Pathology of bones

Osteoporosis

- localized

- generalized
  - primary
    - in senio
    - postmenopauzal
  - secondary
    - endocrinopathies
    - progressive polyartritis *a related diseases*
    - drugs
    - alcohol
    - neoplastic diseases
    - nutrient defficiencies

Osteoporosis

- bone mass measurement
  axial – vetebral column, neck of the femur
  peripheral – heel, finger, tibia

instrumets
X-Ray based (*DXA, dual X-ray absorbometer*)
- bone density
ultrasound (*QUS, kvantitative ultrasound*)
- various bone parameters

Osteoporosis

max BONE mass at 25 – 35 years

woman
the loss by 0,3% to 0,5% bone mass / year
menopause during 5-10 years gradual loss up to
2%-4% bone mass / year

clinical significant osteoporosis:
- every other third woman over 50 years of age
- every other woman over 60 years

women 60 % fractures are based on osteoporosis
men 40 %

women
80% forarm
75% humerus
70% prox. femur
58% vertebral bodies

10% loss of bone mass of **backbone** – 2x increased risk of fracture

10% loss of bone mass of **hip joint** – 2,5x increased risk of fracture

Osteoporosis

genetic factors

physical activity → **max BONE mass** ← nutrition

MENOPAUSE

estrogen ↓

IL-1, IL-6, TNF ↑, glukok

osteoblast
osteoprotegerin ↓

osteoblast
rankl ↑

monocyte
preosteoclast
osteoclast
activity ↑

AGEING

osteoblast replication ↓
bone matrix production ↓
growth factors activity ↓
physical activity ↓

of increased turnover **OSTEOPOROSIS** ***of decreased turnover***

Bone metabolic diseases

**vitamin C defficiency - **scurvy / Moeller-Barlow´s disease
vitamin D defficiency – dwarfism, rhachitis
renal osteopathy

Bone inflammatory diseases

- **osteomyelitis (nonspecific: purulent x non-purulent**
  - acute
  - subacute
  - chronic
    - chronic sclerotizing OM of *Garré*

- **specific**
  - sarcoidosis
  - tuberculosis
  - syfilis
    - tercially - stage with gummata
    - congenital

Kostní záněty

- **osteomyelitis** (non-specific, purulent – acute / chronic)
  blood borne, esp. in children
  per continuitatem – from the vicinty
  direct transition of infection

etiology
Staphylococcus aureus 80 – 90 %
Escherichia coli
Pseudomonas aeruginosa
Klebsiella pneumoniae
Haemophilus influenzae
Streptococcus B
Salmonella species

- **osteomyelitis** (non-specific, non-purulent, chronic)

Tuberculosis

Paget´s disease – osteitis deformans

Stages of the disease

- **osteolytic - osteoclastic**
- **osteoclastic + osteoblastic**
- **stabilised, quiescent**

forms

monoostotic – sec. osteosarcoma (OS) < 1%

polyostotic – sec. osteosarcoma (OS) > 5%

Bone cysts - pseudocysts

- **juvenile (simple)**
- **aneurysmatic**
  primary
  secondary
- **bone ganglion**

Bone neoplasms

- **chondrogenic** **22 %**
- **osteogenic** **19 %**
- **giant cell bone tumor**
- **fibrogenic**
- **vascular**
- **hemopoetic** (lymphomas, incl. PMM; leukemia **40 %**
- **other, incl. neoplasms of uncertain origin** (lipoma, Ewing tu)

- **secondary - metastatic**

Chondrogenic neoplasms

- **chondroma**
  - **- enchondroma**
  - - ecchondroma – osteochondroma **– osteoma** (exostosis)
- **chondroblastoma**
- chondromyxoid fibroma
- **chondrosarcoma**

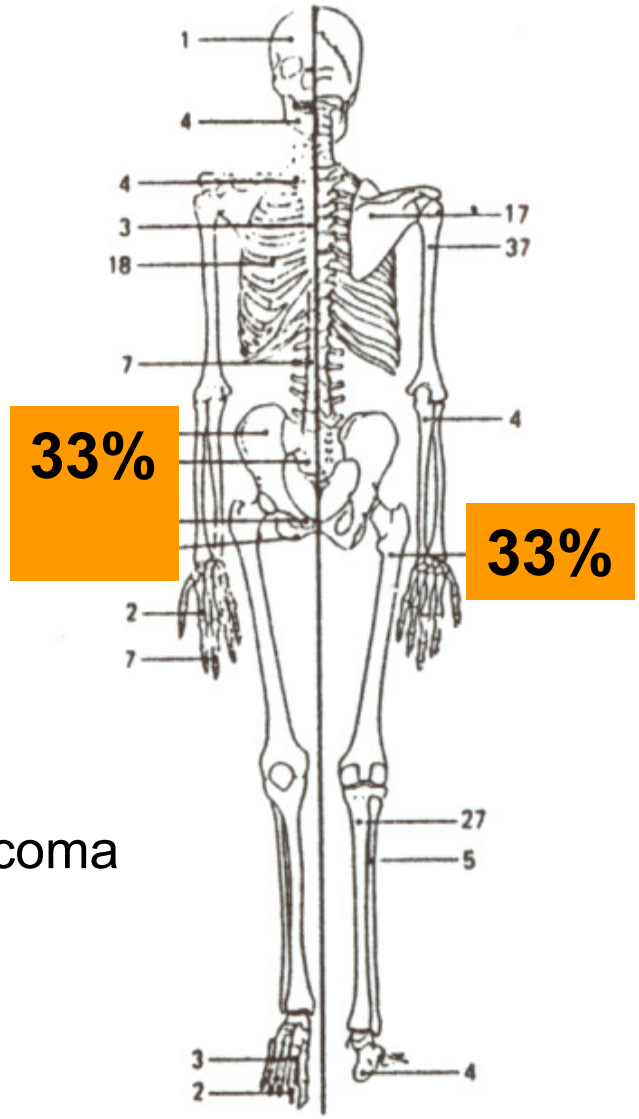
Osteochondroma

Chondroblastoma

Chondrosarcoma

26% of bone malignant neoplasms

>50 years, peak between 5th-7th decade



typy

▶ **chondrosarcoma**

- mesenchymal chondrosarcoma
- clear cell chondrosarcoma

Chondrosarcoma

prognosis - 5 year survival

grade 1	90%
grade 2	80 %
grade 3	40 %

Osteogenic neoplasms

- **hyperostosis**
- **osteoma**

variable genesis

ecchondroma – osteochondroma – **osteoma (exostosis)**

- **osteoid osteoma**
- **giant osteoid osteoma / osteoblastoma**
- **osteosarcoma - OS**

variants

Osteosarcoma

4 – 5 cases / 1 mil. // **35%** malignant bone neoplasms

60% < 25 years

30% > 40 years – predisposition

Paget´s disease

postiradiation therapy

male 3 : 2 female

long bones

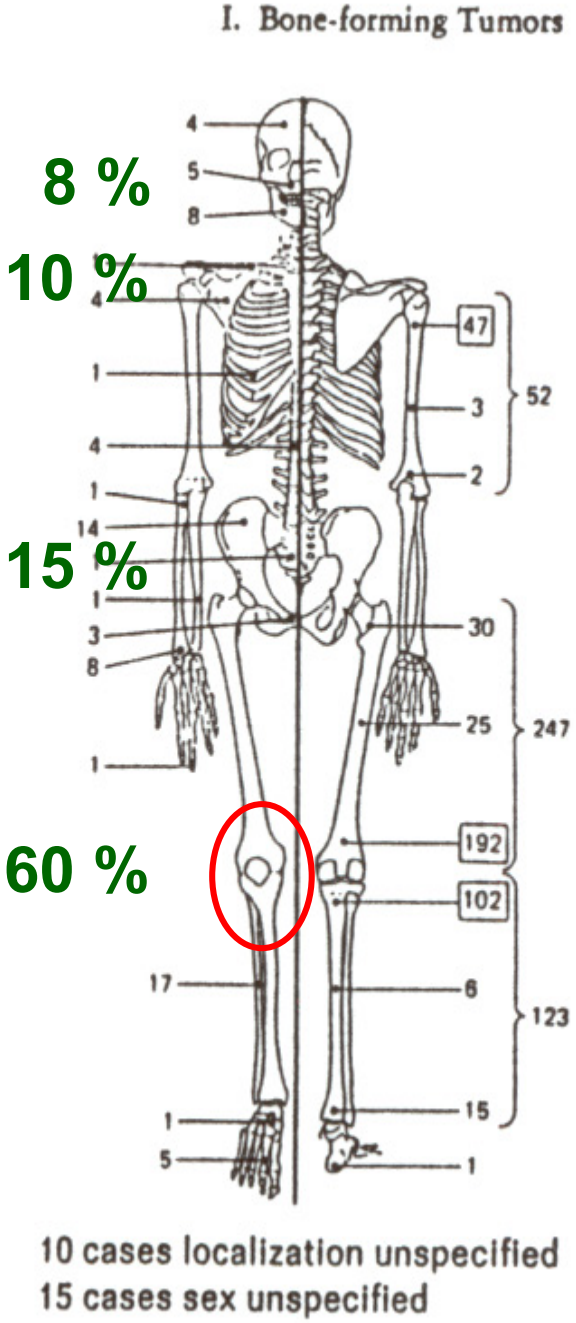
91% metaphysis

9% diaphysis

types

▶ **convention OS**

- teleangiectatic
- small cell
- central, low grade
- secondary
- parostal
- periostal
- high grade surfice type



Osteosarcoma - parostal

x periostal

Giant cell bone tumor

Giant cell bone tumor

prognosis - 5 y survival

benign ~ 96 %
- local recurrence rate 40 - 60 % !
- metastatic (lungs) ~ 4 %

Fibrogenous bone tumors

- **metaphyseal** (cortical) **fibrous defect – nonossifying fibroma**

- **fibrous dysplasia**
  - **monoostotic** **70 %**
  - **polyostotic** **27 %**
  - **syndrome McCune-Albright** **3 %**
    - endocrinopathy
      - preccocious puberty
      - hyperthyreosis
      - hypophyseal adenoma STH
      - adrenocortical primary hyperplasia
    - café au lait spots
    - *somatic mutations of the gene G-protein (GBP)*

fibrosarcoma

Vascular tumors

- **hemangioma**
- **hemangioendothelioma**
- **angiosarcoma** (**1%** of malignant bone tumors)

Other bone tumors a tumors of uncertain origin

- **Ewing sarcoma (tumor)**
  ES

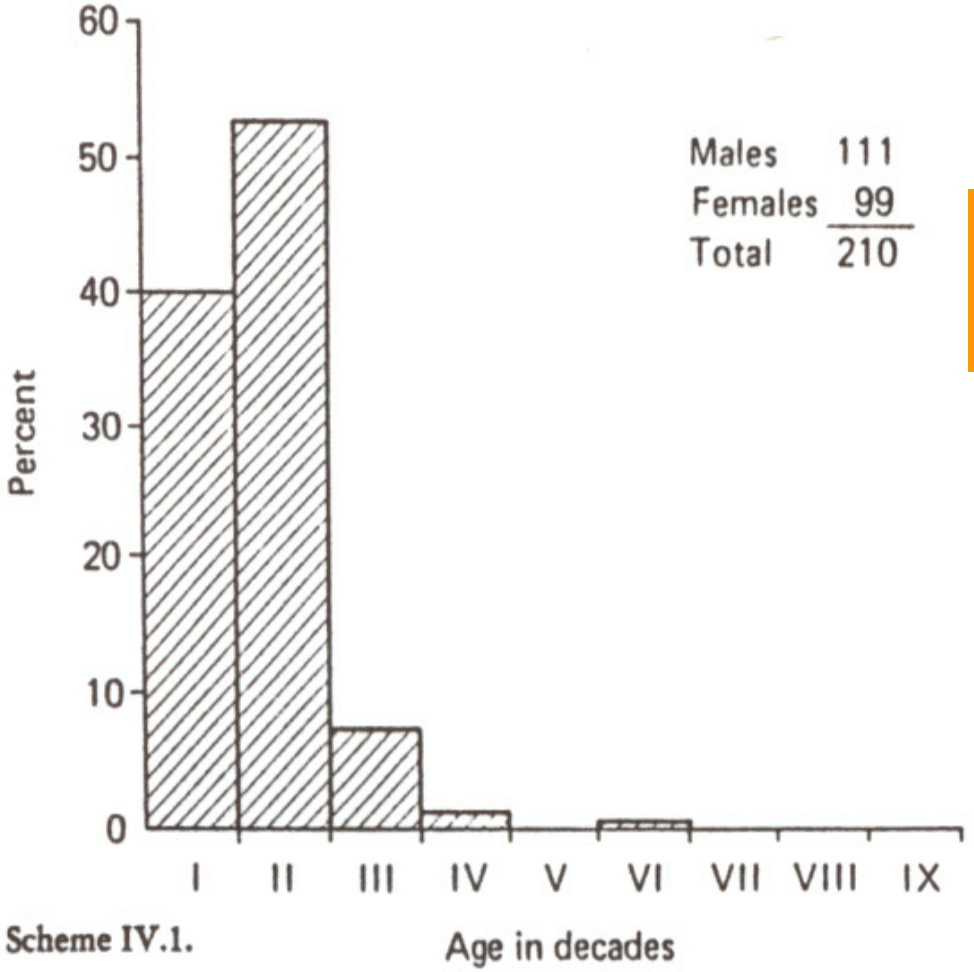
James Ewing, M.D.

25. 11. 1866
Pittsburg

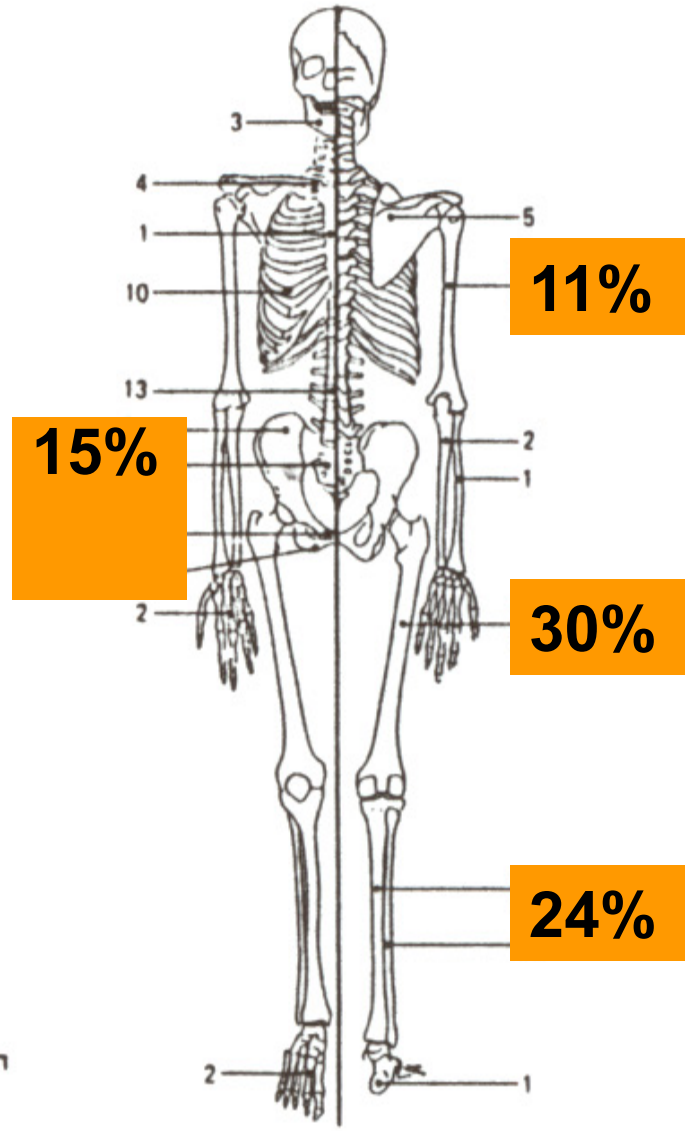
16. 5. 1943
New York

ES

16% of malignant bone neoplasms



Scheme IV.1.



Chordoma

8,4% of malignant bone neoplasms

Hemopoetic bone neoplasms

plasmocytic myeloma

- **lymfomy** (přibližně 7% maligních nádorů kosti)
- **plasmocytární myelom** (nejčastější primární nádor kosti)
- **histiocytóza z Langerhansových buněk (LCH)**
- **(leukémie)**

Langerhan´s cell histiocytosis – eosinophilic granuloma

Precursor of malignant bone neoplasms

- **high risk**
  - **Ollier´s disease** and Maffucci syndrome
  - **retinoblastoma – familial form**
  - other

intermediate risk
- **osteochondromatosis**
- **Paget´s disease polyostotic**
- **radiation related osteitis**

- **low risk**
  - **fibrous dysplasia**
  - **bone infartions**
  - **chronic osteomyelitis**
  - **bone implatns**
  - **giant cell bone tumor**
  - **osteoblastoma**
  - **chondroblastoma**

Metastatic tumors

- **adults**
  - **carcinoma**
    - prostate
    - mammary gland
    - lung
    - GIT
    - kidney
    - thyroid gland *(follicular ca)*
- **children**
  - neuroblastoma
  - rhabdomyosarcoma
  - osteosarcoma
  - Ewing tumor
  - not Wilms tumor / nephroblastoma !