Bone tumors and tumor like bone lesions

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Bone tumors and tumor like bone lesions

- Bone tumors are sometimes easy solving and sometimes almost impossible problem for experienced radiologist.
- The incidence of some benign bone tumors is quite high (30%), while on the other hand primary malignant bone neoplasms are rare. They represent only 1% of death caused by a cancer disease.

Bone tumors and tumor like bone lesions

- Answers on following questions are necessary:
- Is bone lesion inflammatory or tumorous?
- Benign or malignant?
- Primary or secondary bone lesion?

Bone tumors and tumor like bone lesions

- Very important: diagnostic imaging should be made before bone biopsy:
- Biopsy can sometimes be misleading
- After bone biopsy tissue imaging characteristics on the puncture site change; radiological diagnosis can be hard to make.

Etiology

- Mostly unknown
- Heredity (osteosarcoma + retinoblastoma,
  chondrosarcoma + multiple exostoses)
- Ionising radiation (Radium)
- Bone marrow transplantation
- Trauma
- Coexisting bone diseases: Mb. Paget, bone infarction

WHO: Bone tumors classification: origin

	Benign	Malignant
Osteogenic tumors	*Insula compacta* *Osteoid osteoma* *Osteoblastoma*	*Osteosarcoma* *Parosteal osteosarcoma*
Cartilage tumors	*(E)nchondroma* *Chondroblastoma* *Chondromixoid fibroma* *Osteohondrom*	*Hondrosarcoma*
Fibrogenic tumors	*NOF, Fibrozni kortikalni defekt* *Desmoplastic fibroma* *Fibromatosis*	*Fibrosarcoma* *Fibrous histiocytoma*
Giant cell tumor	*Giant cell tumour* *ABC* *Hiperparatyreoid tumour*	*Malignant giant cell tumour*

Bone tumors classification: origin

	Benigni	Maligni
Vascular tumors	*Haemangioma* *Lymphangioma* *Glomus tumor*	*Haemangiopericytoma* *Haemangioendothelioma* *Angiosarcoma*
Lipogenic tumors	*Lipoma*	*Liposarcoma*
Neural tumors	*Neurofibroma* *Neurilemoma(Schwann)*	*Neurofibrosarcoma* *Neuroblastoma*
Notochordal tumors	-	*Chordoma*
Haematopoietic tumors	- *Hystiocitosis (Eosinofil granuloma)*	*Plasma cell myeloma,* *Malignant lymphoma*

Bone tumors classification: origin

	Benigni	Maligni
Joint lesions	*Intraosal ganglia* *PVNS* *Synovial chondromatosis*	*Synovial sarcoma* *Synoviom*
Unknown	*Solitary bone cyst*	*Roundcell: Ewing sarcoma, retikulosarcoma*
Non-neoplastic	*Brodie abscess* *Hydatid cyst* *Haematoma* *Bone infarction*	

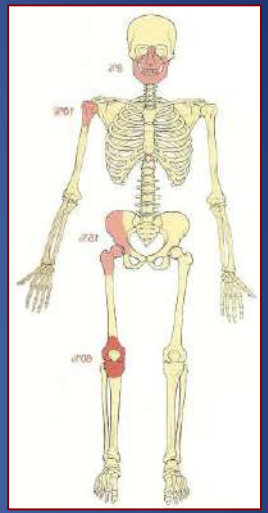
Malignant bone tumors classification: basic disease

PRIMARY	SECUNDARY
Osteosarcoma	Metastsis - breast ca, renal, lung, prostatic, thyroid gland -- mostly axial bones, elderly people
Chondrosarcoma	
Ewing sarcoma	
Malignant fibrous histiocytoma	
Fibrosarcoma, other sarcoma	
(Multiple myeloma)	

- Most frequent bone tumors are secondary (metastatic) changes

American Cancer Society

- 40% - OSTEOSARCOMA (bone tissue)*
- 28% - CHONDROSARCOMA (cartilage)
- 10% - CHORDOMA
- 8% - EWING TUMOUR
- 4% - FIBROSARCOMA, MALIGNANT FIBROUS HISTIOCYTOMA (fibrous tissue)
- HAEMANGIOPERICYTOMA, HAEMANGIOENDOTHELIOMA, ANGIOSARCOMA (vessels)



The Cancer Registry of Slovenia

- Annualy 15-20 new cases, M:F = 1:1
- 10-12% < 30 years, other > 40 years
- 12-14 patients annualy die, mostly elderly

General principles of radiologic diagnostics

- Clinical facts and patients ages are crucial for the interpretation (diagnosis) of bone tumors.
- Most bone tumors are more frequent in certain age group (malignant <30 age; multiple myeloma, metastasis >40 age).
- Benign tumor changes are almost always incidental findings at radiological examinations.

General principles of radiologic diagnostics

- Very important is conventional radiogrpahy.
- Findings are further defined by:
- Computed tomography (CT)
- Magnetic resonance imaging (MR)
- Bone scintigraphy
- Bone biopsy

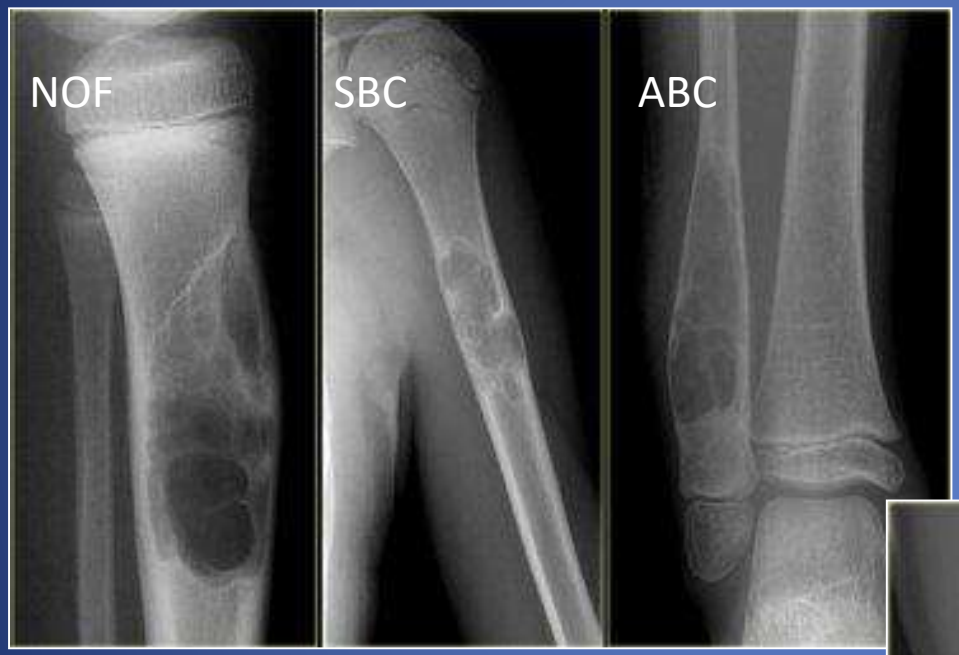
General principles of radiologic diagnostic

- Conventional film should be technically excellent with very good presentation of bone and soft tissue structures.
- Ossifications, calcifications and tumor structure should be very good presented.
- Periosteal reaction on tumor growth must be sharply seen (additional projections): type of periosteal reaction
- Osteolytic (primary destruction) or osteoblastic (bone formation) tumor?

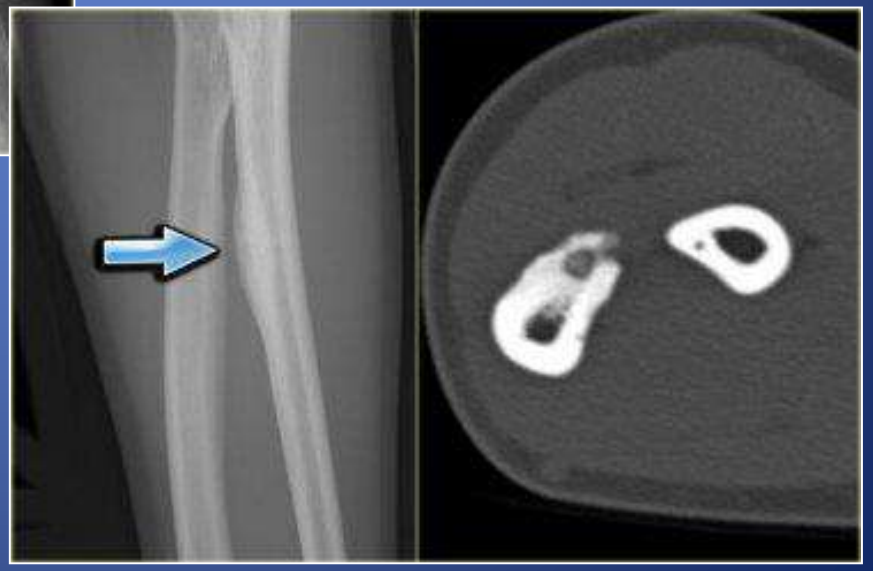
General principles of radiologic diagnostic

- In diagnostic process of bone tumors we should take into account:
- Number of lesions- solitary/multiple lesions?
- Primary bone tumors are (with exception of multiple osteochondromas and cartilage tumors in dyschondroplasias) solitary bone lesions.

General principles of radiologic diagnostic



Chondromyxoid fibroma Giantcell tumour



General principles of radiologic diagnostic

- Which type ob bone is affected?

- With tumors, which affect axial skeleton and proximal ends of long bones (places of hematopoiesis) we should always consider multiple myeloma and metastasis.
- Most malignant tumors affect pelvis and long bones.

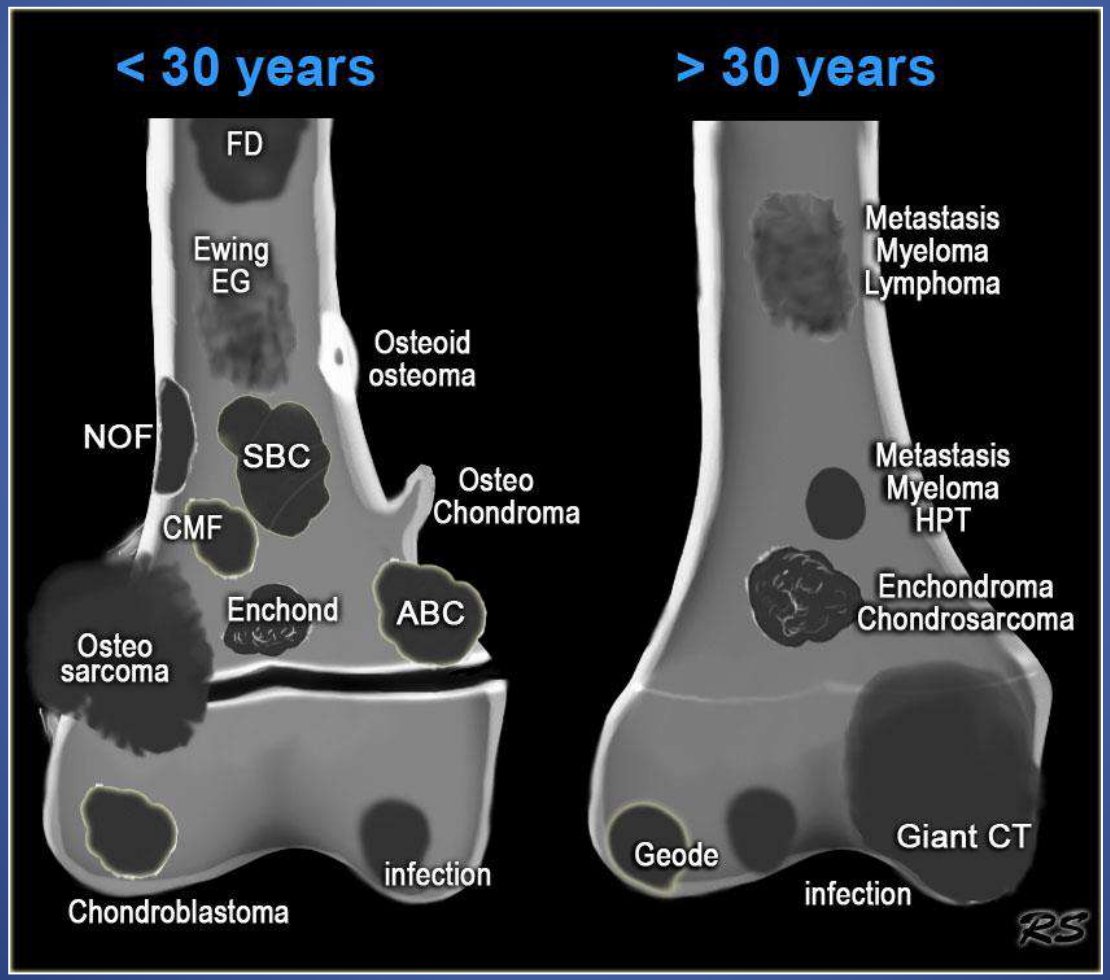
General principles of radiologic diagnostic

General principles of radiologic diagnostic

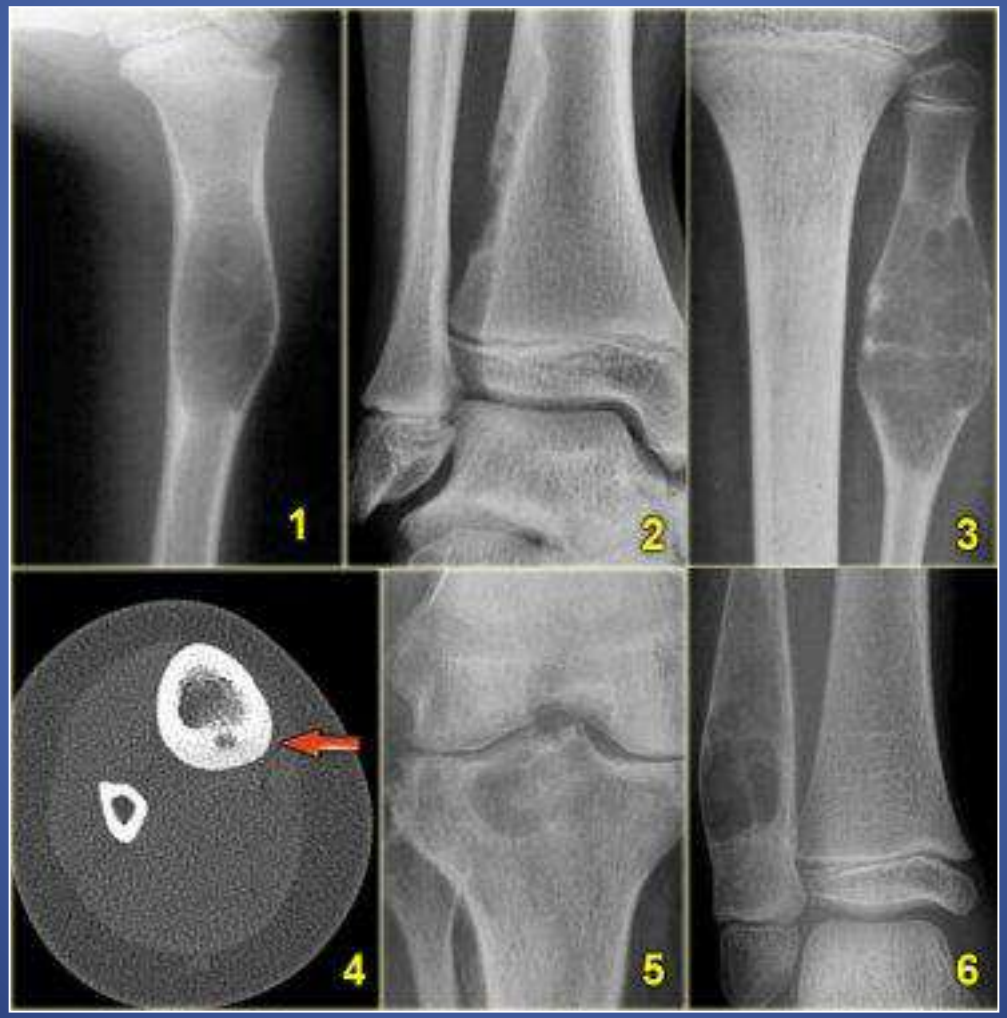
General principles of radiologic diagnostic

- Exact place of tumor inside bone?
- Numerous benign tumor lesions originates in cortical bone, eccentrically, in metadiaphysis of long bones (NOF).
- Chondral tumors (enchondroma) originates medullary.
- Giant cell tumor always lies sub-articular in epiphysis.

General principles of radiologic diagnostic



Tumor location



Tumor location

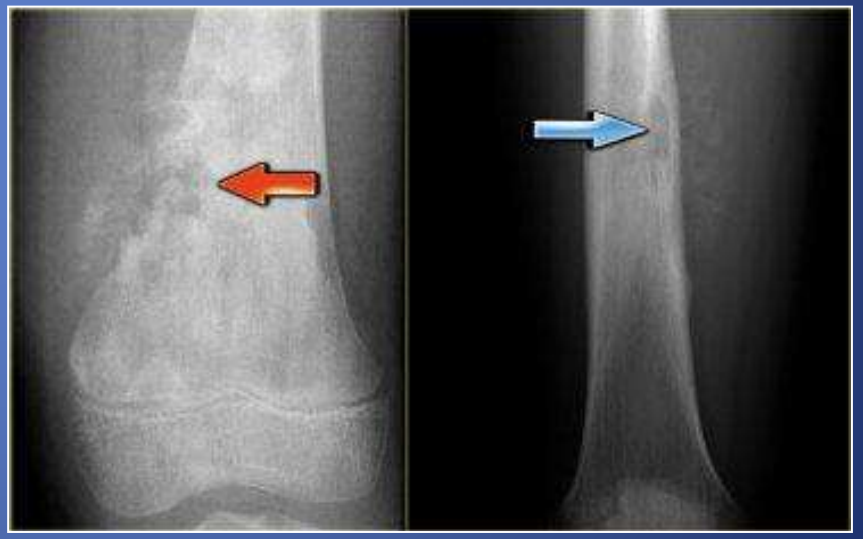
General principles of radiologic diagnostic

- Borders of tumor lesion?
- Wide/small (well-defined or ill defined) zone of transition between tumor and adjacent normal bone
- Cortical destruction
- Periosteal reaction
- Surrounding tissues invasion, aggressive growth
- Nonsclerotic /Sclerotic tumor margins (tumor limits)

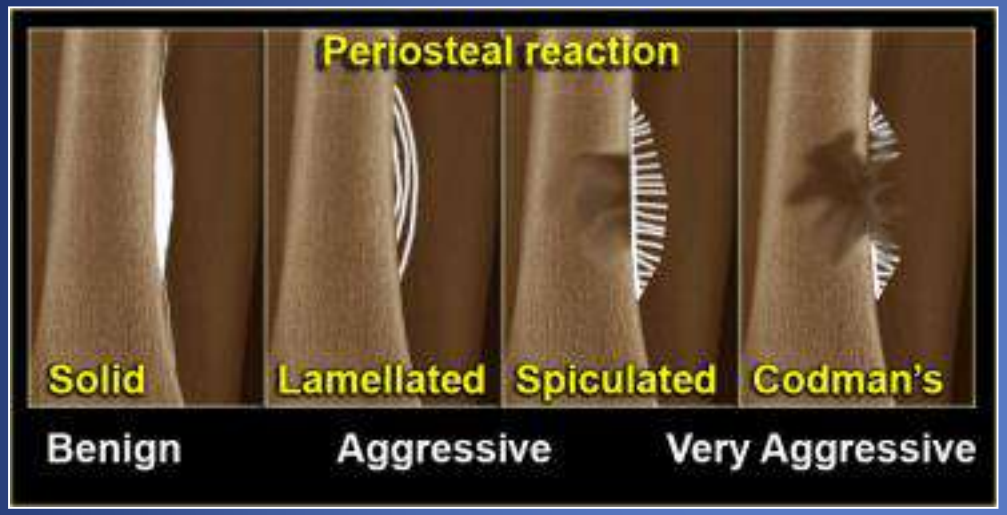
General principles of radiologic diagnostic

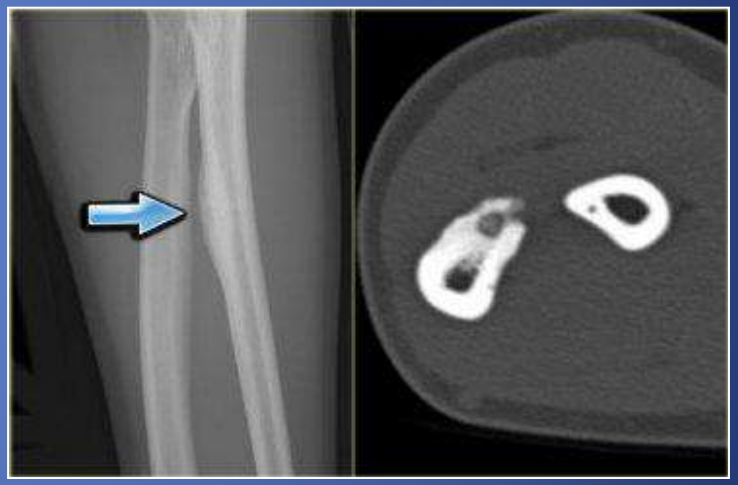
Age	Well-defined	ill-defined	Sclerotic
			
0 - 10	EG SBC	EG - Ewing Osteosarcoma Leukemia	Osteosarcoma
10 - 20	NOF, Osteoblast Fibr dysplasia EG SBC ABC Chondroblast CMF	Ewing EG Osteosarcoma	Osteosarcoma Fibr dysplasia EG Osteoid osteo Osteoblastoma
20 - 40	Giant CT Enchondroma Chondrosarcoma (low grade) HPT - Brown tumor Osteblastoma	Giant CT	Enchondroma Osteoma Bone island Parosteal Osteosar Healed lesions: - NOF, EG - SBC, ABC - Chondroblast
40+	Metastases Myeloma Geode	Metastases Myeloma Chondrosarcoma (high grade)	Metastases Bone island
All ages	Infection	Infection	Infection

General principles of radiologic diagnostic



General principles of radiologic diagnostic

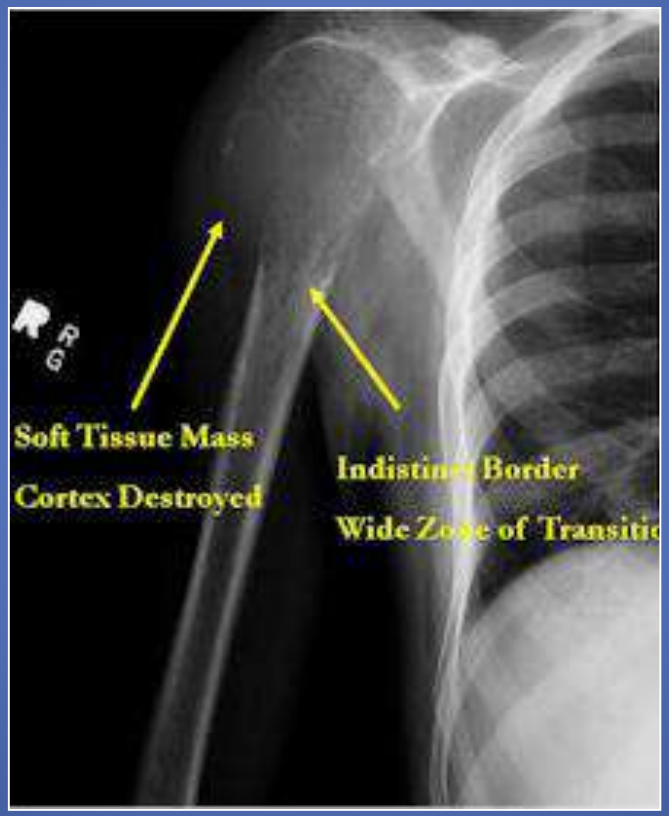




General principles of radiologic diagnostic

Periosteal reaction

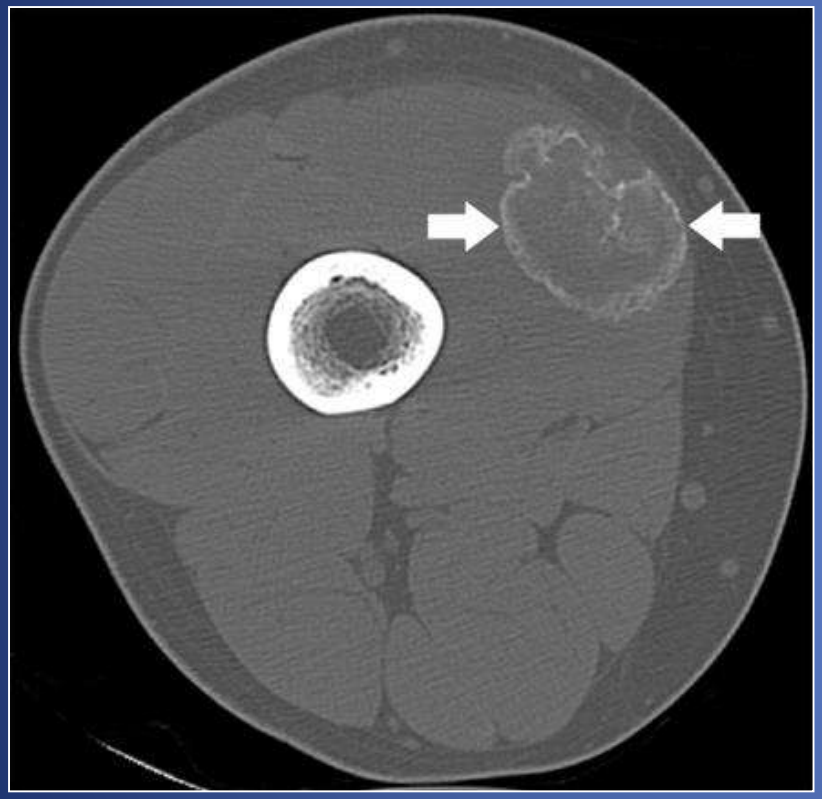
General principles of radiologic diagnostic

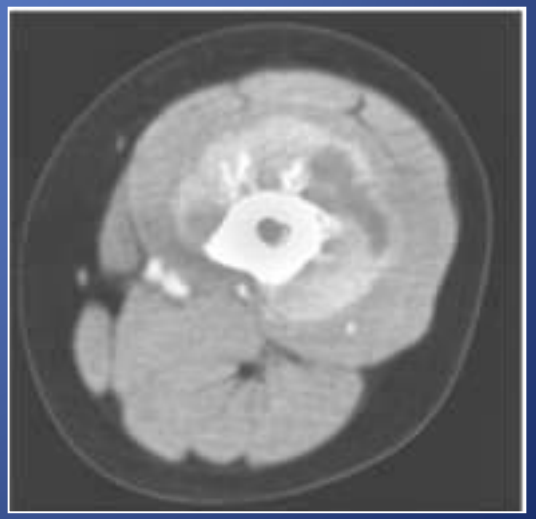


Computerized tomography (CT)

- Multi-slice CT with possibility of multi-planar reconstruction has a great advantage in diagnostics of primary and secondary bone tumors.
- CT can help us to define characteristics of tumor tissue, especially calcifications and fat tissue.
- Pattern of calcification can be of great help in DD (myositis ossificans- malignant tumor).

Computerized tomography (CT)





Computerized tomography (CT)

- CT gives an excellent presentation of bone cortical.
- CT is crucial in diagnosis of osteoid osteoma (presentation of tumor nidus). Clinical suspected osteoid osteoma (CT and scintigraphy should be performed).
- The first choice in diagnosis chronic inflammatory lesions of bone is CT examination (osteomyelitis - bone sequestrum).

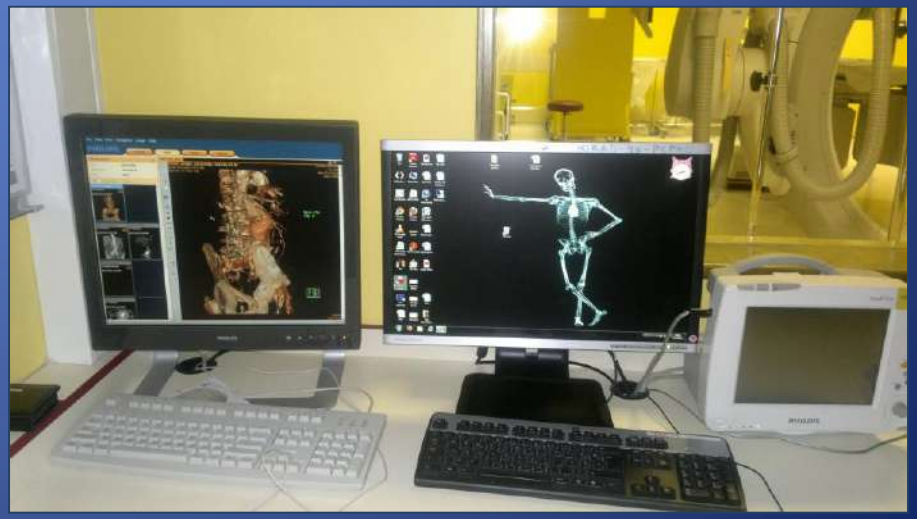
Computerized tomography (CT)

- CT supervision of biopsy: small or deep bone and soft tissue lesions, where the puncture site should be very exact.
- We can use joined CT guided supervision and fluoroscopic control for CT guided biopsies (Expert guide system) or percutaneous therapeutic procedures (RFA, cryoablation).

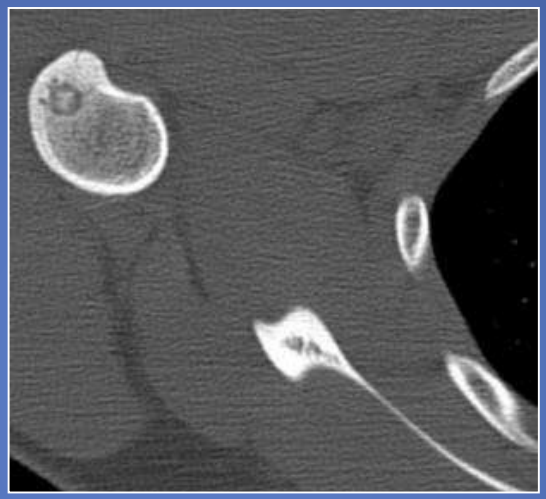
Computerized tomography (CT)

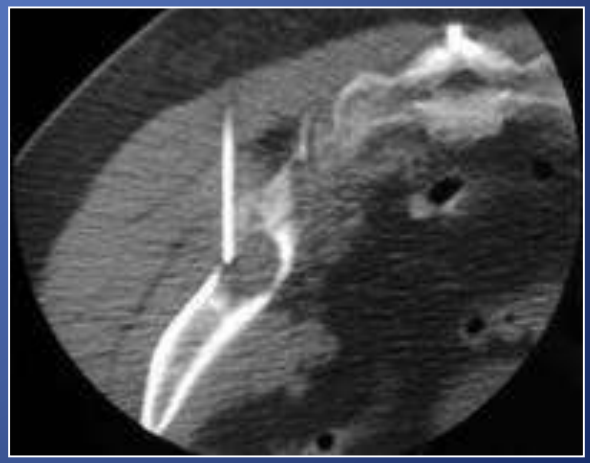
C- arm

CT guidance and fluoroscopic control



Osteoid osteoma





Magnetic Resonance

- MR has the greatest spatial and contrast resolution for deep soft tissue and bone structures.
- Using different sequences and planes the extension of tumor changes can be very precisely defined (stage of tumor, possibility of surgical treatment).

Magnetic Resonance

- Relation of tumor mass to surrounding structures can be defined (vessels, nerves, muscles, adjacent joints, possible infiltration …).
- Bone edema and inflammatory response (reaction) in tumor surroundings can be seen.
- Smaller calcifications and bone structure is better seen at CT examination.

Magnetic resonance

- MR can also be performed after paramagnetic i.v. contrast administration for evaluation of tumor aggressiveness (Gd, i.v.).
- Fast growing tumors have a lot of pathologic vessels and contrast enhancement is very strong and fast (biological potential of certain tumor).

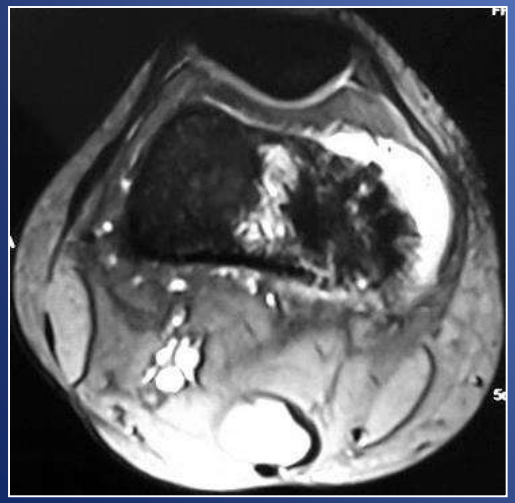
Magnetic resonance

- MR with application of contrast medium can also be used for assessment of tumor healing (chemotherapy) and detection of possible tumor re-ocurrence.
- Assessment of vital and necrotic parts of tumor is possible, also surrounding tissue edema.

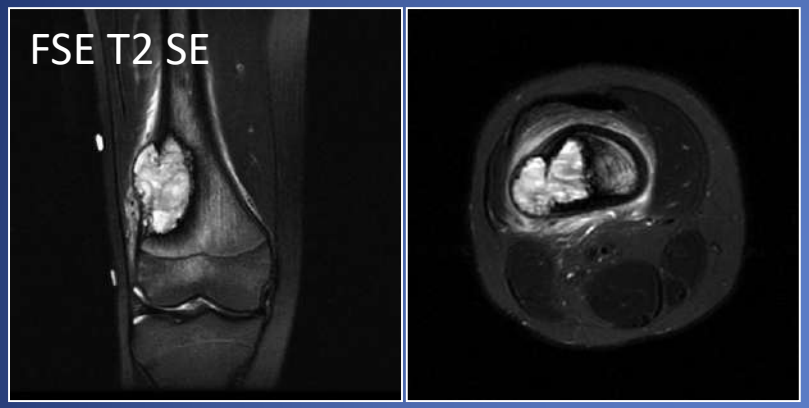
Magnetic resonance

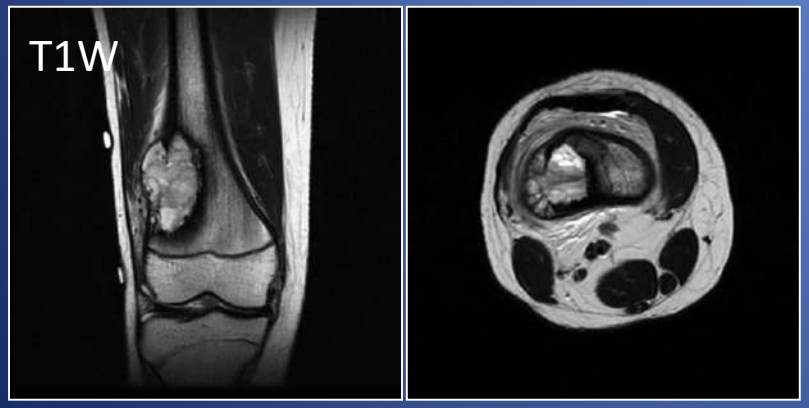
- MR examination:
- Dedicated coil.
- Technics: spin-echo, FSE; GE
- Protocol: T1W, STIR or FSE T2 FS in conventional planes, FSE T2 if necessary; C (Gd): at least two planes T1 FS after contrast administration.

Osteosarcoma

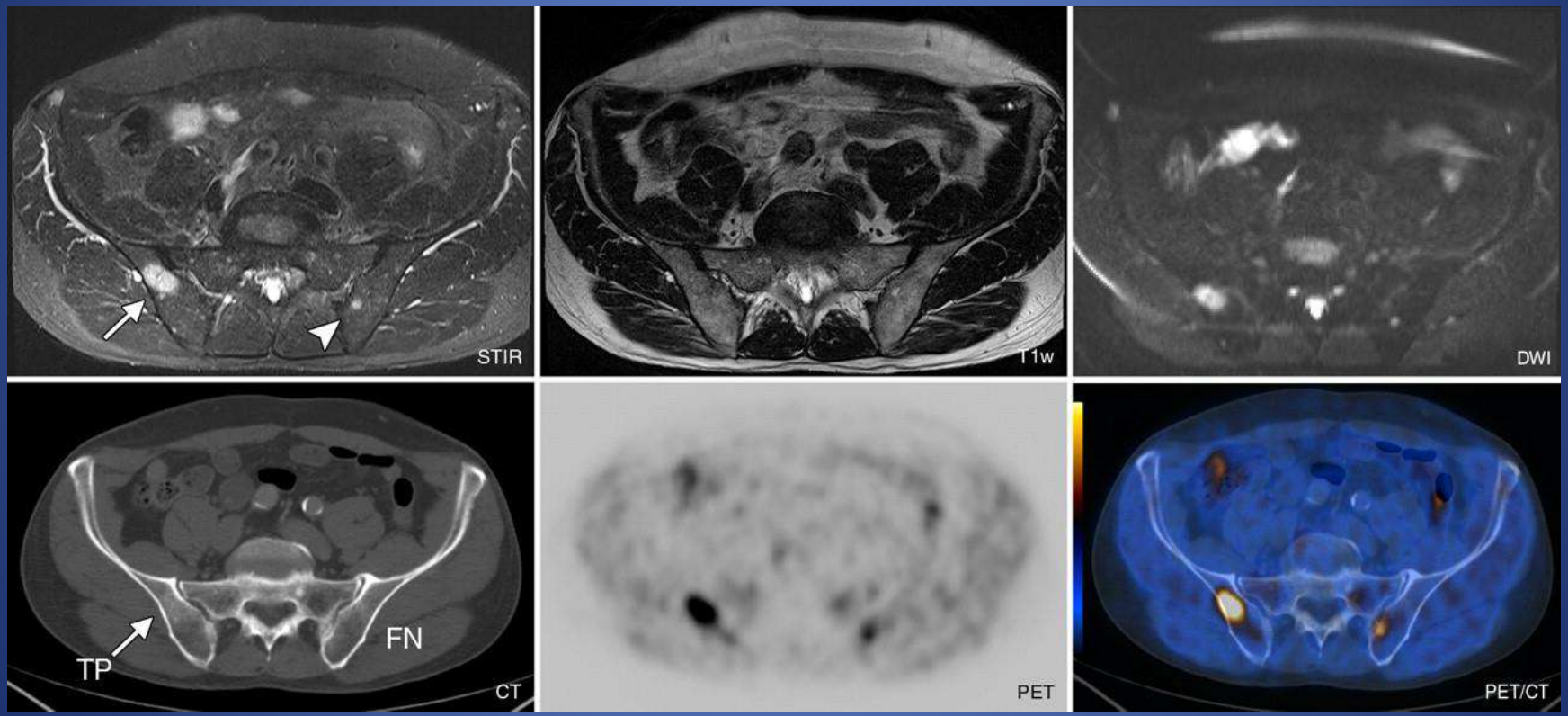


Osteosarcoma





DW imaging: alternative to convencional MR?




THANK YOU FOR ATTENTION!