Congenital Heart Disease for the Adult Sonographer: How Do I …

Image with Segmental Analysis

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Lesson Objectives:

The participant will be able to:

- Improve patient care through segmental approach.
- Improve sonographer/MD communication.
- Improve efficiency in congenital heart disease echo exam.
- Increase congenital heart disease awareness amongst all sonographers.
- Assure complete classification of cardiovascular morphology and physiology in any patient with congenital heart disease.
Why is using a segmental approach important?

- More and more children with congenital heart disease are reaching adulthood; palliated, repaired and un-repaired.
- Necessary in order to describe, visualize, document and communicate findings adequately.
- Increases understanding of structural, hemodynamic, and functional aspects of congenital heart disease.
- Improves patient care.
What is it?

• A methodical description of the anatomical and hemodynamic inter-relationship of cardiac structure, function and physiology.

How is it applied?

• Utilize multiple echo planes to visualize all cardiac structures and related viscera.
Who can do it?
• All sonographers and physicians.

When is a segmental approach necessary?
• Anytime a patient with complex or substantial congenital heart disease lesions is being evaluated by echo.
• Anytime when a standard approach is confusing due to abnormal and/or complex structural or surgical anatomy.
Transthoracic technique

- If parasternal images are bizarre or confusing, move to the apical or subcostal views.
- If known complex congenital heart disease exists, start from either the apical or subcostal view.
- Pay special attention to proper transducer orientation.
- Utilize all available echo windows.
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Back to the Basics

• Cardiac anatomy
• How the blood flows
Determination of cardiac location and situs

- Two major organ groups
  - The abdominal viscera
    - positions of liver, stomach, spleen, and abdominal great vessels (aorta and inferior vena cava)
  - The atria (cardiac situs)
    - Arrangement of the atria

- Three possible positions of the organ groups
  - Solitus – normal position
  - Inversus – mirror image of normal
  - Ambiguous – complex, spatial arrangement of the organs
Abdominal situs

• Situs Solitus
  – Normal arrangements
  – Left stomach, left spleen, right liver, right tri-lobed lung

• Situs Inversus
  – Inverted arrangements
  – Right stomach, right spleen, left liver, left tri-lobed lung
Abdominal situs

- **Left Atrial Isomerism (Polysplenia)**
  - Bilateral left-sidedness
  - Multiple spleens, often interrupted IVC.

- **Right Atrial Isomerism (Asplenia)**
  - Bilateral right-sidedness
  - No spleen
    - Often PS/PA, dextrocardia, AVC defect, TAPVC, no coronary sinus.
Cardiac Location

- **Cardiac Position**
  - Levoposition
  - Mesoposition
  - Dextroposition

- **Cardiac Orientation**
  - Levocardia
  - Mesocardia
  - Dextrocardia
• Venous segment
  • Veno-atrial connection
• Atrial segment
  • Atrioventricular connection
• Ventricular segment
  • Ventricular-great arterial connection
• Great arterial segment
Venous Segment

- **Systemic veins**
  - Inferior vena cava
  - Superior vena cava
  - Coronary sinus
  - Hepatic veins

- **Pulmonary veins**
  - Right upper and lower veins
  - Left upper and lower veins
Atrial Segment

- **Right Atrium**
  - Large pyramidal appendage
  - Terminal crest
    - (crista terminalis)
  - Pectinate muscles
  - Receives caval veins and coronary sinus
    - Variable feature

- **Left Atrium**
  - Small fingerlike appendage
  - No pectinate muscles
  - Receives pulmonary veins
    - Variable feature
Atrioventricular Valves

- **Tricuspid Valve**
  - Low septal annular attachment
  - Septal cordal attachments
  - Triangular orifice
    - (mid-leaflet level)
  - Three leaflets and commissures
  - Three papillary muscles
  - Empties into right ventricle
Atrioventricular Valves

- Mitral Valve
  - High septal annular attachment
  - No septal cordal attachments
  - Elliptical orifice
    - (mid-leaflet level)
  - Two leaflets and commissures
  - Two large papillary muscles
  - Empties into left ventricle
Atrioventricular Connection
- Concordant
- Discordant
- Ambiguous
- Double inlet
  - Univentricular
- Single inlet
  - Atresia
- Common
Atrioventricular Connection

- AV valves follow the ventricle
- Can be right and left straddling, overriding
- Functional assessment
  - Normal
  - Regurgitation
  - Hypoplasia (atresia)
  - Obstruction/Stenosis
Ventricular Segment

• Right Ventricle
  – Tricuspid-pulmonary discontinuity
  – Muscular outflow tract
  – Septal and parietal bands
  – Large apical trabeculations
  – Coarse septal surface
  – Crescentic in cross-sections
  – Thin free wall
  – Receives tricuspid valve
Ventricular Segment

- **Left Ventricle**
  - Mitral-aortic continuity
  - Muscular-valvular outflow tract
  - No septal or parietal band
  - Small apical trabeculations
  - Smooth upper septal surface
  - Circular in cross-section
  - Thick free wall
  - Receives mitral valve
Semilunar Valves

- **Aortic Valve**
  - Tri-leaflet valve
  - Empties into the ascending aorta
  - Coronary arteries

- **Pulmonary Valve**
  - Tri-leaflet valve
  - Empties into the pulmonary trunk
Ventriculoarterial Connection
- Describes the junction of ventricular outflow into the great arteries
  - Concordant
  - Discordant
  - Double outlet
  - Single outlet
  - Common outlet
Ventriculoarterial Connection

- 50% rule
- Fibrous continuity
- Visualize the amount of override
- Evaluate outlet orientation to each other and ventricle
Great Arterial Segment

- Solitus
- Side-by-side
- Transposed
  - refers to abnormal relation of the great arteries to each other
    - d-looped
    - l-looped
    - Anterior
Great Arterial Segment
- Describes the presence, absence, origin, size, position and anatomic deformities

• Aorta
  - Ascending aorta
  - Aortic arch
    • Brachiocephalic
    • Left common carotid
    • Left subclavian
  - Descending aorta

• Pulmonary Artery
  - Main and branch pulmonary arteries
  - Ductus arteriosus
Blood Flow

• Describe the blood flow into and out of the heart in a methodical manner.
Summary

• Segmental approach provides a framework that can support the understanding of any congenital heart defect.

• Can help the sonographer and physician define anatomy in simple terms, using segments and connections.
  – Use descriptive terms what you can identify and state what you cannot.

• Guides the sonographer in obtaining all echocardiographic images to better understand congenital heart disease.

• Improves patient care.
References

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