Cardiopulmonary Disease

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RESPIRATORY DISTRESS IN CONGENITAL HEART DISEASE (CHD)

- Cardiac etiology
- Pulmonary etiology

Respiratory symptoms due to cardiac etiology are expected to improve with treatment of the underlying condition.
Site of abnormality

- Airway abnormalities
- Lung abnormalities
- Pleural and thoracic cage abnormalities

Time of onset of symptoms

- Preoperative
- Immediate postoperative
- Late postoperative
CARDIOPULMONARY DISEASE

- Persistent respiratory distress in the form of failure to extubate or wean from ventilatory support is a hallmark for cardiopulmonary disease especially in small children.
- Airway abnormalities are often the cause

Radiologists are quite often among the first to be consulted in the evaluation of these children.
AIRWAY ANOMALIES ASSOCIATED WITH CHD

Intrinsic
- Stenosis
- Malacia

Extrinsic
- Vascular ring
- Compression by dilated structures such as pulmonary artery, left atrium
- Postoperative causes such as vascular stent

Often both coexist
IMAGING : CHEST XRAY

- Direct evidence
  Narrowing of the airway
- Indirect Evidence
  Deviation of airway
  Hyperinflation
  Atelectasis
LATERAL CXR- AIRWAY NARROWING
CXR: AIRWAY DEVIATION
CXR : HYPERINFLATION/ATELECTASIS

Pulmonary sling with distal tracheomalacia and proximal left bronchomalacia
IMAGING : CT

Modality of choice
- Widely available
- Quick to perform
- Simultaneous assessment of airway and vascular structures
- Multiplanar and 3D reconstructions
CT Techniques

- Single phase
- Multiple pulmonary phase
SINGLE PHASE CT FOR CARDIOPULMONARY DISEASE

Technique

- Helical $\approx 3$ mSV
- Wide-detector $\approx 1$ mSV

16 detector
RIGHT ARCH WITH ABERRANT LEFT SUBCLAVIAN ARTERY.

Narrowing of trachea and RUL bronchus stenosis
MULTIPHASE CT: TECHNIQUE

- Wide-detector acquisition
- Imaging over one entire breath
- Multiple pulmonary phases
DYNAMIC PULMONARY CT

• Wide-detector (entire Z-axis)
• Continuous scan mode
  • 4 rotations
  • 1.4 seconds
DYNAMIC PULMONARY CT

- Respiratory rate (ideal 40 / minute)
- Radiation exposure ($\approx 1.5$ mSV)
  - $80$ kVp
  - $mA = \left[ (kg \times 2.5) + 5 \right] \div 0.35$
DYNAMIC PULMONARY CT

- Advantages
  - Dynamic airway imaging
  - Dynamic pulmonary imaging
  - Simultaneous vascular imaging
- Indications
  - Complex physiology
  - Post operative imaging
COMPLEX CHD: FAILURE TO EXTUBATE

Right arch and Dextrocardia.
Distal tracheomalacia and right main bronchomalacia
EBSTEIN ANOMALY
EBSTEIN ANOMALY

Narrowing of distal left bronchus between LPA and descending thoracic aorta
RESPIRATORY DISTRESS: POST HYBRID PROCEDURE

Extrinsic compression of right upper lobe bronchus by PDA stent
In addition there was tracheomalacia and right main bronchomomalacia
RESPIRATORY DISTRESS POST HYBRID PROCEDURE

Air trapping in right upper and lower lobes
CONCLUSION

- Airway abnormalities present as persistent respiratory distress in the form of failure to extubate or wean from ventilatory support.
- CT is an excellent modality to evaluate airway and mediastinal vascular structures.
- Dynamic pulmonary CT is invaluable in the assessment of tracheobronchomalacia.
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