Diagnostic imaging of

Musculoskeletal diseases

Investigating methods

1. **X ray** **tha basic technique**
2. CT more accurate anatomy, reconstructions
3. MRI bones no, but bone marrow
4. Scintigraphy : osteoblast activity, radiopharmacon uptake (Tc)
5. Ultrasound joints, muscles, tendons,
6. Densitometry : the calcium content
7. Angiography eg. preop,(limbsaving) selective chemotherapy

Plain radiograph

40% of all investigations in a general radiological department : trauma, degenerative

Bones are fit for x-ray investigation

x-ray attenuation of the calcium is much higher, than those of the surrounding soft tissues

The linear resolution is very good for evaluating the fine bony structure

Normal variants – of no clinical importance

mistaken with fractures

pl. persisting apophysis, accessory bones

Persist. apophysis.

os Vesalianum

access. sesamy-bone

A kórfolyamatok röntgenológiai alapjelenségei

- ***calcipenia*** *diffuse Calcium decreasing*
- *atrophy (circumscribed, e.g. in the region of one joint)*
  Sudeck-atrophy
- *osteolysis circumscribed bone disappearing*
- *usuration conturdefect because of external pressure*
- *erosio following an inflammation*
- ***osteosclerosis***
- *periosteal reaction*
- *osteonecrosis nutritive artery blocked*

Diffuse calcipenia

not only in osteoporosis!

normal ¡

normal ¡

Differencies of the calcium content in the lumbal spine

Only 30-40% decreasing of the mineral substance is to be seen in the plain film

Osteosclerosis

Marble bone disease
(osteopetrosis)

circumscribed sclerosis

Paget’s disease

ROD

Ruggers’ jersey spine

periosteal diseases

Codman-triangle

- inflammtion = thickens
  calcification
- any damage/hurt , chr. heart and pulmonary disaeases,
  toxic impacts: thickens and calcify
- new-bone production surround
  - adjacent haematoma
  - malignant tumors: lamellar, spiculated

CT

- transversal imaging

  also in deep soft tissue details

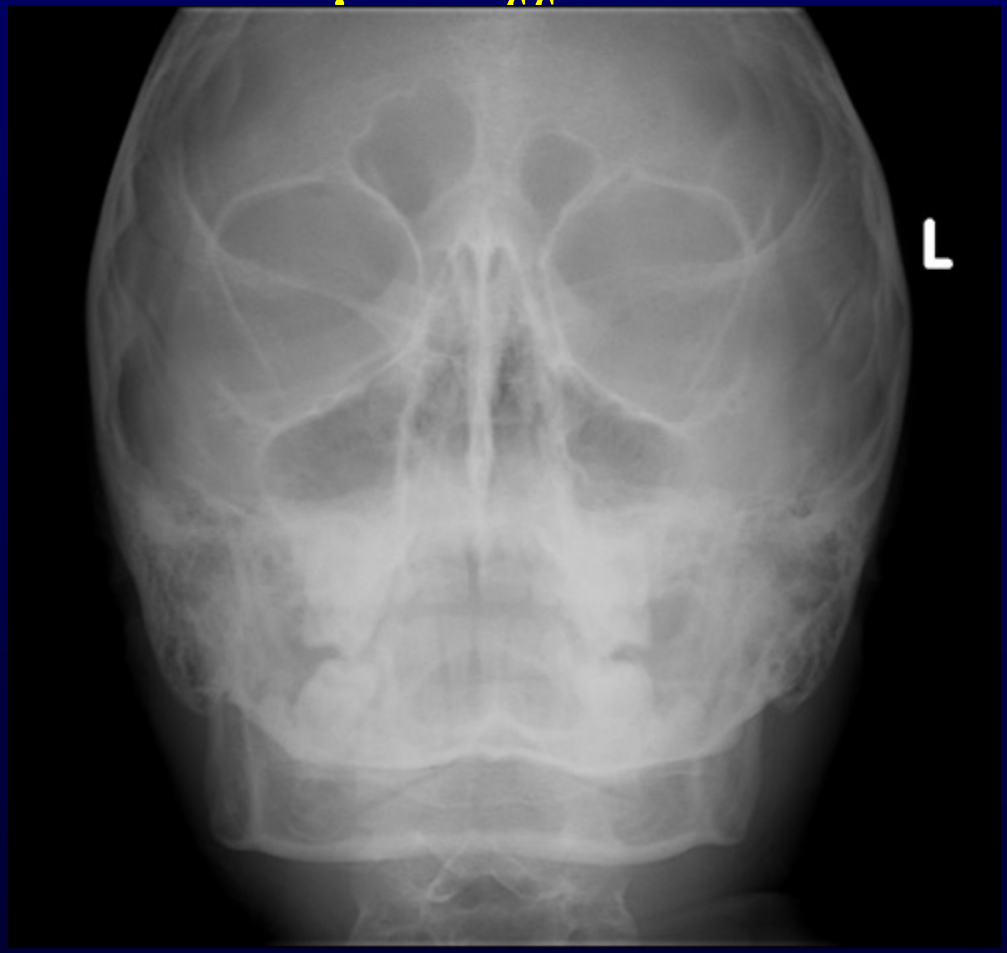
- thin slices – isotropic volume data = good multiplanar reconstructions

  3D: ortopedy, traumatology

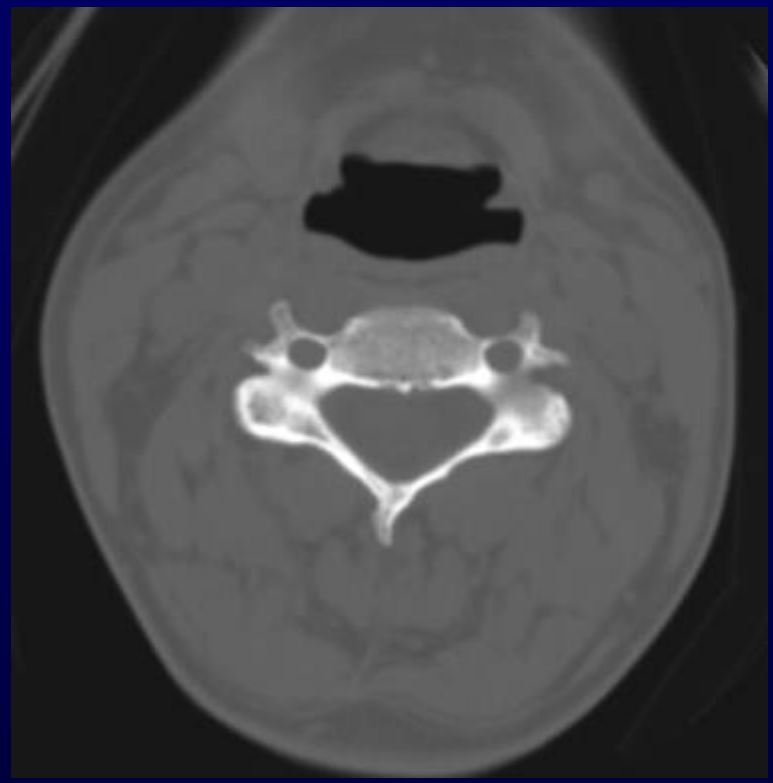
- better resolution, bones and surrounding soft tissues

- contrast media → enhancement indicates

Conventional x ray
(plain radiograph)



CT no summ.



Bone scintigraphy

- entire skeleton together

  systemic /spreaded disorders

- high sensitivity

- low specificity

  high activity : inflammation, damage or tumor

- 3 phases

  blood perfusion

  bloodpool

  metabolic phase: radiofarmakon uptake = osteoblast activity

Osteodensitometry

mineral bone-mass

photon-absorptive techique

- single photon absorptiometry
  - isotope (SPA)
  - x-ray (SXA)

- dual-photon-absorptiometry
  - izotope (DPA)
  - x-ray (DEXA)
  - quantitative CT (QCT és pQCT)

quantitative ultrasound bone-densitometry (QUS)

ODM: bone mass g/cm^2

DEXA: low energy x-ray -vertebra, femur neck

Comparing with the bone density of healthy

20-40 y o persons: **T score**

according to the age: **Z score**

WHO criteria

Normal	± 1 SD
Osteopenia	(- 1 SD) – (- 2,5 SD)
Osteoporosis	- 2,5 SD lower than
Serious porosis	< - 2,5 and 1 vertebral compression

Ultrasound

- bony structure: no
- soft tissues : yes
  - periosteum: haematoma, subperiosteal abscess
  - joints: fluis, tendons, ligaments
  - biopsy

Ultrasound

Newborn screening for displasia

Musculoskeletal diseases

- developmental
- metabolic
- degenerative
- inflammation
- tumors
- blood supply

Developmental

- generalised bone alterations

eg. osteogenesis imperfecta

- circumscribed

developmental disorders in segmentation and vertabral corpus

developmental disorders– generalised

- prenatal form: lethal
- postnatal form:
  - blue sclera
  - deafness
  - frquent fractures

autosomal dominant hereditary

Disturbed collagen sinthesis

osteogenesis imperfecta

developmental disorders

heraditary

autosomal
dominant

Short limbs,
Big head

dwarf

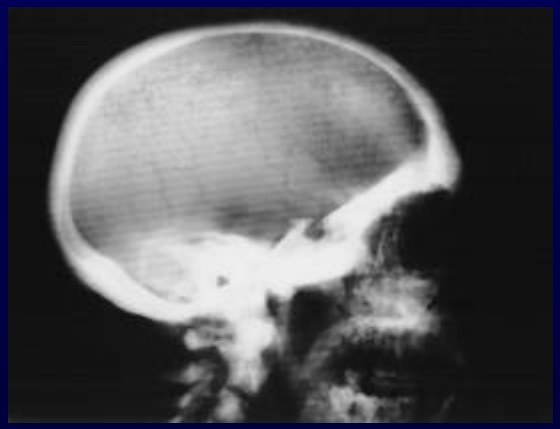
chondrodystrophia foetalis

Osteopetrosis (marmor bone disease)

hereditary (dominant / recessive forms)

osteoclast disorder, bone-resorption ¡

se ALP level normal!



Circumscribed dvelopmental disturbances

spondylolysis „Scotty dog sign”

spina bifida

cervical rib

hemivertebra

Inflammatory diseases

Osteomyelitis

arthritis tuberculosa

Metabolic bone-diseases

the bone resorption and new formation: **remodeling**

homones and local factors

(eg. PTH, sexual and steroid hormons, D3vit …….)

In the matabolic bone diseases:balance lost

increased resorption $\rightarrow$ *calcipenic osteopathia*

osteoporosis

increased bone formation $\rightarrow$ *sclerosis*

Metabolic osteopathies

1. **calcipenic osteopathy**
   - **osteoporosis**
   - osteomalacia
   - hyperparathyreoidism
   - myeloma multiplex

2. bone diseases with sclerosis

conventional x ray

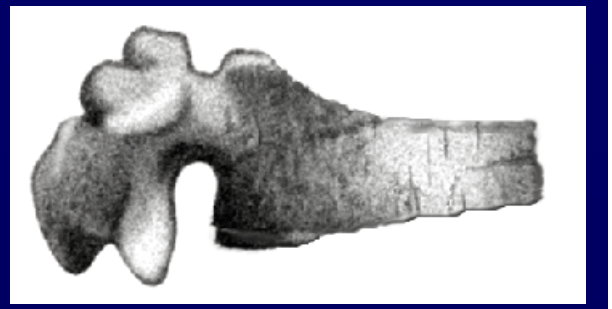
- **diagnostic**
- **differential-diagnostic**

  (the age of the patient, anamnesis, laboratory data)

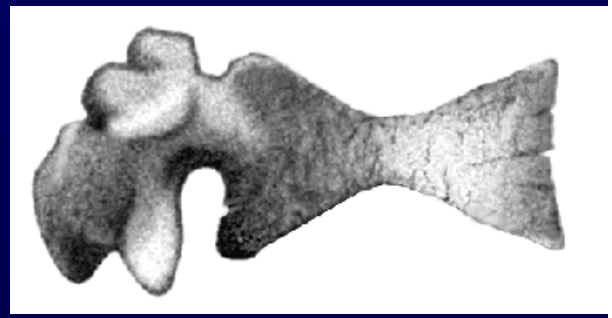
markers of bone-metabolism !

Osteoporosis

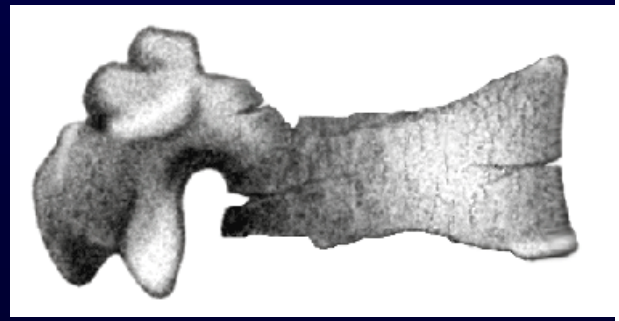
vertebral compression



wedge-like



biconcave



„crush”

revitalised by the digital technique

Metacarpal index (radiogrammetria)

Barnett és Nordin 1961

digital x-ray radiogrammetry

(DXR) 2-4. metacarpus, ulna, radius

Osteomalacia

osteoid mineralisation disturbed

Looser-lines

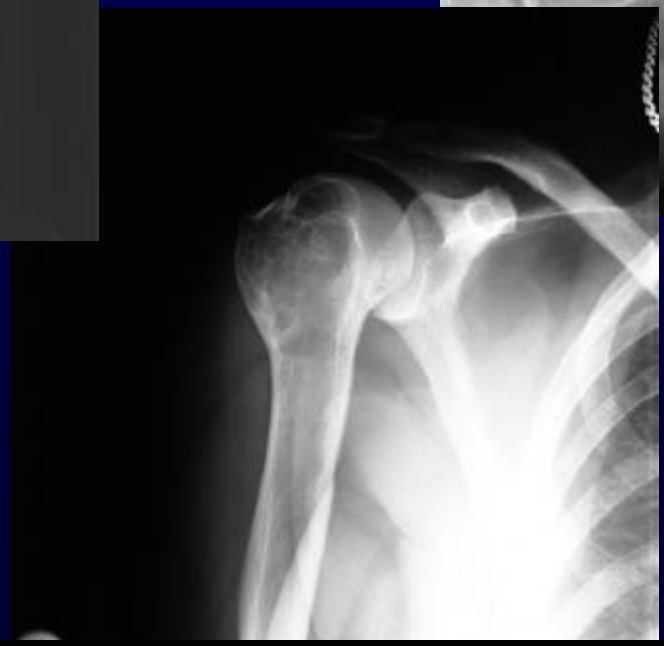
Hyperparathyreoidism (pth adenoma)

subperiosteal resorption

- 2., 3. midle phalanx radial side
- Perpendicular to the cortical
- more frequent in the secondary HPT

Bonecysts

pathologic fracture
of the fibula



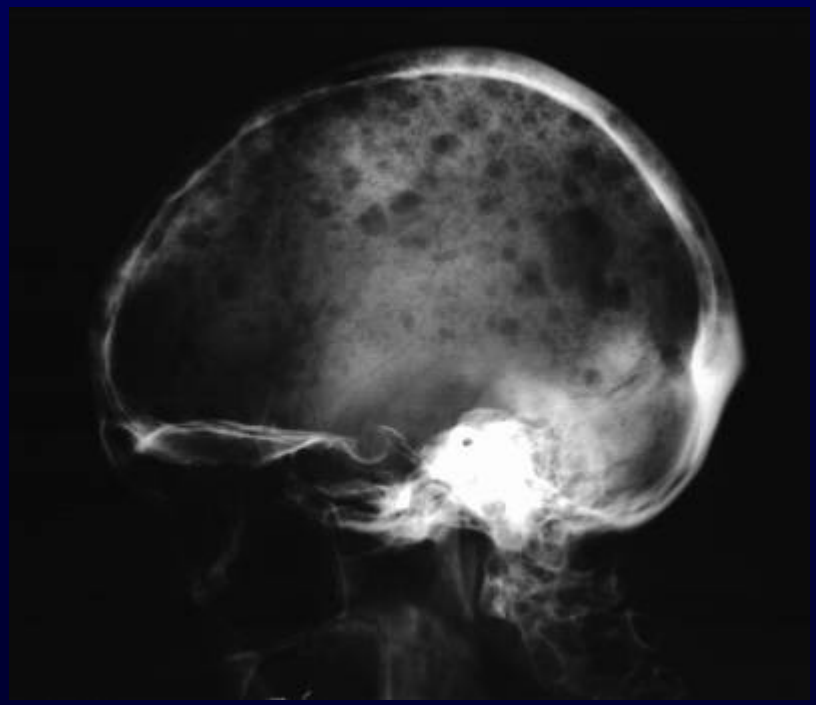
generalised form – M. Recklinghausen

Myeloma multiplex

osteoclast inducating factor

diffuse calcipenia

lythic spots



Renal osteodystrophy (ROD)

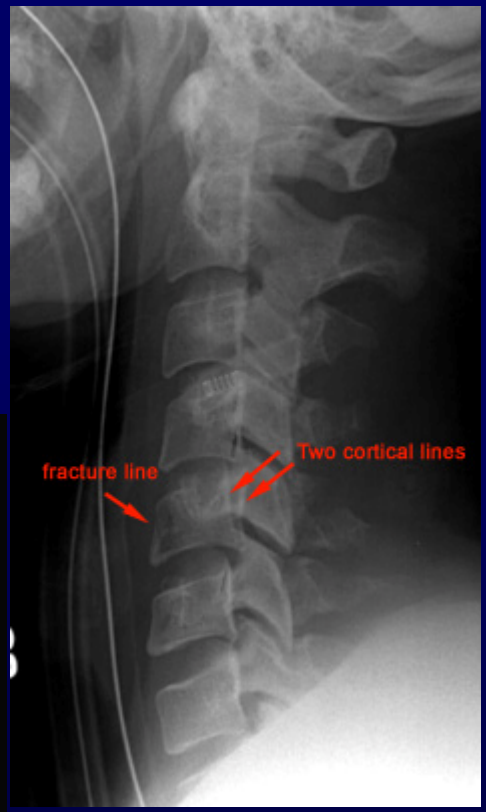
uraemic patients

compound disease: osteomalacy and HPT symptoms

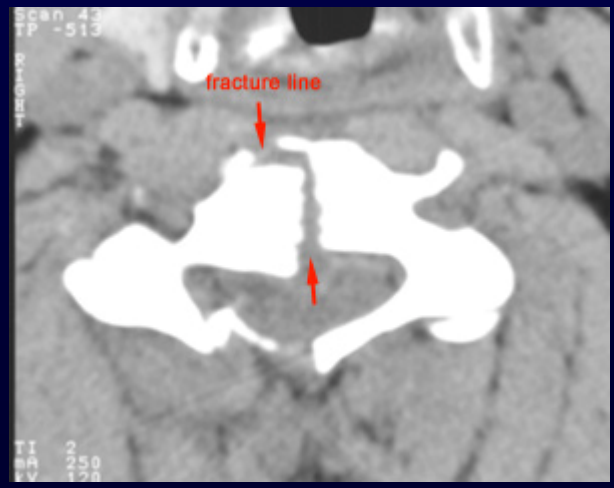
Ruggers'jersey spine

paraarticular calcification

Trauma



MR



CT

Pathologic fracture

Stress fracture

- fatigue fracture

  normal bone, repetitive or cyclical stresses

- insufficiency fracture

  weakened bones (osteoporosis), normal forces or microtrauma

- pathologic fractures

  tumor /inflammation /cysts locally weakened bones

Femoral neck fracture

lateral

medial

Nuclear medicine

isotope

high osteoblast activity - izotóp deposition

early sign of the fracture

femoral neck

os scophoideum fracture

scaphoid fracture

Tumors

benign, malignant

osteoma

osteochondroma

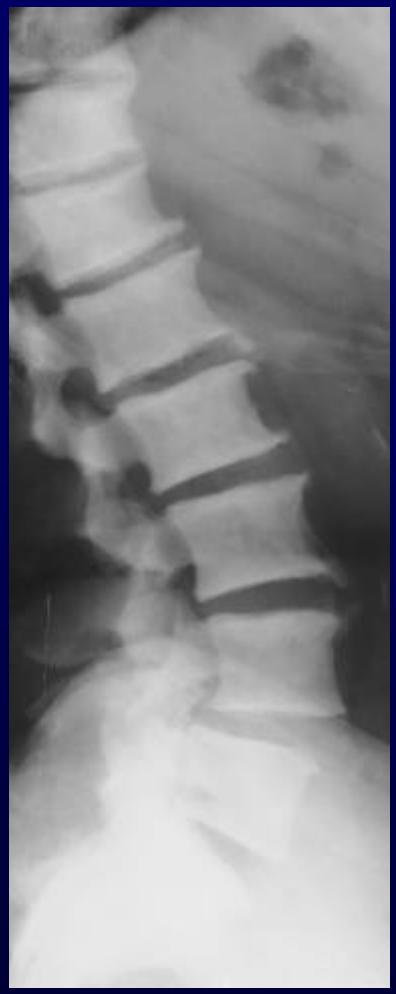
ostesarcoma

Metastasis (haematogenous)

osteolytic

mamma

hypernephroma



osteoplastic

prostata

shigillocellular cc

mixed form

mamma

prostata

Degenerative joint diseases

arthrosis

spondylosis

rheumatoid arthritis (RA)

- atlanto-axial instability
- myelon compression

gout

Metabolic arthropathy

in the joints or around metabolic material depositions

classification according to the material of deposit

GOUT

- purinmetabolism disturbance
- urat level high in the blood - deposits in the joints

Prevalency: 1,5 - 2,6 / 1000

Males of middle ages or older (90%) 28/1000

Females –in the premenopausa rare

Tophus:
chronic gout
Na-urat deposits