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Cases-Controversies-Updates 2013

The Chest X-ray for Cardiologists

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The request, the clinical information and the image:

- CXR please.
- ? evidence of heart disease
The Radiologist is thinking......and after much thought the Report is made.........
“The heart is enlarged.”
Heart Size

• PA CXR – CTR = 50% - upper limit of normal
  < 55% - prognostically important

• Transverse cardiac diameter < 165 mm in males
  < 150 mm in females

• Change in heart size
Ebstein’s Anomaly

CTR = 49%
Ebstein’s Anomaly – Enlarging heart

CTR = 43%

CTR = 49%
Specific Chamber Enlargement

- RA
- RV
- LA
- LV
Heart Enlarged – Why?
APPROACHES TO THE CXR

- Inspirational (a.k.a. the Aunt Minnie) approach

- Organised (a.k.a. the Larry Elliott*) approach

*“The X-ray Diagnosis of Congenital Heart Disease in Infants, Children and Adults – pathologic, hemodynamic and clinical correlations as related to the chest film” by Larry P Elliott & Gerold L Schiebler. 2nd Edition. 1968
AN ORGANISED APPROACH TO THE CXR

- Technical analysis
- Extra-cardiac analysis
- Physiological analysis
- Anatomic analysis
TECHNICAL ANALYSIS

- Image quality
- Depth of inspiration
- Alignment
EXTRA-CARDIAC ANALYSIS

• Bones & Soft tissues
• Abdomen
• Aortic arch
• Pulmonary trunk
• Azygous arch
BONES & SOFT TISSUES

- Evidence of surgery
- Evidence of inherited syndromes which may be associated with heart disease
- Skeletal abnormalities which may have an association with heart disease
- Skeletal abnormalities which may be caused by cardiovascular disease
THORACOTOMY

- Non-cardiac operation (pulmonary/oesophageal)
- Anastomotic shunt e.g. Blalock-Taussig (L/R), Glenn (R), Waterston (R), Pott’s (L)
- Closure of PDA (L)
- Repair of aortic coarctation (L)
- Pulmonary artery banding (L)
- Mitral valvotomy
Thoracotomy + Sternotomy = cyanotic congenital heart disease
SKELETAL ABNORMALITIES SECONDARY TO CVS DISEASE
ABDOMEN

- Liver
- Spleen
- Stomach
- Hiatus hernia
- Gallstones
Situs (1) - Dextrocardia
Situs (1) – Dextrocardia + Inverted Situs
Situs (2) – Dextroversion
Situs (3) - Dextroconfusion
Ambiguous Situs
SUPERIOR MEDIASTINUM

- Azygous arch
- Aortic arch
Aortic Arch
RIGHT-SIDED AORTIC ARCH

- With aberrant left subclavian artery
  - low incidence of congenital heart disease (10-15%)

- With mirror-image branching:
  - high incidence of congenital heart disease (c.90%)
RIGHT-SIDED AORTIC ARCH associations

- Tetralogy of Fallot 25%
- Pulmonary atresia 30-50%
- Truncus arteriosus 30-40%
- TGA with VSD & PS 5-10%
- Tricuspid atresia 5%
- Large VSD 2-3%
- Asplenia syndrome 30-40%
Right – sided Aortic Arch
CXR – PHYSIOLOGY
PULMONARY VASCULAR PATTERNS

1. Normal

2. Increased
   i) PVH
   ii) PAH
   iii) pulmonary plethora
   iv) systemic supply to lungs

3. Decreased

4. Uneven
NORMAL VASCULARITY & NORMAL HEART SIZE

- Means: **normal cardiac index** and **normal end-diastolic pressure in both ventricles**
- Compatible with:
  - normality
  - coronary artery disease
  - mild valve disease
  - small shunt
NORMAL VASCULARITY & LARGE HEART

• Means: normal cardiac index and normal end-diastolic pressure in both ventricles

• May be due to:
  - pericardial effusion
  - volume overload
  - LVF under treatment
# Pulmonary Venous Hypertension

<table>
<thead>
<tr>
<th>Pulmonary Venous Pressure</th>
<th>CXR Appearance</th>
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<tbody>
<tr>
<td>Up to 19mmHg at rest, or rising on exercise</td>
<td>Upper zone vessels dilated. Lower zone vessels normal.</td>
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<tr>
<td>20-29mmHg at rest</td>
<td>Upper zone vessels larger. Lower zone vessels smaller. Interstitial oedema. Small pleural effusions.</td>
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<tr>
<td>&gt;30mmHg at rest</td>
<td>Alveolar oedema. Larger pleural effusions.</td>
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PULMONARY VENOUS HYPERTENSION
PULMONARY VENOUS HYPERTENSION
PULMONARY VENOUS HYPERTENSION

= post-capillary problem

May be due to:

- obstruction at mitral valve level
- obstruction proximal to the mitral valve
- LV failure from any cause
PVH – why?
PVH – why?
PVH – why?
PVH – why?
PULMONARY ARTERIAL HYPERTENSION

Systolic PA pressure > 30 mm.Hg

CXR Signs:
1. Dilatation of the central (elastic) pulmonary arteries
2. Narrowing of the peripheral (muscular) pulmonary arteries
PAH – why?
PULMONARY PLETHORA

- MEANS: increased flow through the lungs
- CAUSING: enlargement of pulmonary vessels
- INDICATING: a left-to-right shunt
- DUE TO: a left-to-right shunt alone, or a bidirectional shunt
PULMONARY PLETHORA

IS THE PATIENT CYANOSSED?
PULMONARY PLETHORA in an ACYANOTIC PATIENT INDICATES A LEFT-TO-RIGHT SHUNT AT:

- Atrial level
- Ventricular level
- Great vessel level, or
- More than 1 level
Plethora without cyanosis
Plethora without cyanosis
PULMONARY PLETHORA in a CYANOSIZED PATIENT

INDICATES A BI-DIRECTIONAL SHUNT:

5 T’s’ a D & a C:
- Transposition
- Total anomalous pulmonary venous drainage
- Tricuspid atresia
- ”T”ingle ventricle
- Truncus arteriosus
- Double outlet right ventricle
- Common atrium
Plethora with cyanosis
Plethora with cyanosis
Plethora with cyanosis
PULMONARY OLIGAEMIA

Causes

- RV outflow obstruction with right-to-left shunt (at atrial* or ventricular** level)
- RV outflow obstruction without a shunt
- RV inflow obstruction
- RV failure

* heart often enlarged, sometimes huge
** heart size usually normal
PULMONARY OLIGAEMIA
UNEVEN/ASYMMETRIC VASCULARITY – CAUSES

- Apparent
  - technical (rotation, lateral decentering)
  - scoliosis
  - mastectomy
  - Poland’s syndrome
  - pleural disease
- Pulmonary
  - COPD, emphysema, fibrosis, collapse
  - hypoplasia, MacLeod’s syndrome AVM’s
  - surgery
- Cardiovascular
  - pulmonary embolism
  - congenital absence of a pulmonary artery
  - pulmonary artery stenosis
  - aberrant origin of left pulmonary artery
  - extrinsic pressure on hilum
  - hemitruncus arteriosus
  - left-to-right shunt
  - post-operative
Uneven Vascularity
How I report the CXR

1. Is it a good quality radiograph?
2. Anything noteworthy in the bones, soft tissues, diaphragm or upper abdomen?
3. Anything noteworthy in the mediastinum and hila? (i.e. aorta, central PA’s and azygous v.)
4. What is the vascular pattern?
5. Does the cardiac shadow tell me anything else?
6. Cardiothoracic ratio.
7. Any change from previous CXR.
SUMMARY

- Use a disciplined approach
- The pulmonary vascular pattern is the key to diagnosis
- If physiology & anatomy seem not to correlate then go with the physiology