IMAGISTICAL SEMIOLOGY IN PEDIATRY

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KEY POINTS

1. Radiological investigation in pediatry.
2. CT and MRI examination in pediatry.
3. USG, angiography, scintigraphy, PET CT in pediatry.
4. Special aspects of X-Ray anatomy in children

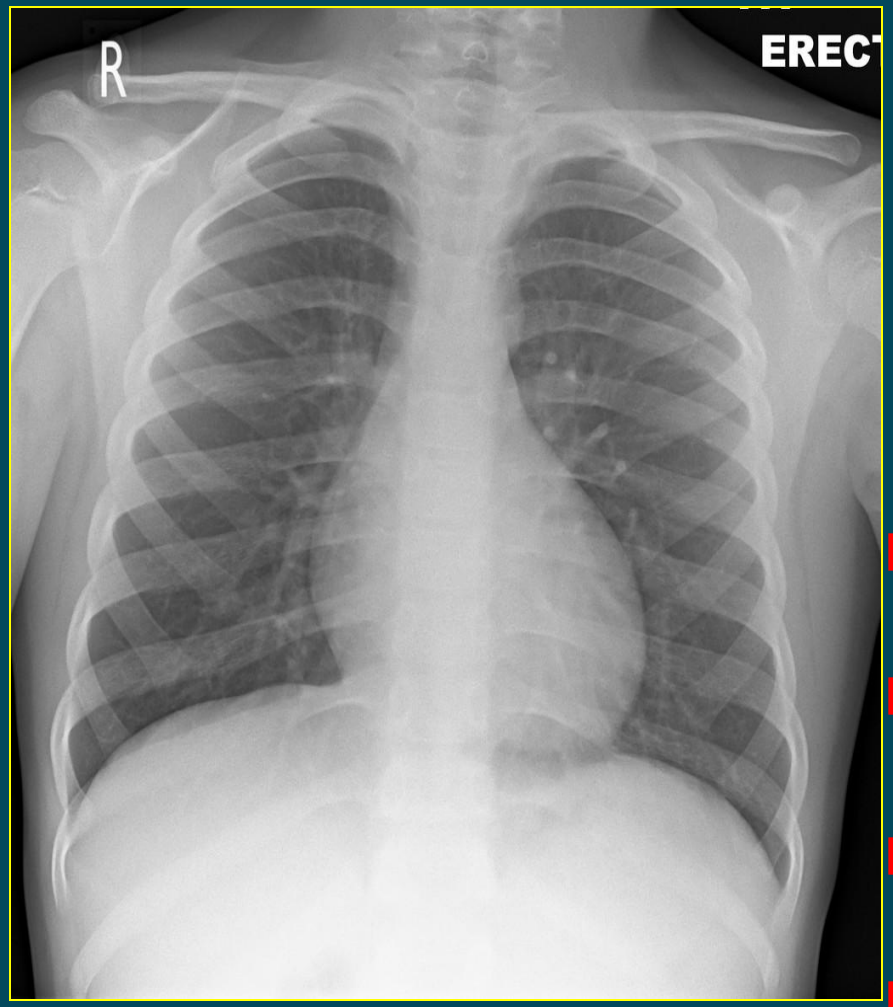
HOMEWORK

Special aspects of X-Ray anatomy in children

Goals for radiological examination in pediatry

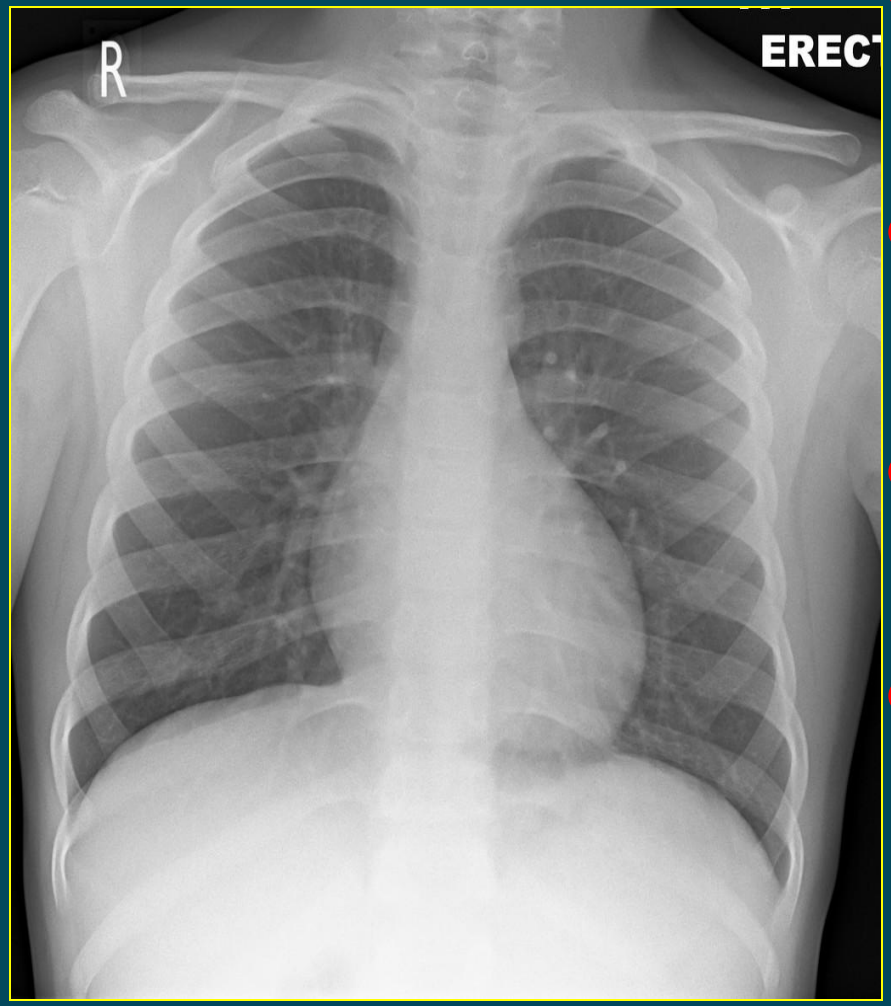
- ***Respitatory deterioration cause confirmation.***
- ***Tube position confirmation.***
- ***Heart and pulmonary vessels position visualisation.***
- ***Trauma visualisation.***
- ***Child scheleton analysis.***

HOW TO UNDERSTAND AN X-RAY



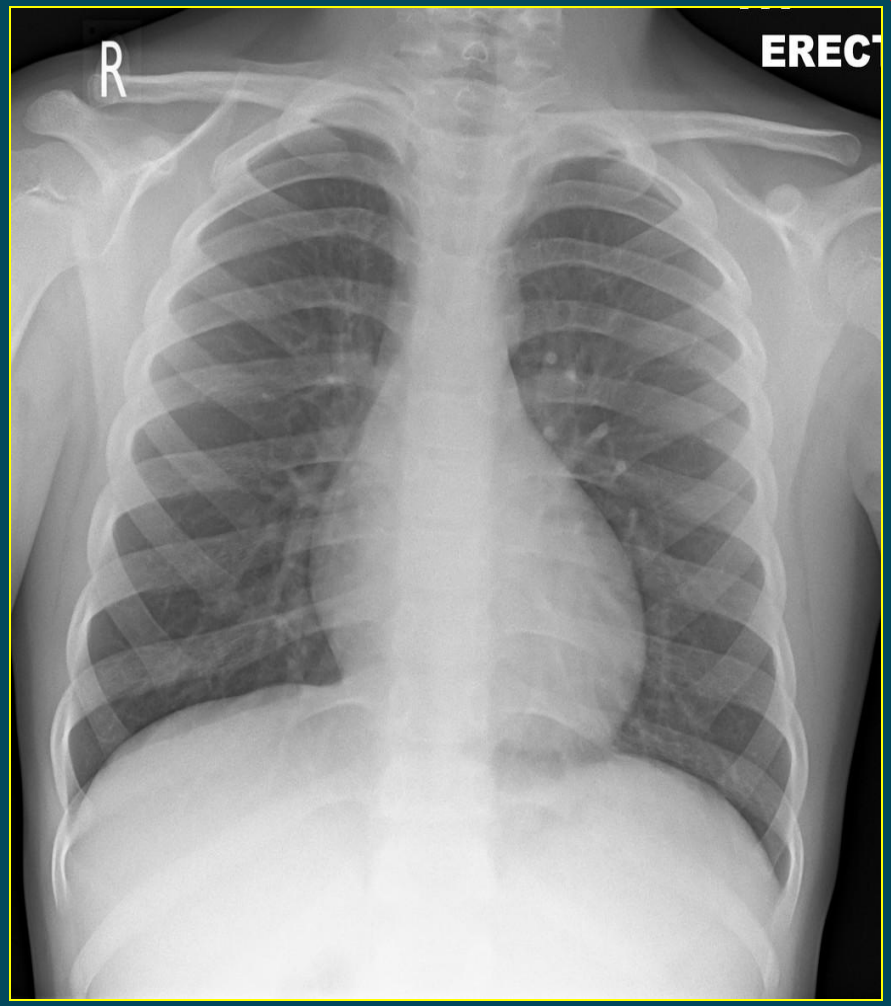
- Whole film examination
- “ABCF” method
- Abdomen
- Bones
- Chest
- Foreign bodies

CHEST



- Trachea
- Mediastinum
- Lung area
- Pulmonary vascularisation
- Pleura

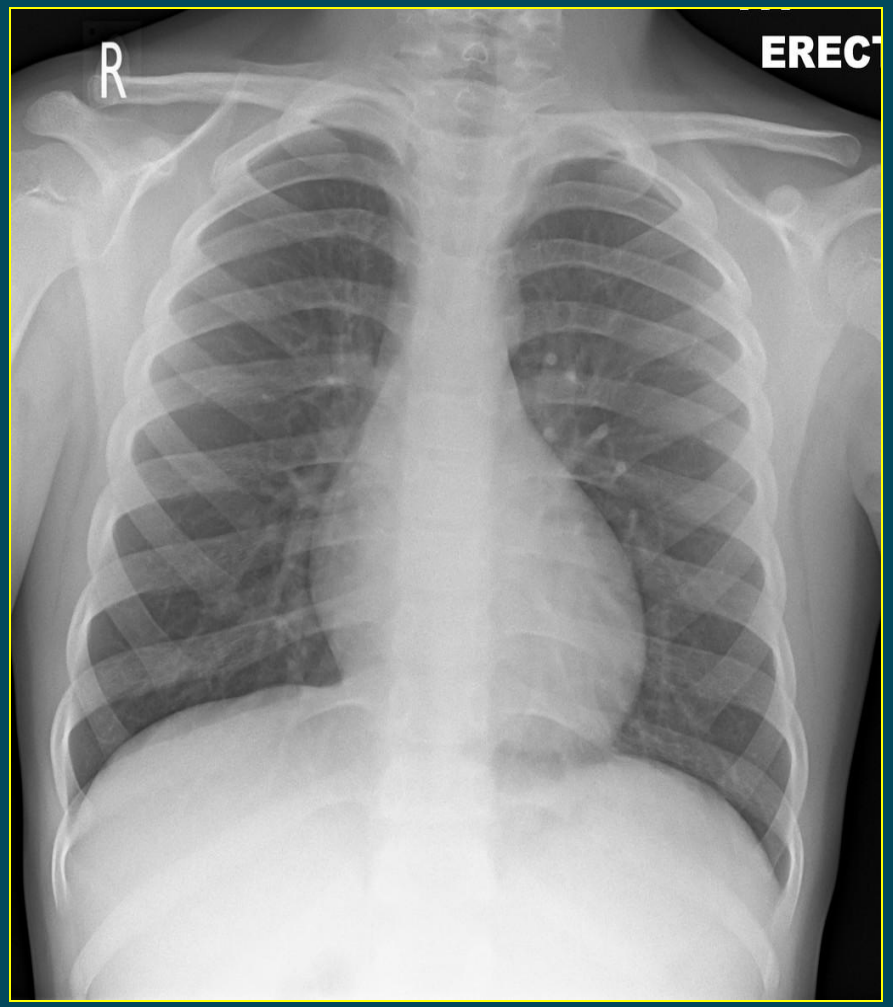
BONES



- Fractures
- Osteolytic or osteoblastic pathologies
- Metabolic bone pathologies
- Anomaly

Abdomen

It is very important to analyse both chest and abdomen!



- **Position of the diaphragm**
- **Presence of air in the stomach fundus**
- **Position of the liver**
- **Intestine gases pattern**
- **Air in the abdominal cavity**
- **Abdominal organs position**

NORMAL PICTURE

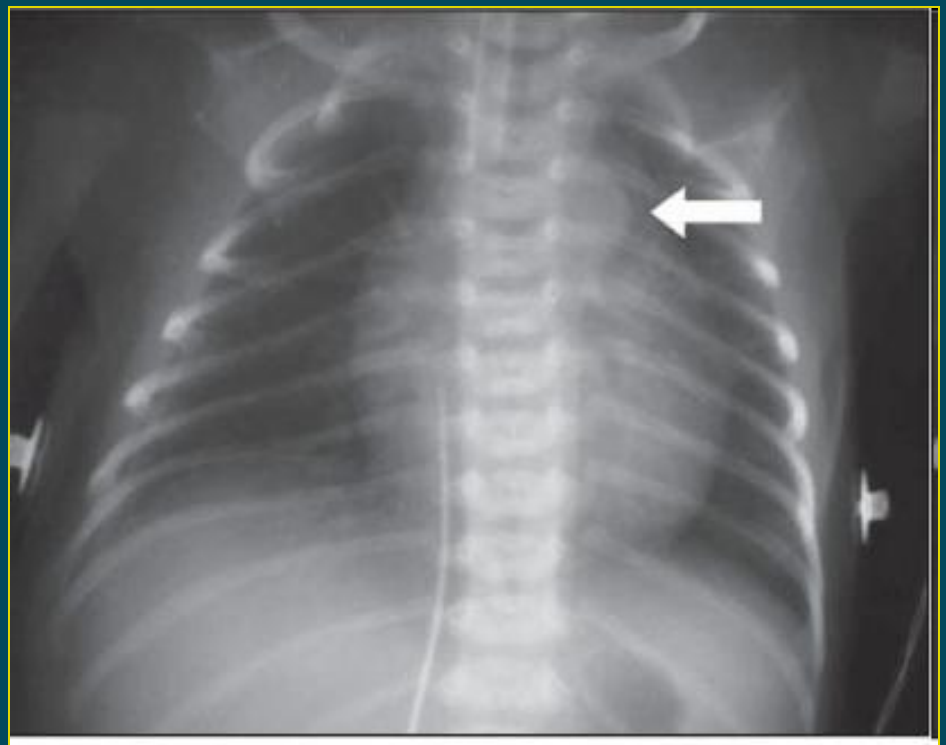
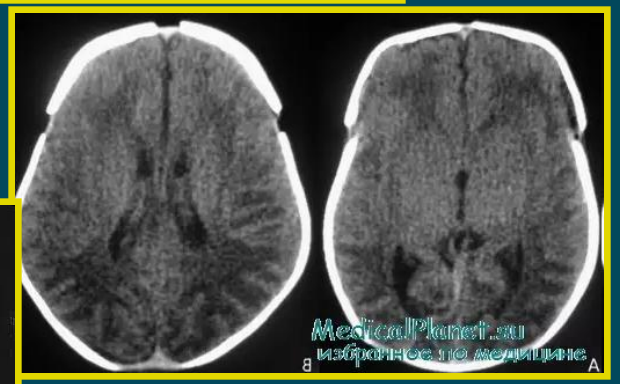
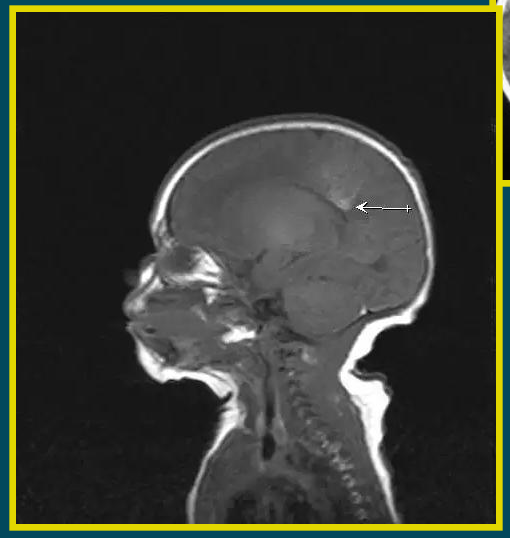


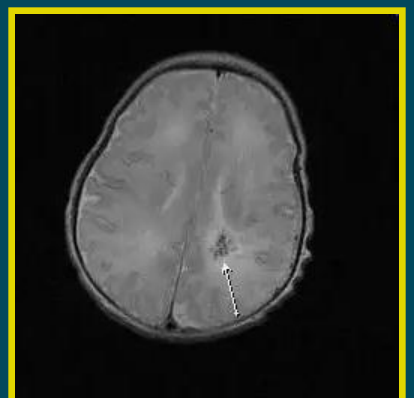
Figure 4. One-day-old newborn infant chest x-ray demonstrating the ductus
bump (arrow).

- Cylindrical form of the chest until 1 year old
- Horizontal position of the ribs until 1 year old
- Visibility of the thymus until 3 year old but can persist until 5-7 year old
- Position of the diaphragm (6/8)

IMAGING METHODS FOR NEWBORN CEREBRAL PATHOLOGIES INVESTIGATION

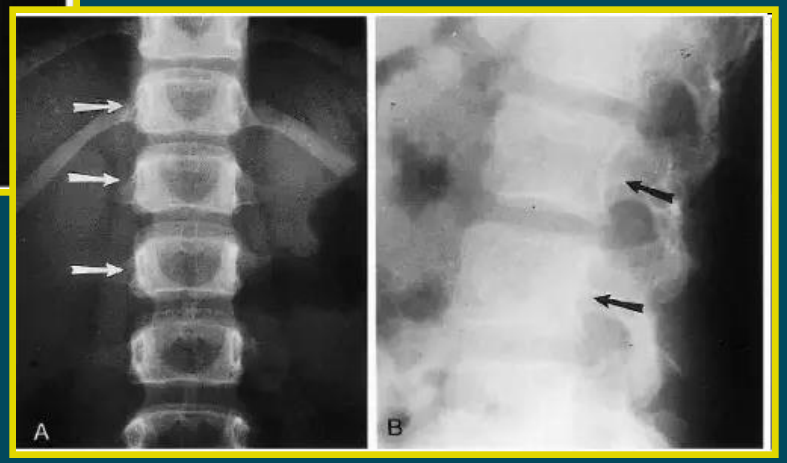






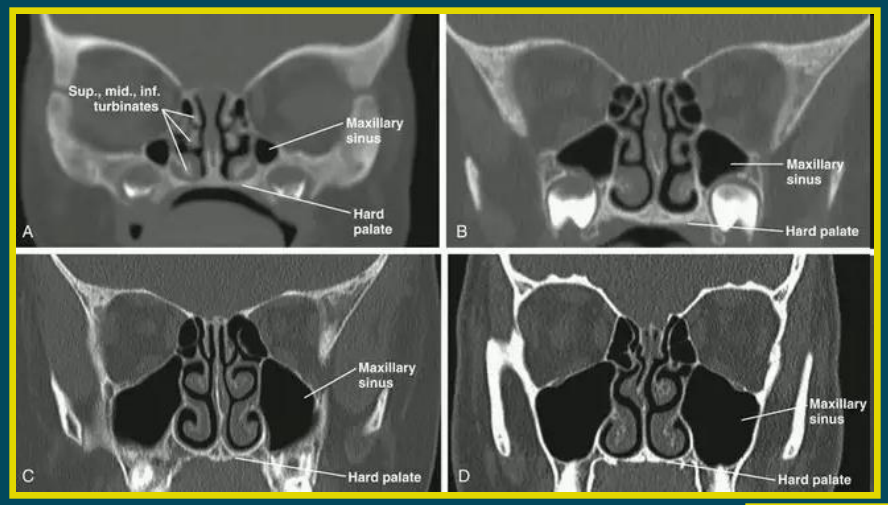
- Ultrasonography is the election and screening method for vessel visualisation within the soft spot
- Computed tomography is used for précising diagnostic, requires contrast media for vessel visualisation, short investigation time
- MRI précising diagnosis, doesn't requires contrast, long investigation time, non-ionising method

RADIOLOGICAL ANATOMY PERCULIARITIES OF CHILDREN VERTEBRA I COLUMN

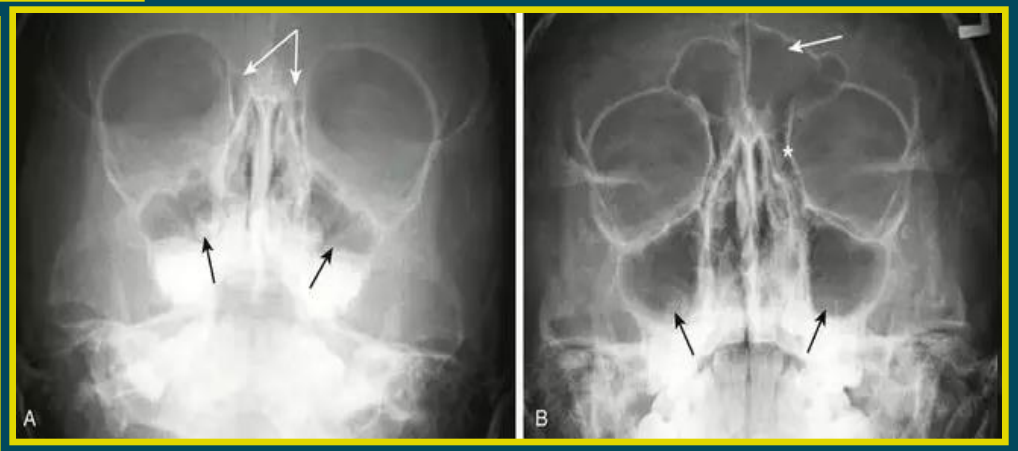


- Convex shape of newborn vertebra
- Intervertebral space is equal to vertebra body dimension
- Physiological curves appears at 6 month
- Before 16 years sacral vertebra are separated

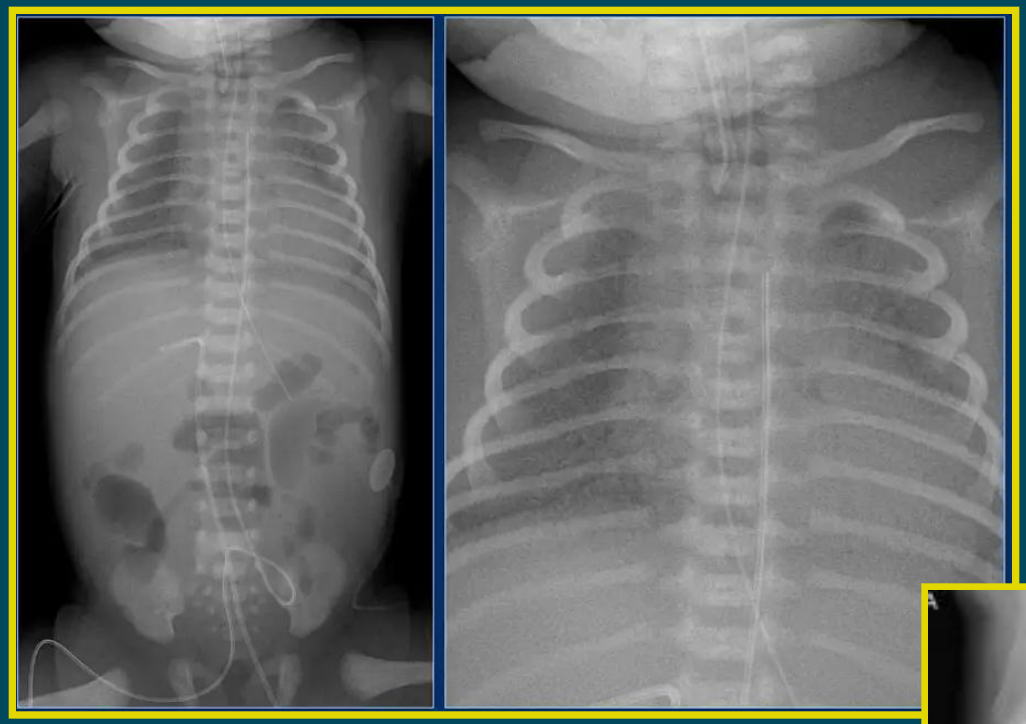
RADIOLOGICAL ANATOMY PERCULIARITIES OF CHILDREN PARANASAL SYNUSES



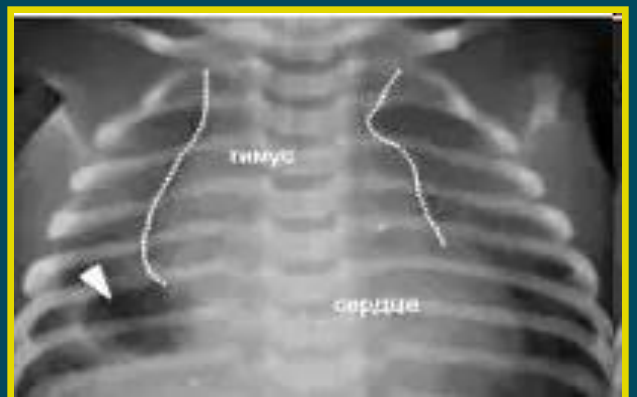
- Aborning appears only maxillary sinus
- Frontal sinus appears at the age of 6-8 years old
- Sphenoid sinus appears the age of 3-5 years old

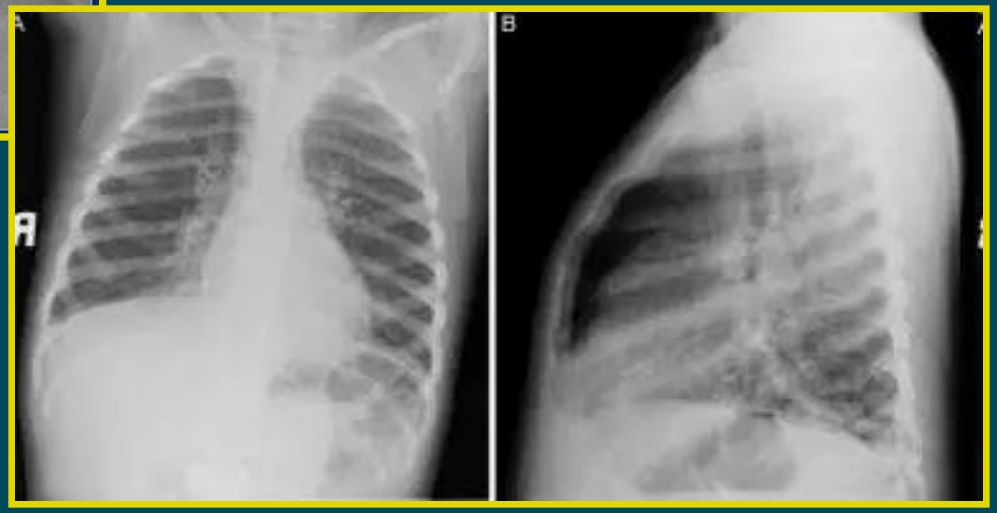


RADIOLOGICAL ANATOMY PERCULIARITIES OF CHILDREN CHEST

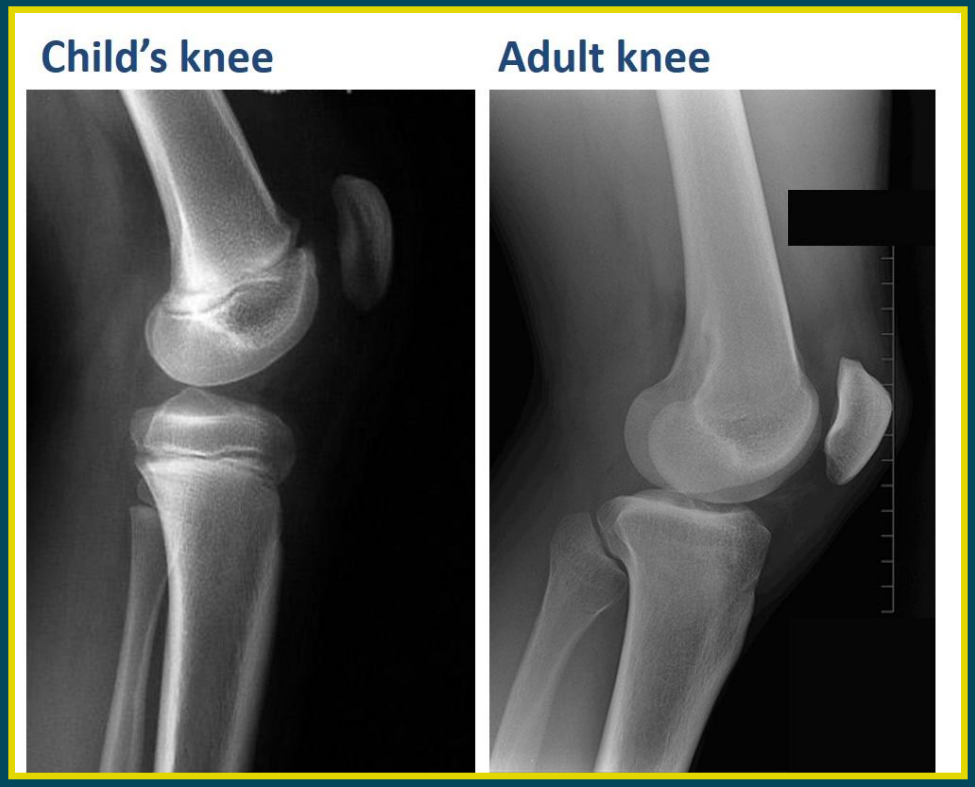


- Horizontal position of newborn ribs
- Heart is relatively big and horizontally situated before the age of 5
- Thymomegaly before the age of 3





RADIOLOGICAL ANATOMY PERCULIARITIES OF CHILDREN TUBULAR BONES



- Tubular bones in children has the growing zone with cartilage – metaphysis
- Bones contain a few amount of mineral substances and are more flexible

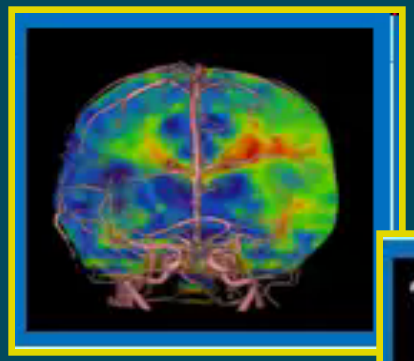
PERCULIARITIES OF IMAGING INVESTIGATION IN CHILDREN

- Babies are investigated in horizontal position or with special supports
- Children are investigated with the adult persons
- CT and MRI needs anesthesia

PEDIATRY MRI INVESTIGATION

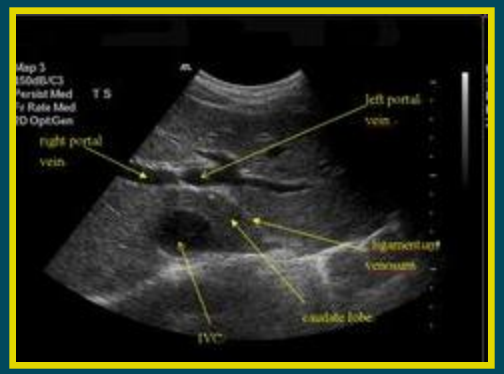
- MRI is widely used for brain investigation because it offers vessel image without contrastation
- The is no radiation
- For liver, biliary and urinary ducts without contrastation
- Method offers many details about muscles and joints

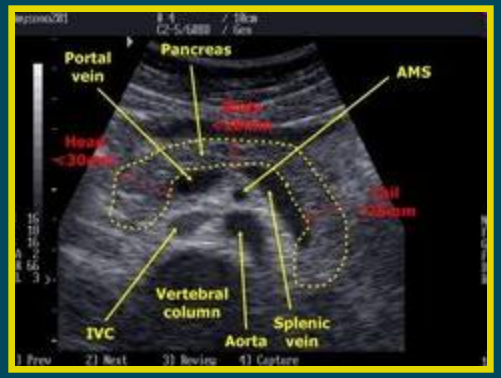
PEDIATRY CT EXAMINATION



- Using very short investigation time (2-5sec) for pulmonary protocol in order to minimize dose of radiation
- Neuroprotocol permits multiple scanning at the moment of contrast agent introducing
- Cardioprotocol (3-5 sec) permits 3D modeling in 3 cardiace cycles , functional heart analysis

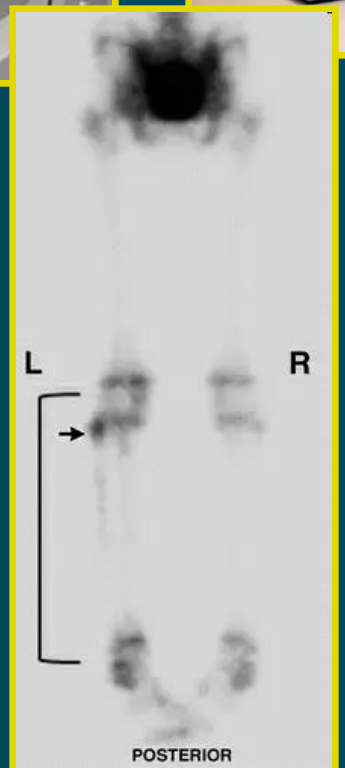
PEDIATRY USG EXAMINATION





- Low cost and large access permit to use USG like a screening method
- Neurosonography
- Echocardiography
- Echography of coxofemural joints
- Abdominal USG
- Renal USG
- Genital organs USG
- Thyroid gland USG

PEDIATRY NUCLEAR MEDICINE



- PET CT is utilised in oncology – neuroblastoma, sarcoma, limfoma
- Bone scintigraphy is the election method for the early detection of osteomielitis

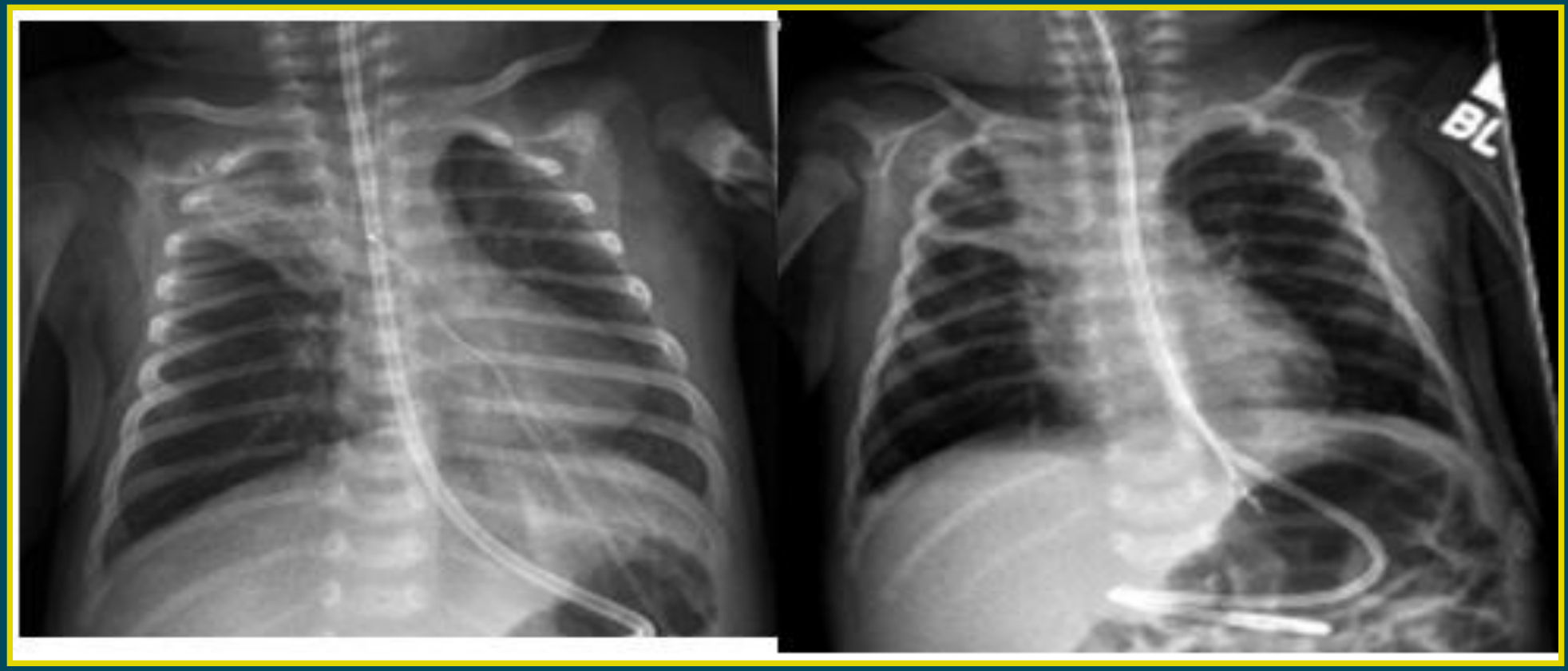
LUNG PATHOLOGIES IN CHILDREN

BRONCHIOLITIS

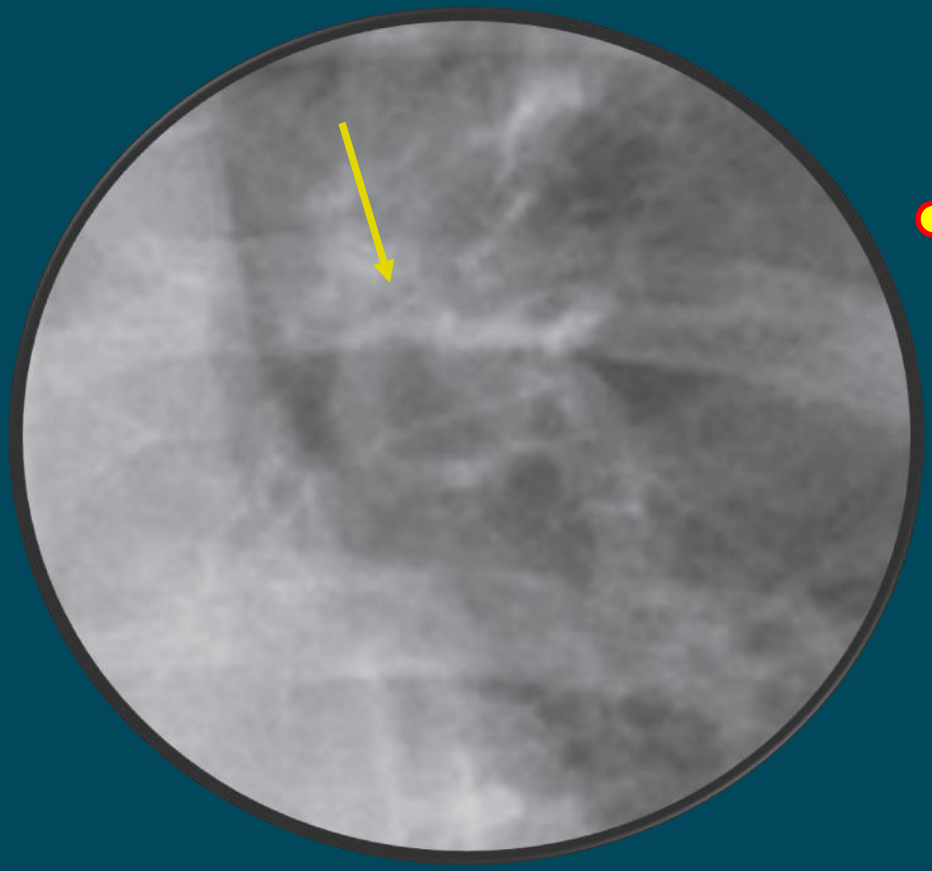
BRONCHIAL ASTHMA

PNEMONIA

BRONCHIOLITIS



BRONCHIOLITIS



- Bronchial walls are thickened and appear visible on the X-Ray – native bronchography

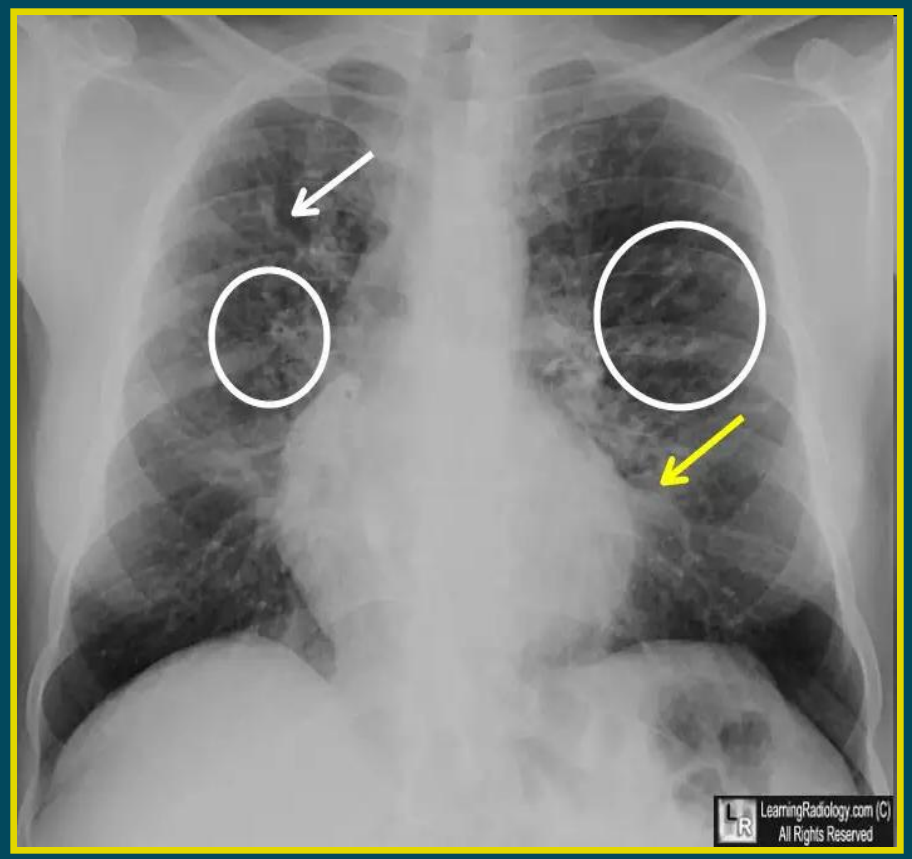
BRONCHIAL ASTHMA

- Hyperlucency of both lungs
- Bilateral intercostal space dilation
- Lower position of the diaphragm
- Pneumomediastinum

MUCOVISCIDOSIS CLINICAL FORMS

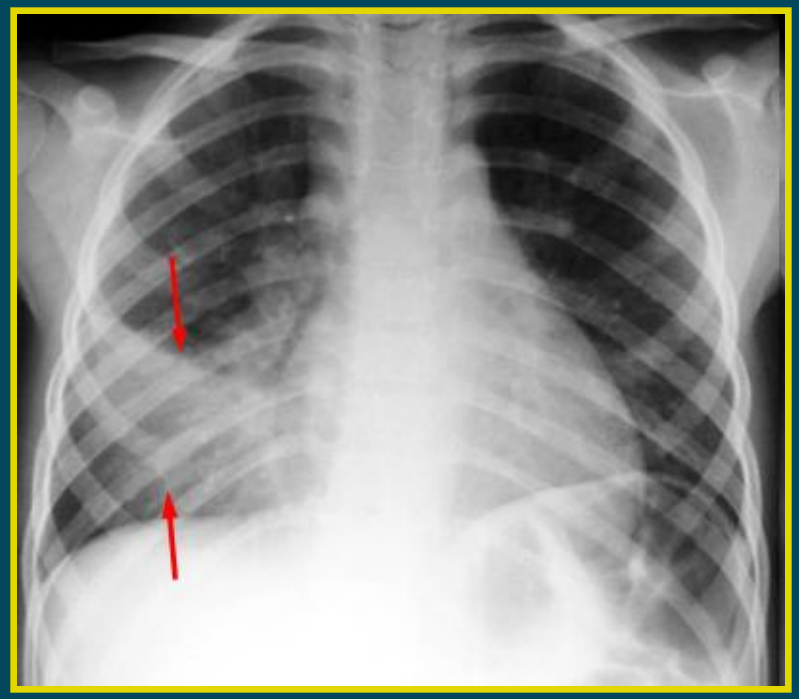
- **Meconium ileus (5-10%) may be as intestinal occlusion or meconium peritonitis**
- **Intestinal form (5%) fermentative pancreatic dysfunction**
- **Bronchopulmonary form (15-20%) pneumonia, bronchitis, atelectasis**
- **Mixt form (65-75%) – pulmonary and intestinal**

MUCOVISCIDOSIS IMAGING METHODS



- Bronchi are blocked with solid mucus
- Peribroncheal induration
- Atelectasis
- Bronchiectasis

BACTERIAL PNEUMONIA



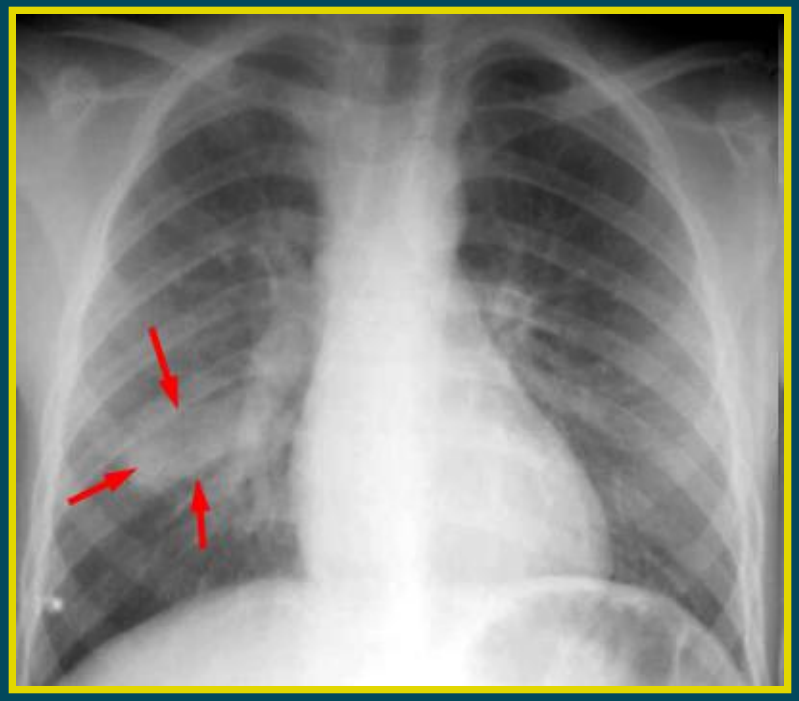
- Right medial lobe opacity with consolidation

BACTERIAL PNEUMONIA

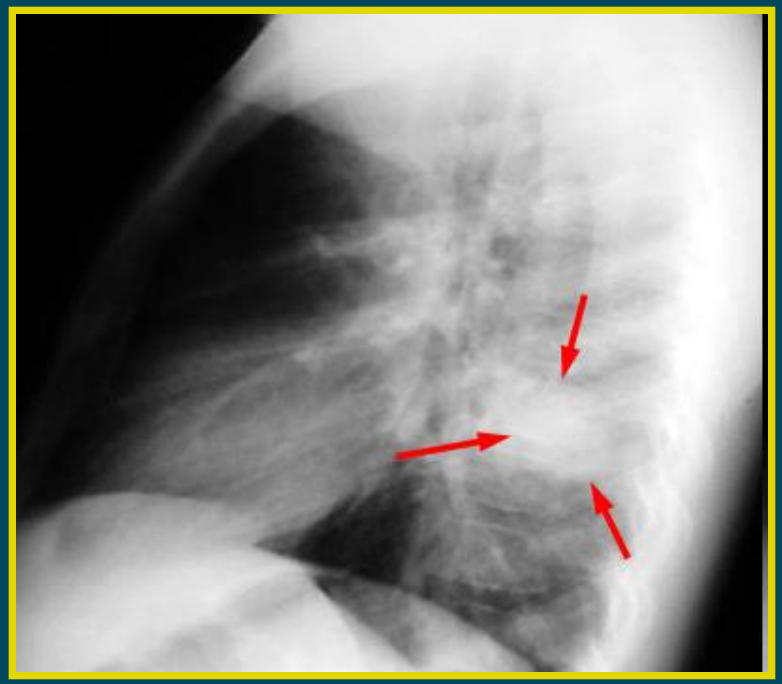
- Macular asymmetric opacities with consolidation of the right lung
- Small right pleural effusion in cardio-diaphragmatic sinus
- Normal lung volume

BACTERIAL PNEUMONIA

ROUND PNEUMONIA



- Round opacity in the inferior right lobe
- Differential diagnose – tumour, echinococcus, abcess



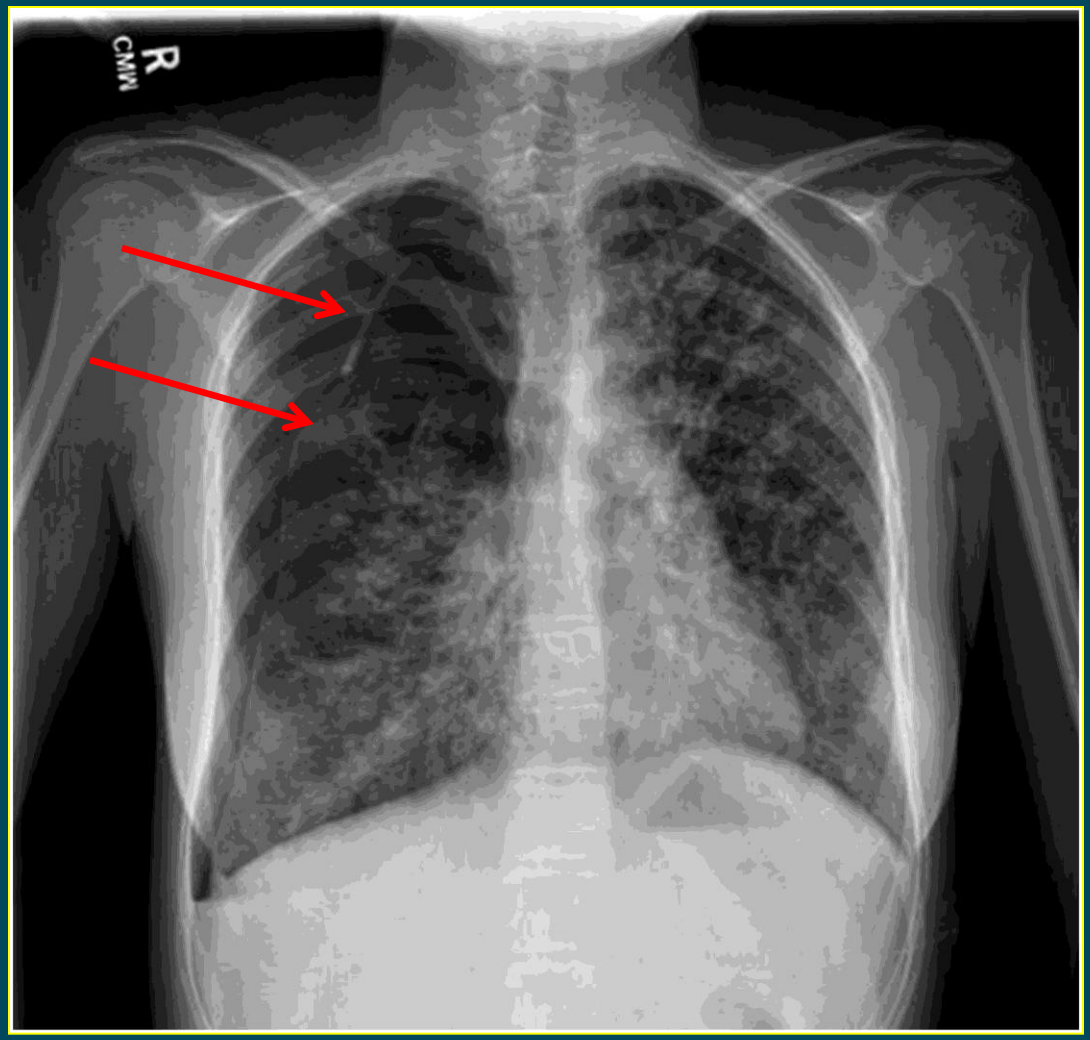
VIRAL PNEUMONIA

Figure 3. Interstitial infiltrates.

All radiographs courtesy of the author.

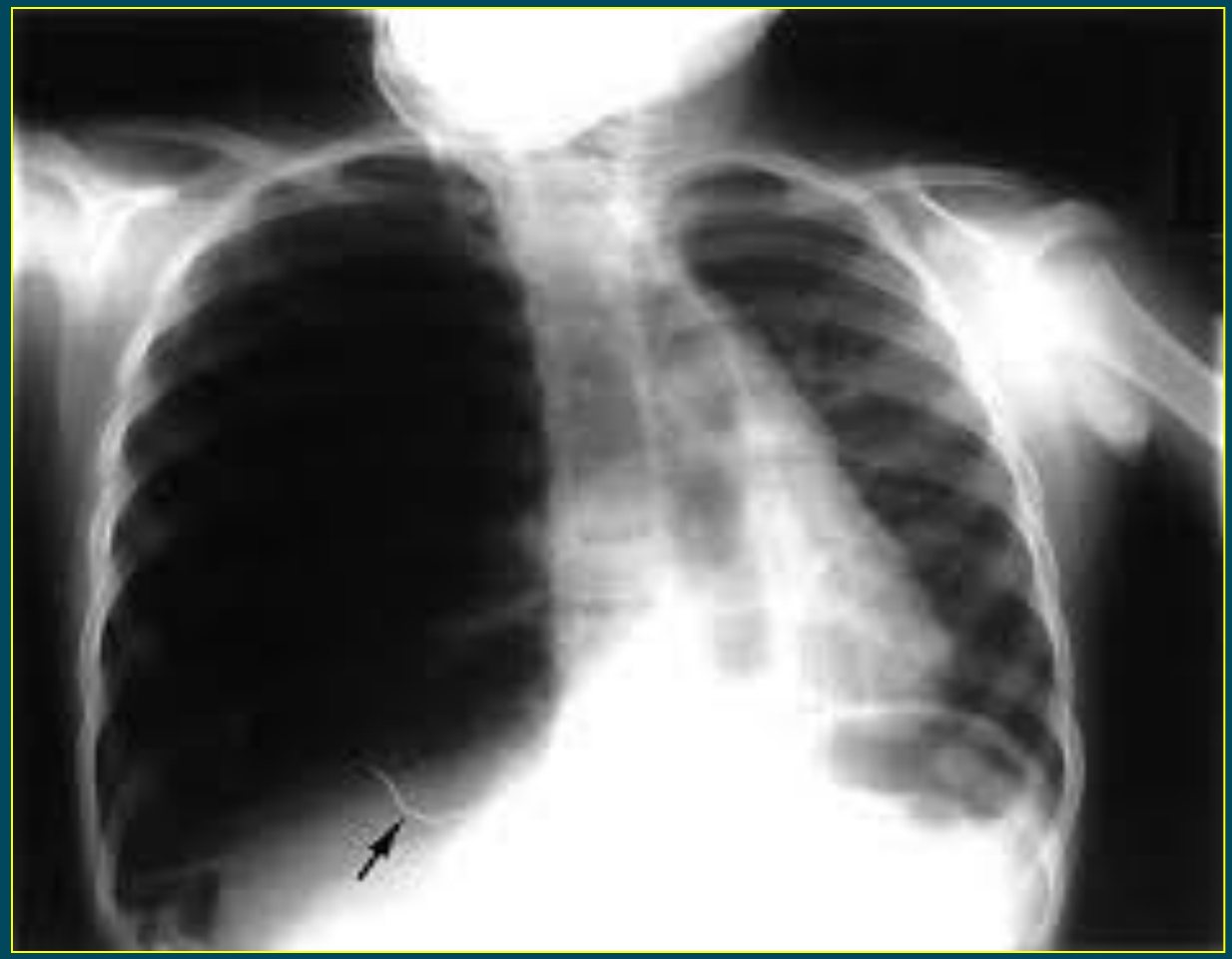
- Bilateral lung interstitial infiltrates
- Infiltrates consolidation
- Aeric bronchograme
- Caracteristical for children before 5 years

PNEUMOTHORAX

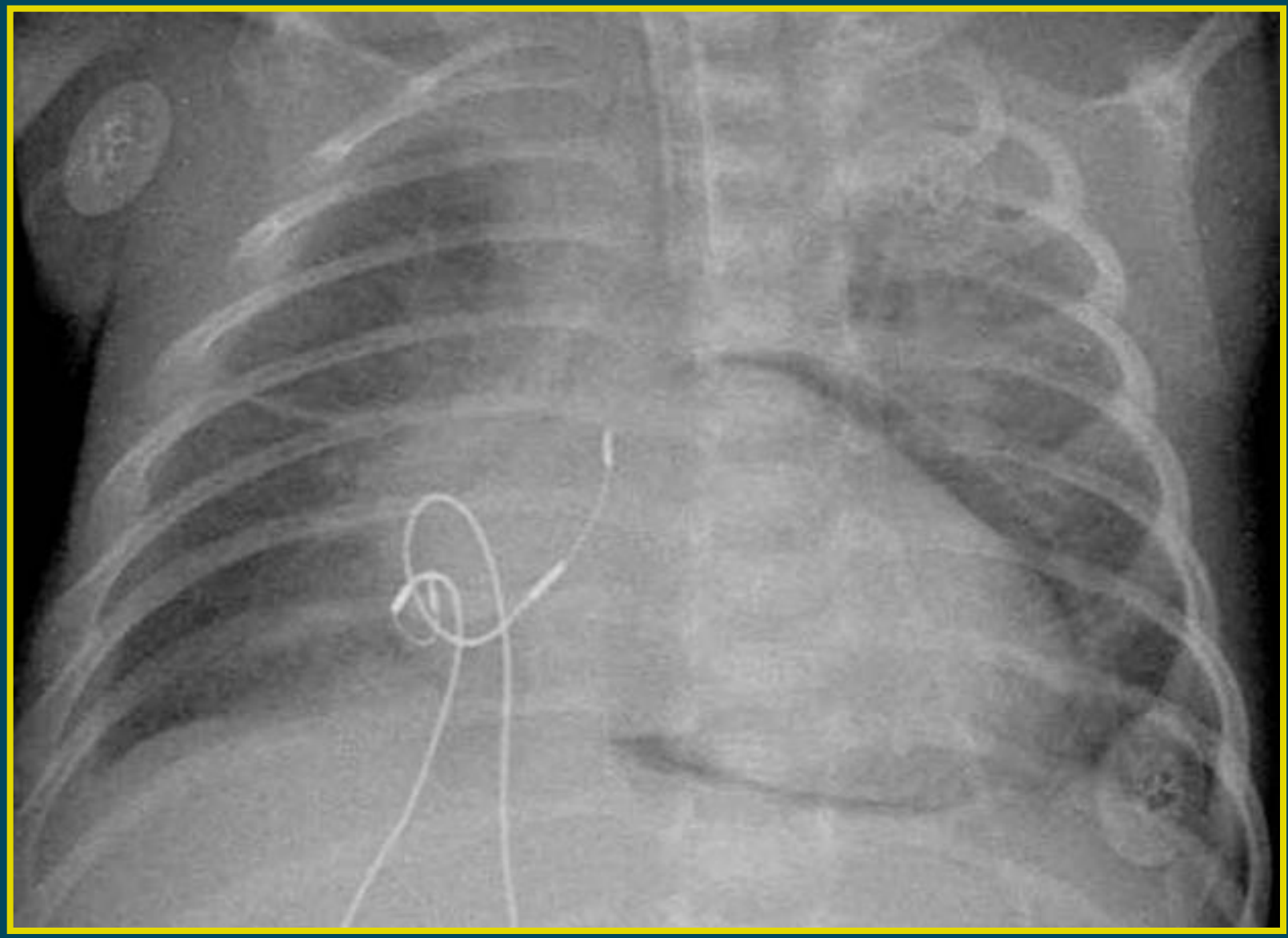


- Visceral pleura visibility – lung collapse
- Diaphragm flattening
- Opposite mediastinal shift
- Right pleural effusion with horizontal line

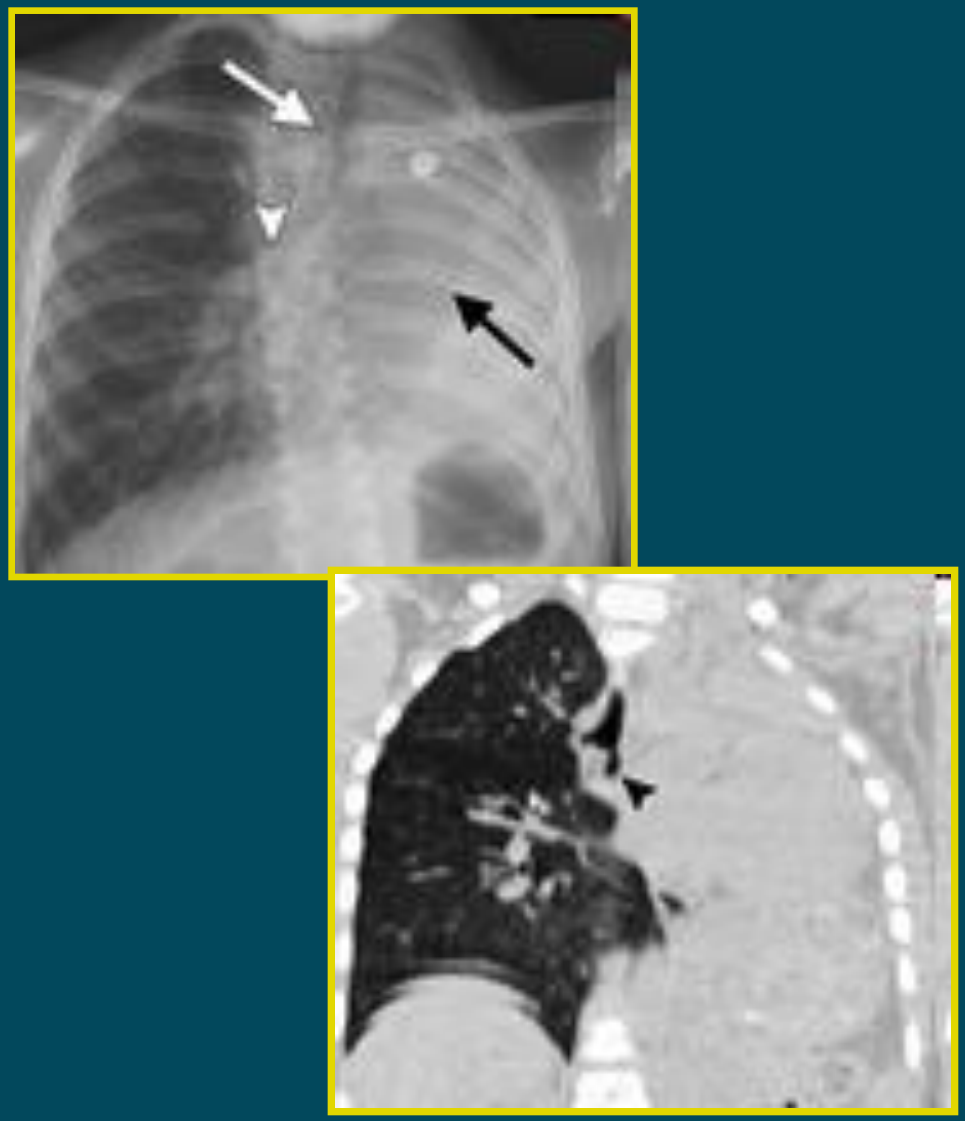
RIGHT TENSION PNEUMOTHORAX



PNEUMOPERICARD



Pulmonary agenesis



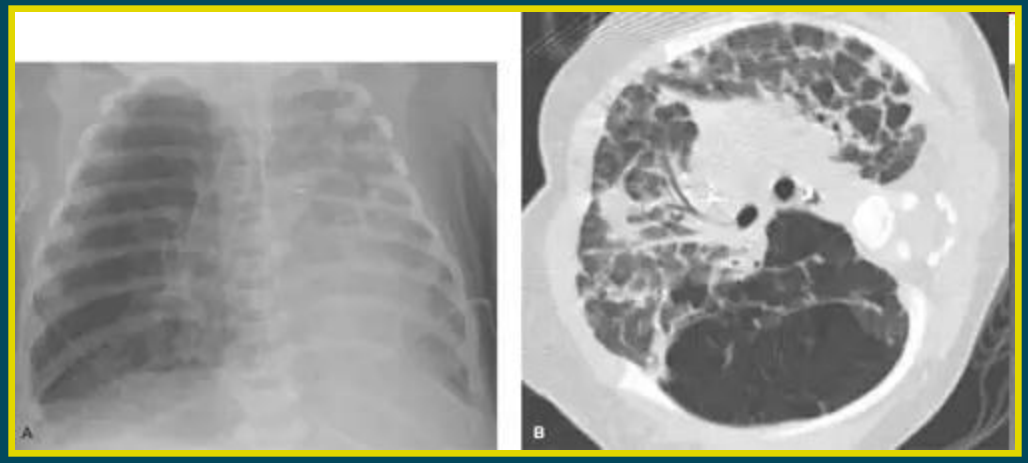
- There is no visibility of the left main bronchus
- Total left hemithorax opacity
- Mediastinal organs are displaced to the left
- Right medial lobe hyperlucency and its extention to the left – lung hernia

CONGENITAL LOBAR EMFISEMA

- Left lung hyperlucency and its extension to the right – lung hernia
- Mediastinal organs are displaced to the right
- CT - left lung hyperlucency with deformation of the pulmonary pattern

BRONCHOPULMONARY DYSPLASIA

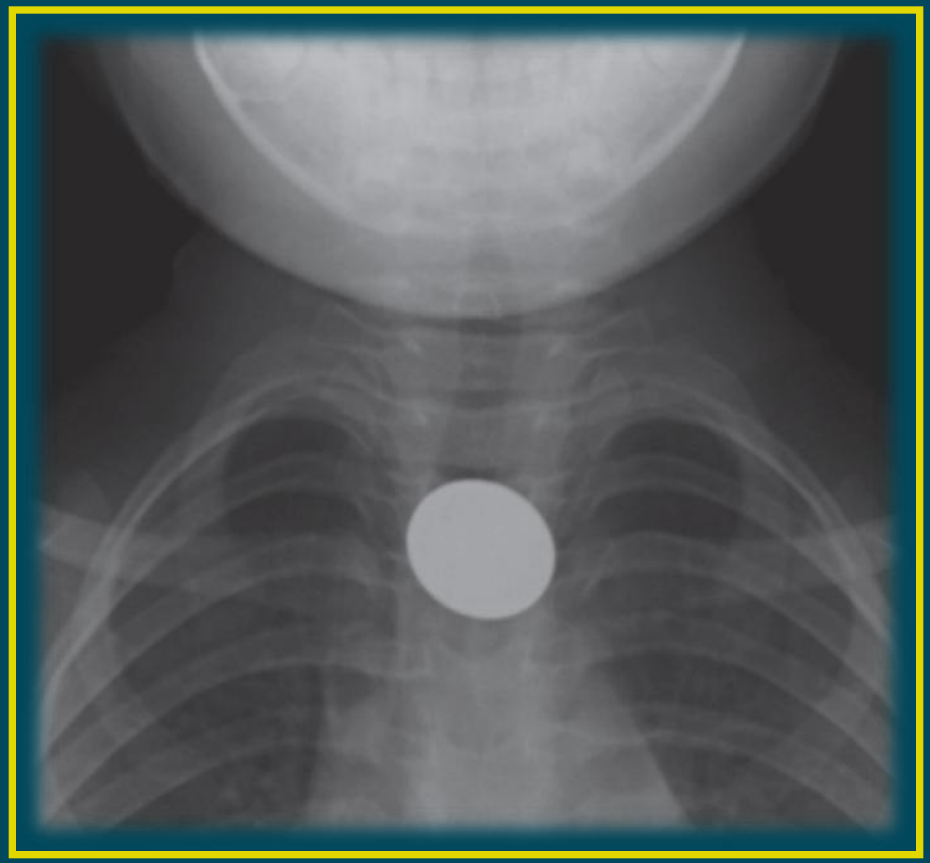
- Reticular diffuse multiple opacities
- Hyperaeration of the lungs
- Cardiomegaly
- May appear aspiration or pulmonary edema



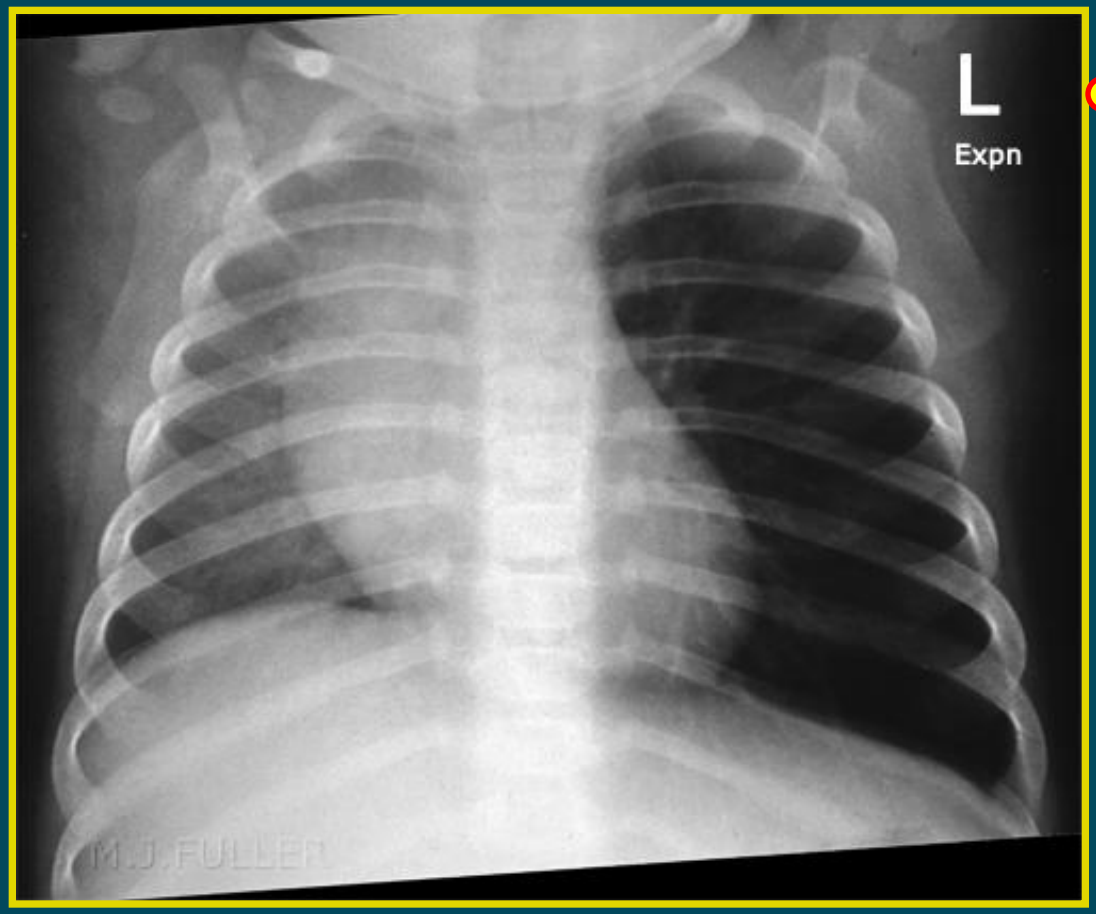
PUPLMONARY HYPOPLASIA

- Right lung hypoplasia with right mediastinal shift
- Right diafragm elevation
- Right lung hyperlucency – compensatory emphysema

FOREIGN BODY ASPIRATION

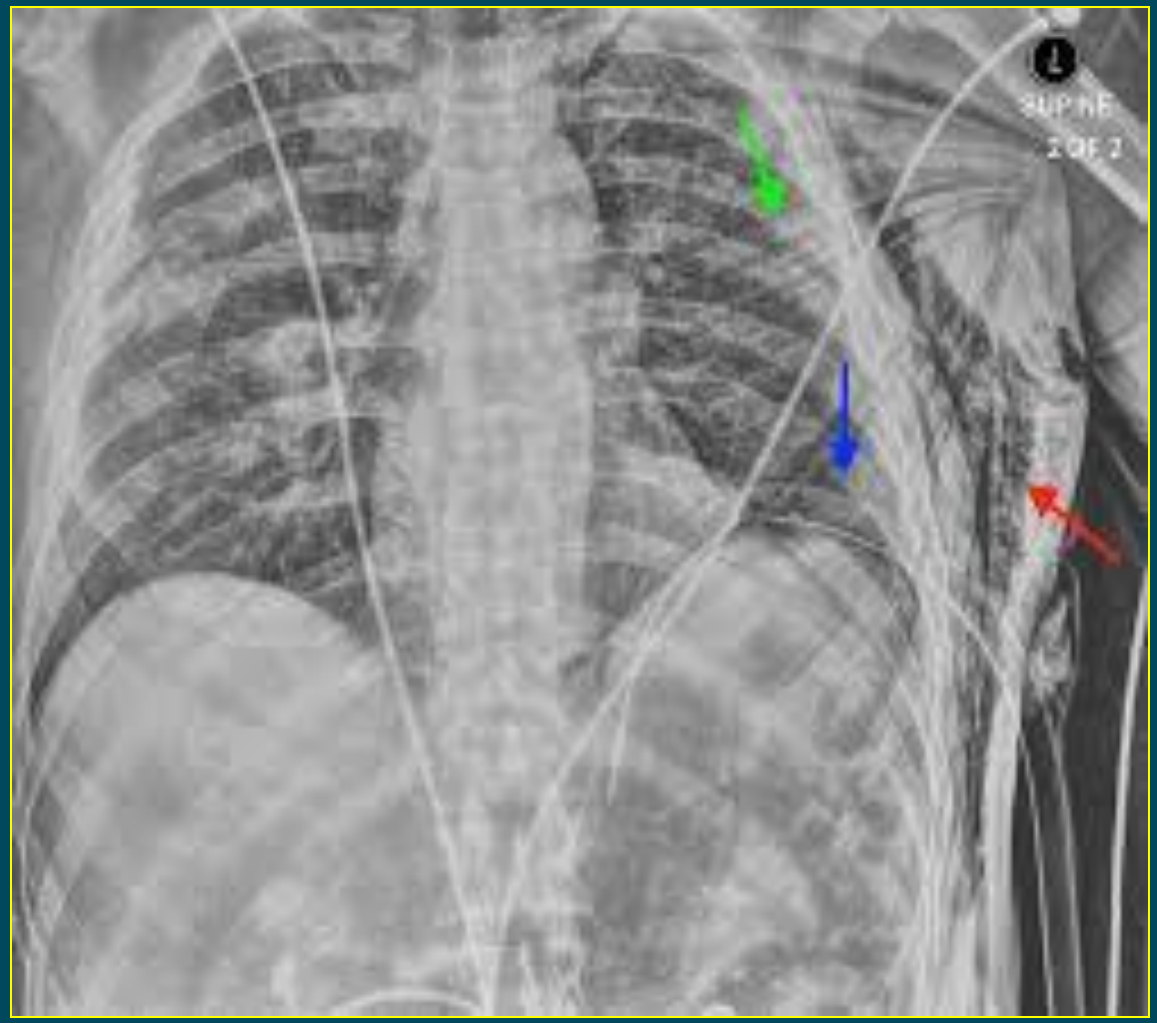


FOREIGN BODY ASPIRATION



- Left lung hyperlucency as a sign of bronchi permeability deregulation
- Right mediastinal shift

SUBCUTANEOUS EMPHYSEMA WITH COSTAL FRACTURES



JUVENILE RHEUMATHOID ARTHRITIS

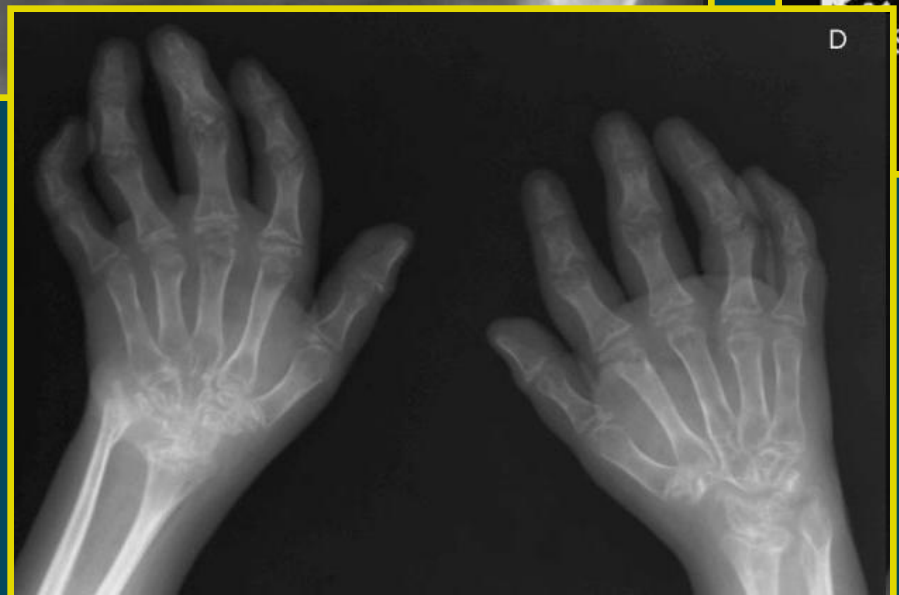
- 50% are children before 5 years
- Large joints are affected

JUVENILE RHEUMATHOID ARTHRITIS

X-Ray stages:

I – epihysis osteoporosis
II – epihysis osteoporosis + joint space narrowing + unic cartilage destruction
III – cartilage and bone destruction, subluxations
IV – fibrosis or bone anchylosis

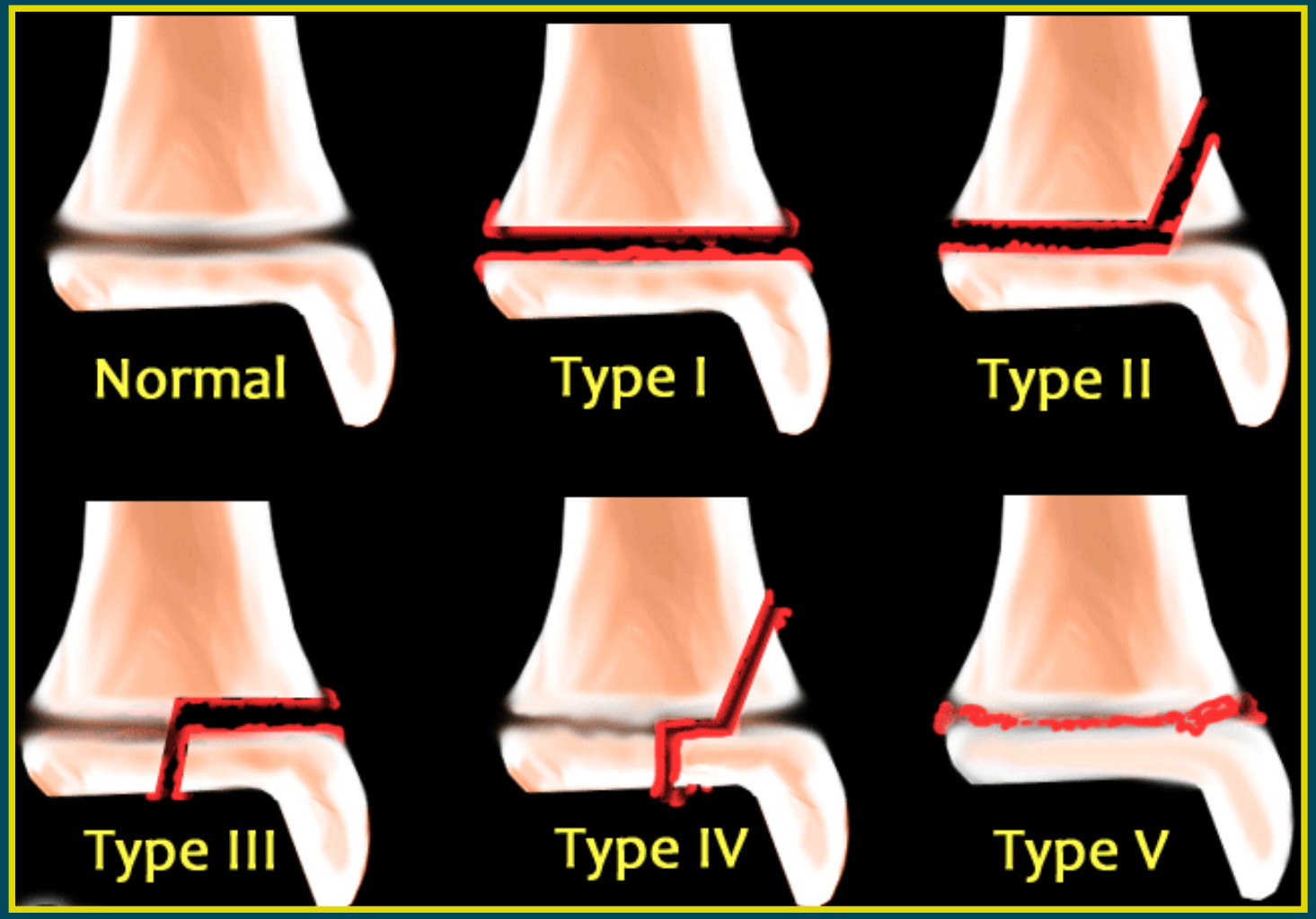
JUVENILE RHEUMATHOID ARTHRITIS



”GREEN STICK“ BONE FRACTURE

- Iincomplete fracture
- More frequent in children before 10 years
- Common situation in medial diaphysis of the forearm and surae

EPIPHYSIOLYSIS
Salter-Harris CLASSIFICATION



EPIPHYSIOLYSIS TYPE I

- **Isolated sliding with favourable prognosis**

EPIPHYSIOLYSIS TYPE II

Epiphysiolysis + oblique metaphyseal fracture

EPIPHYSIOLYSIS TYPE III

Epiphysiolysis + epiphyseal fracture

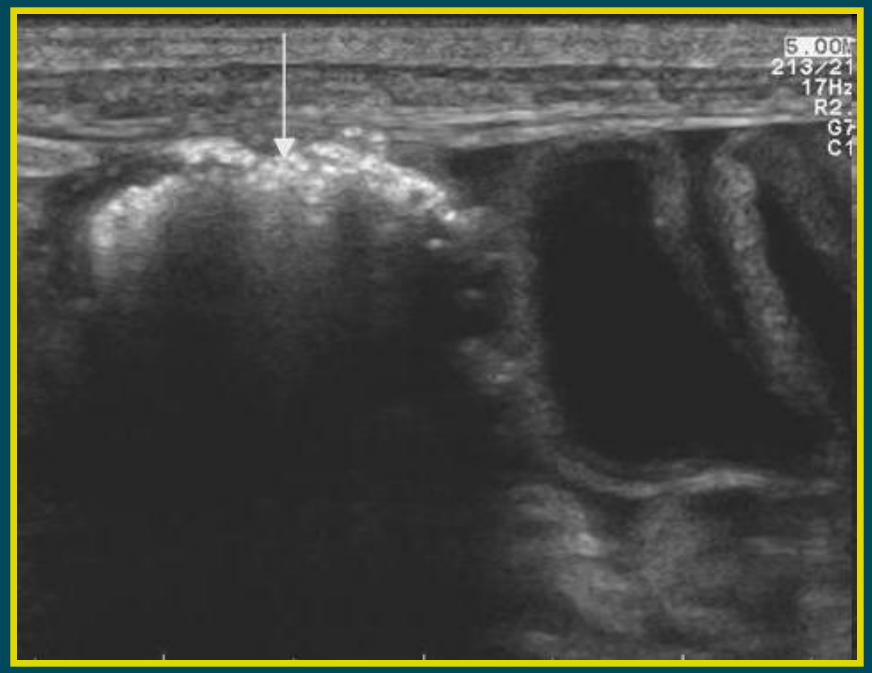
EPIPHYSIOLYSIS TYPE IV

- Epiphysiolysis
- Epiphyseal fracture
- Oblique metaphyseal fracture

EPIPHYSIOLYSIS TYPE V

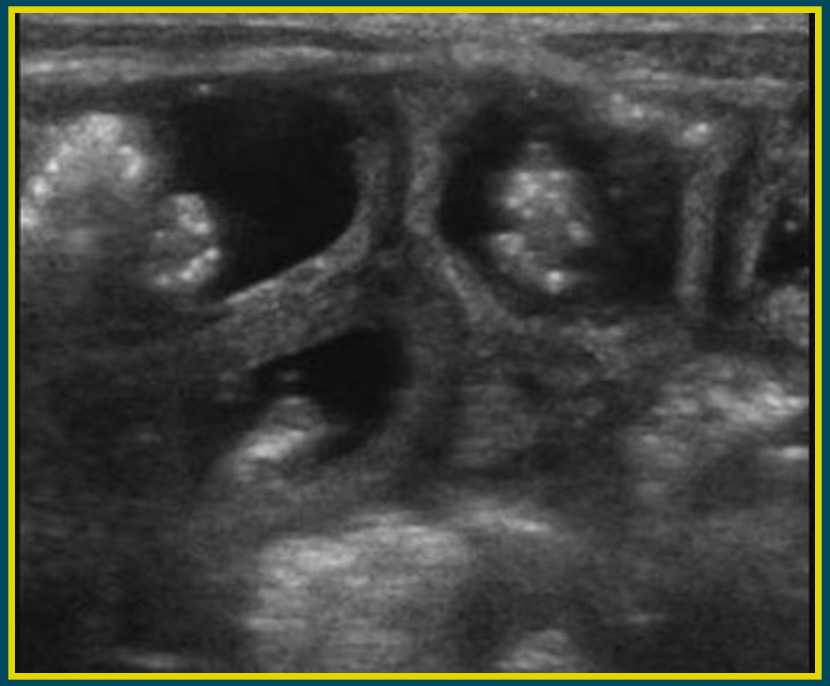
Growing cartilage injury by compression

NECROTIZING ENTEROCOLITIS USG

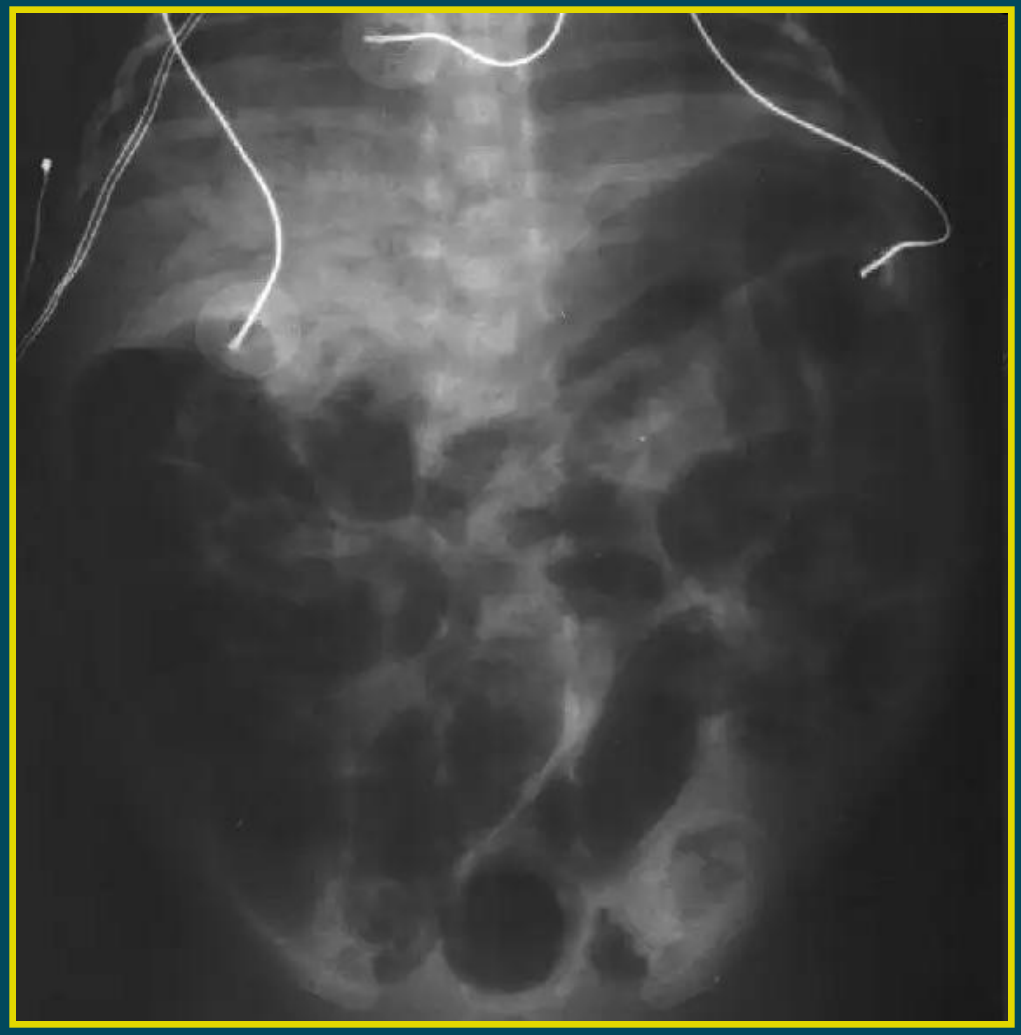


Hyperecogenic air bubbles inside of the intestine wall

Small intestine dilation



NECROTIZING ENTEROCOLITIS ABDOMINAL X-RAY



Small intestine dilation with air inside of their wall – pneumatosis intestinalis

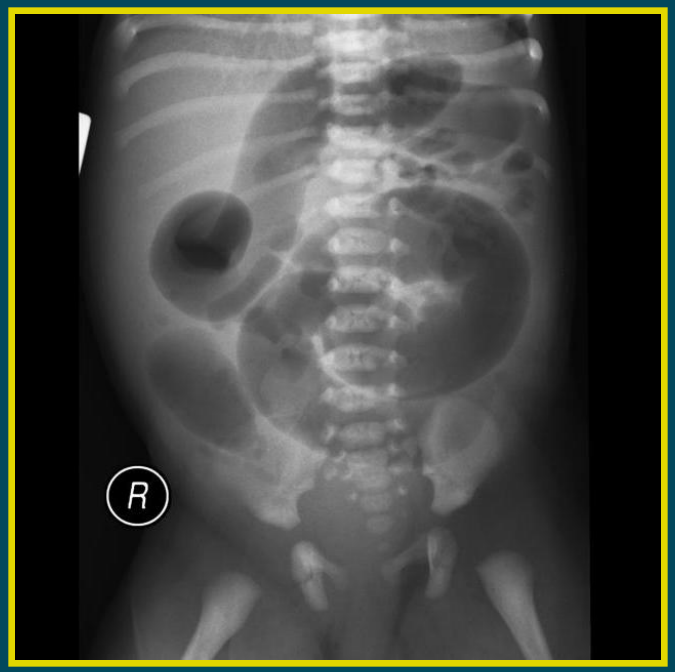
HIRSCHSPRUNG'S DISEASE

- Congenital injury of large intestine innervation
- Intestinal spasme with prestenotic dilation

HIRSCHSPRUNG'S DISEASE VARIANTES

- Pathology with short aganglionar segment (75%) – rectus and distal sigmoid colon
- Long segment (15%) – is extended before splenic flexure or transvers colon
- Total pathology (7,5%)
- Ultrashot aganglionar segment – 3 cm internal anal sphincter

HIRSCHSPRUNG'S DISEASE



Thank you for attention !