PEDIATRIC RADIOLOGY

CHILDREN ARE NOT SMALL ADULTS !!!
CHILDREN ARE SPECIALS

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CT
PET-CT
PET
PACS
X-ray, fluoroscopy
ULTRASOUND
SCINTIGRAPHY
MRI
X-RAY

- As immature tissue is more sensitive to radiation damage than mature tissue.

- Red bone marrow is much more sensitive for irradiation.

- Gonads are near to the examined organs.

- No pediatric examination should be „routine”.
CONTRAST MEDIA EXAMINATIONS

- The same contrast media are used in children as in adults

- Air in GI investigation is the cheapest and safest of all contrast media
ULTRASOUND

- Prenatal US
- Abdominal US
  
  Bowels

- Brain-US – spine-US
- Chest- near to the diaphragm, jugulum, chest wall (thymus)
- Joints (dysplasia, fluid)
- Bone (osteomyelitis, small fractures)
- Soft tissue
NEWBORN BRAIN-US

- Positive findings are important
- Operator dependent

- Low birth weight
- Hypoxy - bleeding
- Postasphyxia
- Congenital malformation
- Sepsis
- Cramp
US OF THE SPINE

- newborn: 7-10 MHz, linear transducer
CHEST ULTRASOUND

- Neglected area (bone-lung barrier)
  - true, but

- Pathology occupies the area of the bone, lung

- Child: small
  - thymus
  - CT, MR - anesthesy
  - No radiation

- visible: some lung pathology
  - pleural space
  - mediastinum
  - chest wall
PLEURAL SPACE: ULTRASOUND

- fluid?
- Structure of the fluid
  - simple
  - complex
- Thoracocentesis
- follow up
ISOTOPE

- Functional examination
- Much lower irradiation like X-ray
- Bone, parenchymal organs, bowel, ect.
- **Indication:**
  - Central nervous system - bleeding
  - Chest – lung, trachea, bronchi
  - Abdominal : trauma
  - Bone - trauma
  - Sedation
  - Irradiation !
  - Contrast media!
  - Multislice CT
CT

- ALARA (as low as reasonable achievable)
- Chest X-Ray = 0.1 mSV
- CT = 3-20 mSV (1-7 years background irradiation)
MR - INDICATION

- Central nervous system
- Musculoskeletal
- Mediastinum
- Abdominal
- Vessel, cardiac
Advantage:

- Good anatomy, without contrast material
- With contrast material:
  - anatomy
  - function

Disadvantage:

- Long time, anesthesia, prize
PRENATAL MR

- 2.3. trimester
- After 24. weeks
- Fast sequents
- Very fat patient (US limited)
- Before i.u. intervention
CHEST:
RESPIRATORY DISTRESS DISEASE (RDS)

- lack of surfactant
- premature
- radiology: 6-24 hours age
- reticulogranular nodules
- air - bronchogram
- I-IV. stadium
MECONIUM ASPIRATION SYNDROME

- intrauterine or intrapartum inhalation of meconium
- Obstruction of the small and medium airways, atelectasia, air lacking, chemical pneumonia
- often ptx, pneumomediastinum
NEONATAL PNEUMONIA

- Infection in utero or near delivery
- Streptococcus B pneumonia
- Radiology: similar to other respiratory distress
- Chest X ray
CONSOLIDATION

- As in adulthood

BUT

consolidation in the middle or lower lobe: could be because of foreign body aspiration
FOREIGN BODY ASPIRATION

- Ninety-five percent of foreign bodies are non opaque.
- On an expiratory film there is air trapping on the affected side and mediastinal shift to the unaffected side.
- On the inspiratory film there is mediastinal shift back to affected side as the other lung aerates normally.
- Fluoroscopy
- Bronchoscopy
CONGENITAL DIAPHRAGMATIC HERNIA

- INCIDENCE:
  - 1/4000 live birth
  - Left side 80%
  - Lung hypoplasia, persistent foetal circulation
THYMUS

- Normal thymus may be visible up to the age of 3
- Great variation - problem in diagnosis
- Normally it does not compress the trachea or oesophagus
- Relatively radiolucent
- US: echostructure is similar to the liver
- Ectopic thymus (posterior mediastinum, neck)
- Differential diagnosis: mediastinal masses
- CT, MR - rarely!
THYMUS - US
MEDIASTINUM

- Chest X-Ray
- US: anterior mediastinum, thymus
- CT: trachea, bronchi
- MRI: mediastinum
GASTROINTESTINAL DISEASES
IMAGING

- Why do I make the examination?
- What kind of imaging: anatomical? Functional?

- To choose the method:
  - US
  - plane film
  - enema
  - swallowing
  - isotope
  - MRI
- Native babygram
- Tube into the esophagus
- Lower fistula: gas in the bowel
HYPERTROPIC PYLORIC STENOSIS (HPS)

- Non-bilious vomiting, 4-6 weeks old, boys
- US
  - Length: above 17 mm
  - Wall-thickness: above 3 mm
MALROTATION - VOLVULUS

MALROTATION symptoms:
- often asymptomatic
- sometimes bilious vomiting, high ileus
- bloody stool,
- malabsorption

VOLVULUS
- ileus
- bowel ischemia
- peritonitis
- Shock
VOLVULUS

US sings:

- “whirlpool” sign – diagnosis
- Swallow-examination

HIGH ILEUS

- Plane fim
- Duodenal atresia
- Jejunal atresia
LOW ILEUS

- symptoms: vomitus, bowel distension
- Plane film
  - Ileal atresia
  - Meconium ileus
  - Small left colon
  - Hirschsprung disease
- Contrast enema
HIRSCHSPRUNG DISEASE

- Etiology/Pathophysiology:
  large bowel obstruction due to congenital absence of ganglion cells in the myenteric plexus of the colon starting at a transition point and extending all the way to the rectum.

- Present in: 1: 5000-8000 live births
  Diagnosis: 80% in the first 6 weeks
  boy/girl = 4-9:1

- Symptoms: failure to pass meconium in the first 24 hours coupled with a gradual onset of abdominal distension and vomiting,
ENEMA

- The radiographic diagnosis is made by demonstrating the transition zone, but this may not be possible in the newborn because it takes weeks for the bowel to dilate.

- The aganglionic segment is of normal caliber without stricture or constriction. The normally innervated bowel is dilated above the transition zone.
INTUSSUSCEPTION

PRESENT: 3 months-2 years
unknown origin
later leading point – 5 %
(lymphoma, bowel duplication, Meckel diverticulum)

colicky abdominal pain causing the infant to cry and draw their legs up onto their abdomen, hematochezia with, and a palpable abdominal mass.

- colicky abdominal pain 100%
- Bowel distension 90%
- palpable abdominal mass. 80%
- vomiting 70%
- "currant jelly" stools 70%

DIAGNOSIS:
US (plane film – perforation)
Lymph node enlargement
THERAPY

- Therapeutic examination such as an air enema may be performed. Air should be instilled into the rectum under fluoroscopy while maintaining a maximum of 110 mm. of mercury.
- US guided enema
- contraindication: severe peritonitis
- Painful!
- Sedation
NECROTIZING ENTEROCOLITIS (NEC)

Seen most often in small preterm infants in intensive care units

- abdominal distension, bloody stool, apnoe, acidosis

- pneumatosis intestinalis,
- portal venous gas,
- free air
• Thickened bowel wall
• Pneumatosis intestini
• Free abdominal fluid
UROGENITAL SYSTEM
CONGENITAL OBSTRUCTIVE UROPATHIES

- Pelviureteral obstruction
- Ureterovesical obstruction
- Subvesical (posterior urethral valve)
- Double system with or without ureterocele
- Multicystic dysplastic kidney
- VUR
PELVICURETERAL OBSTRUCTION

- Most frequent obstructive uropathy, 35-40%
- Incidence: boy/girl=5:1, bilateral: 25%.
- Morphology: hydronephrosis, narrow parenchymal, no ureter
- Function
SUBVESICAL OBSTRUCTION

- A congenital malformation of the male urethra,
- This obstruction leads to vesicoureteral reflux which can lead to renal dysplasia.
- Incidence: 1: 5000-8000, in male
- The distension can also lead to a calyceal leak of urine which can cause a perinephric urinoma or a urinary ascites, also prenatally
- Clinical presentation:
  - newborn: distended bladder, failure to void, renal damage, hydronephrosis, hydroureter, urinoma, ascites
- Thick walled bladder,
- hydrenephrosis,
- hydroureter,
- dysplastic kidney
VOIDING CYSTOURETHROGRAPHY (VCUG)
WILMS TUMOR

- Most frequent renal tumor
- 1-5 years old
- Diagnosis: US, CT (MRI), chest CT
- Unilateral, bilateral
- Size, connection with organs, vessels
- Follow-up
large mass with capsule like margins
is markedly inhomogenous
US: mixed echogenicity
CT: predominance of hypodense areas
MR, T2W: increased signal intensity
MUSCULOSKELETAL DISEASES
HIP DYSPLASIA

- incidence: 1:200,000
- Boy-girl = 1:9
- Clinical symptoms
- imaging:
  - US (4-5 months)
  - Later: X-ray
- Screening: 6 weeks old
ABUSED CHILD, BATTERED CHILD

- Clinical, radiological, social
- Most severe cases in infant age
- Important role of radiologist in the diagnosis
MAIN POINT OF VIEW

- Risk factors: „different” child, mental or physical
- Social risk factors: unemployment, poverty, alcoholism, drugs,
- depression

Drawing of an abused child
WHEN COULD WE THINK ON IT?

- incongruous anamnesis and symptoms
- Contradiction in the stories of the parents
- Wheeled fractures without medical treatment
- Very ill, underweight child
- Abdominal trauma, unknown cause
- Suspicious burns
BONE FRACTURES

- More fractures, different time
- Under 2 years of age more frequent

  Diaphyseal fractures

- femur, humerus, tibia
- Spiral fracture of the long bones
METAPHYSEAL FRACTURES

- Most frequent
- Lower limb
- Bilateral in different stadium

Epiphyseal fractures are rare

Corner fracture  bucket-handle fracture
RIB FRACTURES

- Rib fracture on the chest X-Ray
- Sometimes bilateral, multiple (shaken baby)
SKULL FRACTURES
X-RAY

- skull
- spine
- chest
- pelvis
- Bones, elbow, ankle, knee
- Callus: 6. day, not later then 8. day
CEREBRAL INJURIES (13-25%)

- subdural haematoma, oedema, ventricular and cerebral bleeding
- Shaking
- Generally subdural hematomas are bilateral after abusing
- CT
- MRI
ABDOMINAL INJURIES (3%)

- Parenchymal injuries: liver, spleen, pancreas, kidney
- Free abdominal fluid
- US, CT