial Alignment.
- Evaluate the Great Arteries relationship to each other.
- Sequential segmental analysis

### Segmental analysis

<table>
<thead>
<tr>
<th>4 Segments</th>
<th>3 Connections</th>
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</thead>
<tbody>
<tr>
<td>Great veins</td>
<td>Venoatrial</td>
</tr>
<tr>
<td>Atria</td>
<td>Atrioventricular</td>
</tr>
<tr>
<td>Ventricles</td>
<td>Ventriculoarterial</td>
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<tr>
<td>Great arteries</td>
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</tbody>
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### 2-D Screening Fetal Cardiac Exam
- Highest possible transducer frequency & frame rate to maximize image resolution. Adjust focal zone & zoom to area of interest, minimize depth
- Find 4 chamber view, transverse section through fetal thorax, rotate 90° to obtain short axis
- Atria & ventricles should be fairly equal in size
- Floppy foramen ovale tissue/flap in the LA (R→L shunting)
- RV can be identified by the moderator band and should be anterior to the LV
Fetal cardiac exam- multiple views

• Four/Five chamber- atria, ventricles, septae, pulmonary veins, semilunar valves
• Long axis- superior and inferior vena cava, great vessels, ductus arteriosus
• Short axis/ductal arch- pulmonary veins, caval connections, ductus arteriosus, ventricular outflow, branch pulmonary arteries
• Aortic arch-head vessels

Fetal Chest - 4 Chamber View

2-D Fetal Cardiac Exam

A normal fetal heart is

Symmetric, axis 45° left
The outflow tracts cross at around $90^\circ$.

Factors influencing the Quality of the Fetal Echocardiogram

- Maternal Obesity
- Poly/Oligo hydramnios
- Too young or old fetus
- Previous Abdominal Surgery
- Fetal Position

Cases

- Normal fetal echo
- Abnormal 4 chamber views
- Great artery abnormalities
- Miscellaneous
Cardio-thoracic ratio

Cardio-thoracic ratio

4 chamber view
Abnormal 4 chamber view- HLHS

AV CANAL

Abnormal 4 chamber- VSD
VSD

VSD in short axis

VSD in short axis
Conclusion

- Pts. with abnormal OB scan, pts. at risk of having an infant with CHD- All need in-depth fetal echocardiogram
- Identifying cardiac infants prior to birth, with delivery at tertiary cardiac centers have an overall better prognosis
- Families are better prepared and know what to expect
- Most of the time Fetal echo is a fun game of puzzle