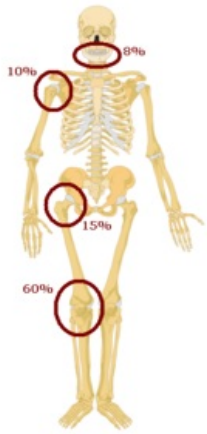
Malignant tumors of the skeleton

Malignant tumors of the skeleton are tumors with a tendency to metastasize + local bone destruction.

- by age: Ewing's sarcoma (10-20 years), osteosarcoma (15-25 years), malignant fibrous histiocytoma (20-30 years), chondrosarcoma (over 50 years), bone metastases (over 40 years)
- treatment in general: biopsy → CHT (Ewing + RT) → wide resection/amputation → adjuvant CHT

Osteosarcoma

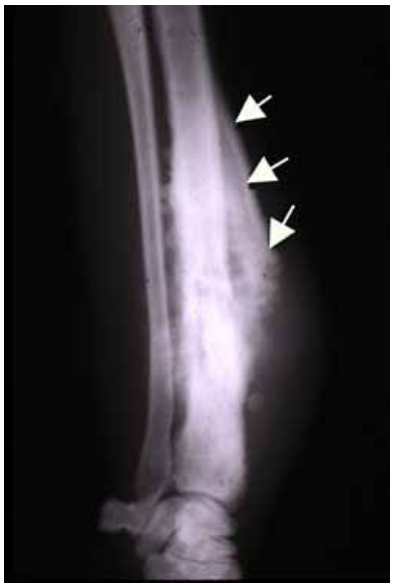
Osteosarcoma is a malignant primary **bone tumor** (the 2nd most common primary malignant bone tumor after the exclusion of multiple myeloma). It most often affects the long bones of the lower limb near the knee joint. Osteosarcoma grows in the bone, which it destroys, and invades the soft tissues around the bone. It soon metastasizes, especially via the hematogenous route to the **lungs**, other **bones**, and the **brain**. It is one of the **most common malignant bone tumors**, along with chondrosarcoma. The age group most at risk is the 10 - 20 years age group. Every year, 4 out of one million children are diagnosed with osteosarcoma.[1]



Predilection sites for osteosarcoma

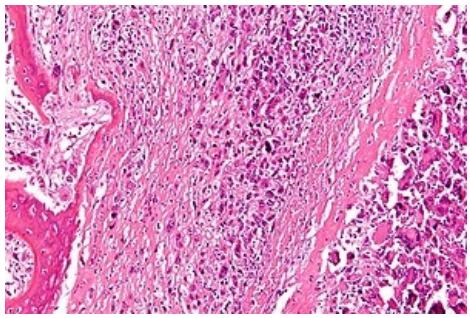
Classification

- **Central** (medullary, conventional) osteosarcoma is a **highly malignant tumor** (the most common malignant bone tumor) that occurs in individuals under 20 years of age (one of the most common tumors in this age group) or in older individuals due to Paget's disease, fibrosis dysplasia, and similar pathological bone processes. It can affect any bone (more often the femur, tibia, humerus, at the transition from the diaphysis to the metaphysis). It soon metastasizes (mainly to the lungs, brain, other bones). It is **clinically** manifested by persistent dull pain, mild swelling of the bone and mild fever. The tumor begins to grow in the metaphyseal marrow, infiltrates the cortex below the periosteum, and then can grow into the adjacent soft tissues. **Osteoid** formation is evident **microscopically** (non-mineralized bases) by tumor cells (the tumor consists of osteoblasts). In different proportions, bone, and cartilaginous and fibrous tissue are represented (or with wide vascular spaces - telangiectatic osteosarcoma - the most malignant form of osteosarcoma). Depending on which type of tissue predominates, osteosarcoma can be:
  - **Fibroplastic** - spindle cell ligament;
  - **Chondroplastic** - tumor of cartilaginous tissue with atypical spindle cell elements;
  - **Osteoplastic** - islets or beams of osteoid (can be mineralized), tumor osteoblasts have atypical or polymorphic nuclei (the only sign that it is a tumor process).
- **Peripheral** (superficial) osteosarcoma: creates a painful protuberance on the bone surface. X-ray shows secondary periosteal ossification. It includes, for example, parosteal (juxtacortical) osteosarcoma with a very good prognosis, osteosarcoma with a high degree of malignancy, and periosteal osteosarcoma.[2]


Codman's triangle

Clinical picture

- Pain in the affected bone, typically resting and nocturnal (i.e., without physical exertion)
- With tumor growth, solid swelling occurs, which may not be painful to the touch (typically around the knee joint).
- At an advanced stage, a pathological fracture of the relevant bone might occur.
- Non-specific general symptoms - night sweating, fever, weight loss
- Cough and difficulty breathing - lung metastases. [1]


Detail of tumor cells

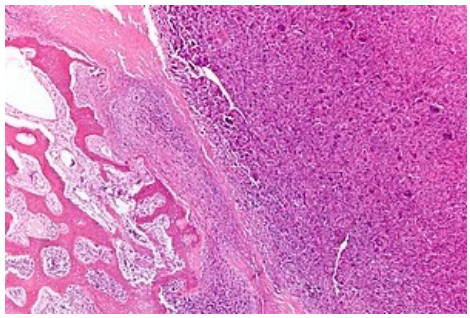
Diagnosis

- **Elevated phosphatase levels**[2] are a biochemical marker of bone tumors
- Simple X-ray (typically areas of osteolysis and newly formed bone, unbounded, exhibits periosteal reaction, *Codman's triangle* = space bounded by elevated periosteum, bone surface and tumor), NMR
- Definitive diagnosis histologically (sarcoma stroma, osteoid formation by tumor osteoblasts)

- CT of the lungs and scintigraphic examination of the skeleton– metastases[1].

Treatment

- Chemotherapy (adriamycin, high-dose MTX, leucovorin, cisPt, BCD, ifosfamide)
- Radical surgical removal of the tumor (amputation or limb saving surgery)
- Osteosarcoma generally has a low sensitivity to radiotherapy[1].



Normal bone tissue is visible on the left, while osteosarcoma is visible in the middle. Stained with HE

Prognosis

Patients with a radically operated tumor and a good response to chemotherapy have up to an 80% chance of recovering.[1]

Ewing's Sarcoma

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Last update: Tuesday, 01 Nov 2022 at 4.47 pm.

This article has been translated from WikiSkripta; ready for the **editor's review**.

Ewing's sarcoma - tibia

Ewing's sarcoma (EWS) belongs to the *sarcomas of the Ewing group:* EWS, PNET (primitive neuroectodermal tumor), Askin's tumor (Ewing on the chest wall).

It is the 2nd most common malignant bone tumor in children and adolescents, the highest incidence between 5–30 years of age. Early metastasis to the lungs is typical.

It most often develops in the bone marrow of the diaphysis of long bones (mainly femur, tibia). It often mimics acute osteomyelitis: subfebrile, leukocytosis, increased sedimentation, pain, including positive scintigraphy.

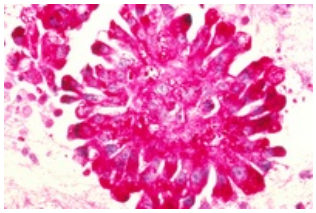
Clinical picture: Pain, swelling, pathological fractures

RTG: osteolytic changes with permeative bone destruction + periosteal reaction.

Therapy: 1. neoadjuvant CHT , 2. radical surgical resection, 3. intraoperative / subsequent RT , 4. adjuvant CHT.

Prognosis: 5-year survival 60-76% (in case of no metastases).

Chondrosarcoma



Cells of Ewing's sarcoma

Chondrosarcoma is one of the most common malignant bone tumors, it is an adult tumor.

- In the metaphysis of the proximal part of the humerus, femur, tibia, , and elsewhere.
- It arises primarily or by malignancy of the enchondrum exostoses.
- Typically: a man aged 40-70 years, complains of pain in the gluteal region, the area of the hip joint or pain in the equilateral thigh / knee, attacks the affected limb, the pain gradually worsens and does not subside at rest.
- **X-ray:** intraosseous osteolytic lesion with islets calcification.
- **Histological picture:** lobularly arranged masses of cartilaginous tissue with cellular atypia.
- **Therapy::** single treatment surgical removal of the tumor: broad / radical resection of the tumor, ev. metastasectomy in solitary lung disease.

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Links

Related articles

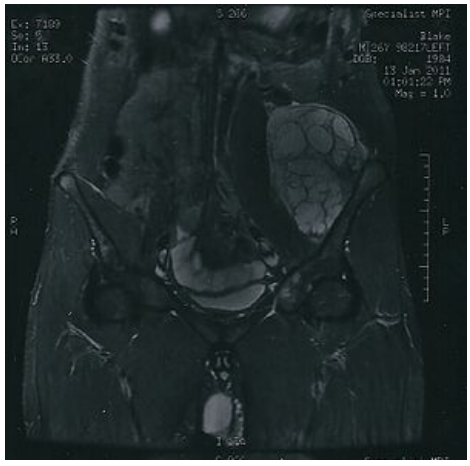
- Osteosarcoma
- Spinal tumors

References

- SOSNA, A. – VAVŘÍK, P. – KRBEC, M., et al. *Základy ortopedie.* 1. edition. Praha : Triton, 2001. ISBN 80-7254-202-8.
- GALLO, Jiří, et al. *Ortopedie pro studenty lékařských a zdravotnických fakult.* 1. edition. Olomouc : Univerzita Palackého v Olomouci, 2011. ISBN 978-80-244-2486-6.

Plasma cell myeloma

Plasmocellular myeloma, or **plasmacytoma**, is a malignant tumor of the plasma cells. It is usually found in the bone marrow, where it destroys bone and can cause pathological fractures. If there are more deposits, we call it multiple myeloma (Kahler's disease). Tumor cells produce protein chains - **paraprotein**. However, there are rarely non-secretory myelomas in which no paraprotein can be detected in serum.



Left pelvic chondrosarcoma

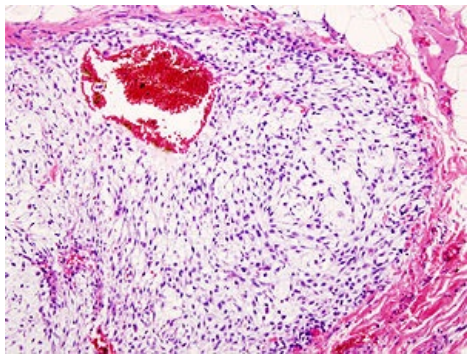
Pathology

Macroscopy

Myeloma takes the form of dark red osteolytic deposits in the bone marrow (calva, vertebrae, pelvis, humeral shaft, femur).

Complications

- Pathological fractures (there is a risk of spinal cord lesions in the case of vertebrae).
- AL amyloidosis.
  - Myocardium - rhythm disorders, heart failure.
  - Large intestine - malabsorption.
  - Kidneys - renal failure (proteinuria, periorbital edema, uremia).
  - Liver, blood vessels, nodes...
  - Tongue - macroglossia.
- Myeloma kidney - clogging of tubules by protein chains - *'Bence Jones protein'*.



Chondrosarcoma

Life threatening conditions

- Failure of an organ affected by amyloidosis,
- bronchopneumonia - develops after vertebral fracture and spinal cord injury,
- bone marrow tumor generalization infection (same as leukemia).

Clinical part

Epidemiology

The disease affects men more often than women (1.5: 1). The incidence is rising from the age of 50, the median age is 70 years. The incidence in the Czech Republic is 3-4: 100,000 inhabitants / year. The etiology of the disease is unknown.[3] It is almost non-existent in childhood and very rare in young people.

Clinical symptoms

The initial period may be completely asymptomatic (in indolent lymphomas), but> 70% of patients are dominated by **pain** in the back and ribs. Pain is tied to physical activity.

The clinical picture is formed by a set of symptoms hidden under the acronym **CRAB**:

- **C**alcium – hypercalcemia, which is associated with bone loss. Hypercalcemia also causes depression, lethargy and weakness.
- **R**enal failure – renal failure due to tubulopathy, uncommon myeloma,
- **A**nemia – normocytic normochromic anemia is the most common symptom, it is associated with weight loss, fatigue, shortness of breath and paleness
- **B**one – Bone involvement - very common, tumor cells in the bone marrow produce osteoclasts activating factors, leading to bone osteolysis and pathological fractures that occur in up to 70% of patients.

Susceptibility to infections, manifestations of hyperviscous syndrome (headache, vision disorders) and palpable infiltrates over osteolytic deposits (especially on the skull) also contribute to the clinical picture.

Examination methods

- X-ray - reveals pathological deposits (often the skull and spine are affected, but myeloma may be in any bone), as well as CT, MRI, PET,
- **detection of paraprotein in blood** – Plasma protein electrophoresis (see picture), serum paraprotein concentration is usually> 30 g/l,
- **detertion of free chain (FLC)** – the most sensitive method, it also detects non-secretory myeloma, when the determination of the paraprotein would be negative, the normal ratio of kappa: lambda light chains is 2: 1, in the case of myeloma it is, for example, 350: 1,
- detection of Bence Jones protein in the urine,
- bone marrow examination - the number of plasma cells usually exceeds 10% of all nuclear cells in the marrow, as well as immunohistochemical and cytogenetic examination (occurrence of deletions, trisomies that are of prognostic significance),
- cytogenetic examination - numerical and structural changes of chromosomes, important for prognosis
- laboratory examination,
  - normocytic normochromic anemia, mild leukopenia and thrombocytopenia
  - often increased sedimentation,
  - hypercalcemia,
  - renal function - increased urea and creatinine,
  - examination of LD, thymidine kinase and beta $_2$ -microglobulin, hyperuricemia - their increased values have a negative prognostic significance.

Clinical stages and variants

Clinical stages

Classification according to Durie and Salmon[4]:

- **clinical stage I** – paraprotein concentration IgG <50 g / l, or IgA <30 g / l, proteinuria <4 g / 24 hours, no osteolytic changes without hypercalcemia,
- **clinical stage II** – values are between stages I and III,
- **clinical stage III** – araprotein IgG> 70 g / l, or IgA> 50 g / l, proteinuria> 12 g / 24 hours, multiple bone deposits, hypercalcemia> 2.75 mmol / l, hemoglobin concentration <85 g / l,
- subclassification A, B according to the value of serum creatinine (renal impairment),
  - **subclassification A** – serum creatinine ≤ 177 µmol/l,
  - **subclassification B** – serum creatinine > 177 µmol/l.

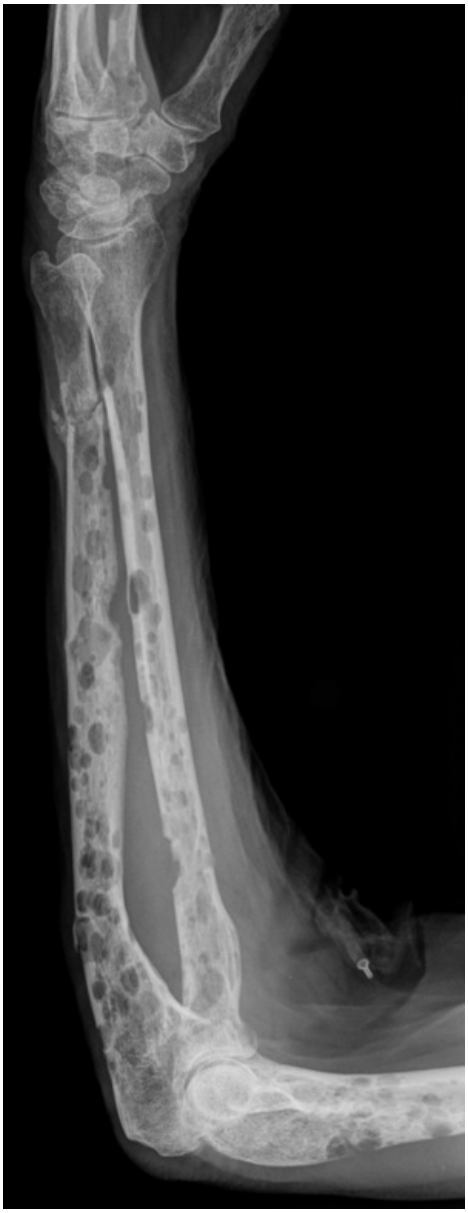
Clinical variants

Asymptomatic myeloma,

- smoldering myeloma,
- indolent myeloma,
- stage I multiple myeloma,

symptomatic myeloma,

- stage II and III multiple myeloma,
- solitary plasmacytoma.



X-ray with multiple osteolytic lesions in the forearm.

Therapy

- If myeloma is asymptomatic, it is not treated, it is only monitored,
- if symptomatic, it is treated:
  - younger patients are indicated for autologous hematopoietic stem cell transplantation,
  - elderly patients are indicated for chemotherapy,

- chemotherapy - cyclophosphamide and dexamethasone (or thalidomide) are used as standard, since 2009 registered in the Czech Republic for primary therapy bortezomib [5]
- radiotherapy - for painful bone deposits,
- palliative treatment - in patients with severe comorbidities, melphalan and prednisone, or radiotherapy.

Other rarer skeletal malignancies

- Creating Adamantine Longbones
- chordoma
- malignant fibrous histiocytoma

- fibrosarcoma
- Liposarcoma

Links

related articles

- Benign tumors of the skeleton

Reference

1. FN Brno. *Osteosarkom* [online]. Klinika dětské onkologie FN Brno, [cit. 2011-01-02]. <https://www.fnbrno.cz/detska-nemocnice/klinika-detske-onkologie/informace-pro-pacienty/t2698>.
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