VASCULAR RINGS
A CASE - BASED REVIEW

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Frontal chest radiographs on three different individuals. For each case suggest the most likely diagnosis.

a. No ring or sling
b. Vascular ring very likely
c. Vascular ring unlikely
d. Pulmonary sling very likely
e. Pulmonary sling unlikely
Case 1: 16month girl with respiratory distress
Case 2: 16month girl with respiratory distress
Case 3: 2.5 month girl with respiratory distress
Additional lateral chest radiographs on the same three children. For each case suggest the most likely diagnosis.

a. No ring or sling
b. Vascular ring very likely
c. Vascular ring unlikely
d. Pulmonary sling very likely
e. Pulmonary sling unlikely
Case 1: 16-month-old girl with respiratory distress
Case 2: 16month girl with respiratory distress
Case 3: 2.5 month girl with respiratory distress
Q7,8,9

Contrast esophagrams on the same three children. For each case suggest the most likely diagnosis.

a. No ring or sling
b. Vascular ring very likely
c. Vascular ring unlikely
d. Pulmonary sling very likely
e. Pulmonary sling unlikely
Case 1: 16-month girl with respiratory distress
Case 2: 16month girl with respiratory distress
Case 3: 2.5 month girl with respiratory distress
Q10,11,12

- CT axial images on the 3 cases. For each case suggest the most likely diagnosis.

a. No ring or sling
b. Vascular ring very likely
c. Vascular ring unlikely
d. Pulmonary sling very likely
e. Pulmonary sling unlikely
Case1: 16month girl with respiratory distress
Case 2: 16month girl with respiratory distress
Case 3: 2.5 month girl with respiratory distress
Chest Radiographic Findings Suggestive of a Vascular Ring

- Right Aortic arch
- Descending Aorta on opposite side of arch
- Anterior bowing of trachea (lateral view)
6 month old with recurrent respiratory infections
Vascular Ring

ESOPHAGRAM

• Not necessary if plain film suggests ring
• Confirms likely presence of ring
• May suggest type but not definitive
Imaging Vascular Rings
CT Angiography

- Fast - decreased need for sedation
- .6mm-1mm axial spiral
- Timed/triggered dynamic IV contrast (2-3cc/Kg)
- 2 and 3-D reconstruction
- Pay attention to parameters and radiation dose
- Lower kVp (80 -100)
- Automodulation of mAs (ref mAs 150)
- Breast shield in girls
Imaging Vascular Rings
MR Imaging/Angiography

- Multiplanar capability/many sequence options.
- Need specific sequences to optimally evaluate airway
- Timed/triggered dynamic IV contrast for MRA
- 2 and 3-D reconstruction of images
- No ionizing radiation
- Long study/sedation often required
Vascular Ring – combination of vascular/ligamentous structures encircling the airway

- **COMMON**
  - Double Aortic Arch
  - Right arch, aberrant left subclavian artery + ductus

- **UNCOMMON**
  - Left arch, aberrant right subclavian artery + ductus
  - Right or left circumflex aorta and ductus ± aberrant subclavian artery
  - Mirror image right arch + ductus
Imaging Vascular Rings

KEY FEATURES

• Arch location
• Branching of aorta
• Compression of airway
• Diverticulum of Kommerel
• Descending aorta
DOUBLE AORTIC ARCH

DOUBLE AO ARCH WITH ATRETIC LEFT SEGMENT
DOUBLE AORTIC ARCH
4 symmetric vessels
Bilateral Arches
Ipsilateral carotid and subclavian Branches
Compressed trachea
DOUBLE AORTIC ARCH

Compressed airway
Descending aorta on left
RIGHT ARCH ABERRANT LEFT SUBCLAVIAN ARTERY
2.5yo RAA  ABERRANT LSCA BRANCH, Mild tracheal Compression, Diverticulum, Lt descending AO
LAA ABERRANT RSCA PLUS DIVERTICULUM
LAA ARSCA BRANCH

Mild Tracheal Compression

Diverticulum behind trachea (prior TEF repair) Lt SVC
MIRROR IMAGE RIGHT ARCH RING

ANTERIOR

AA

DA

LT INNOM

AA

DA
Mirror image right Arch Branching
Mild tracheal Compression
Diverticulum
Right descending aorta
Mirror image Rt Arch Branching
Mild tracheal Compression
Diverticulum
Circumflex aorta descending on left
Left Pulmonary Artery Sling

- Left pulmonary artery arises from RPA
- Courses posteriorly between the trachea and esophagus
Type I PA Sling

- Higher level of sling
- N bronchial branching or tracheal bronchus
- Associated compression/malacia (trachea/RMSB)
15yo girl with known VSD
15yo girl with known VSD
Type 1 PA sling
LPA Sling – Chest Radiographic Findings

- May be normal
- Mass posterior to trachea on lateral view
- Unilateral hyperinflation (Type I)
- Bilateral hyperinflation or small right lung (Type II). Low T carina
Type II PA Sling (Ring/Sling complex)

- Low position of PA sling
- Horizontal low carina
- Abnormal airway branching
- Associated long segment airway stenosis
- May be right lung hypoplasia/agenesis
5 week old male with severe stridor
Newborn male with severe respiratory distress
Newborn male with severe respiratory distress

Type IIA LPAS
49 YO F PREVIOUS TOF REPAIR
RIGHT DIAPHRAGMATIC PARALYSIS  DECREASED EXERCISE TOLERANCE

Previously unrecognized Type IIA PA sling and tracheal stenosis
Tracheal stenosis
10 day old with tachypnea
10 day old with tachypnea
5 month old male with persistent respiratory symptoms
SUMMARY

• Vascular rings and slings are often first suspected on the basis of plain chest radiographs.

• There is a wide spectrum of lesions and radiographic appearances.

• Cross-sectional angiography provides the detailed anatomy needed for operative planning of vascular lesions compressing the airway.

• Carefully evaluate and report vascular & airway appearance and relationships.

• Multiple planes, 2D and 3D reconstructions are useful in understanding and communicating the important anatomy.
References
Vascular Ring/Pulmonary Artery Sling


