

Radiological diagnosis of osteo- articular infection

B. STALLENBERG

Service d'imagerie médicale

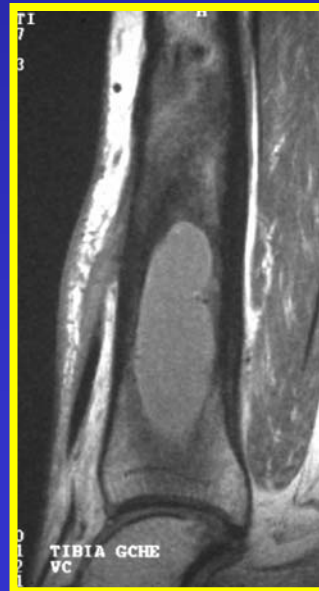
CUB ERASME

Société belge d'infectiologie et de microbiologie clinique

DEFINITIONS

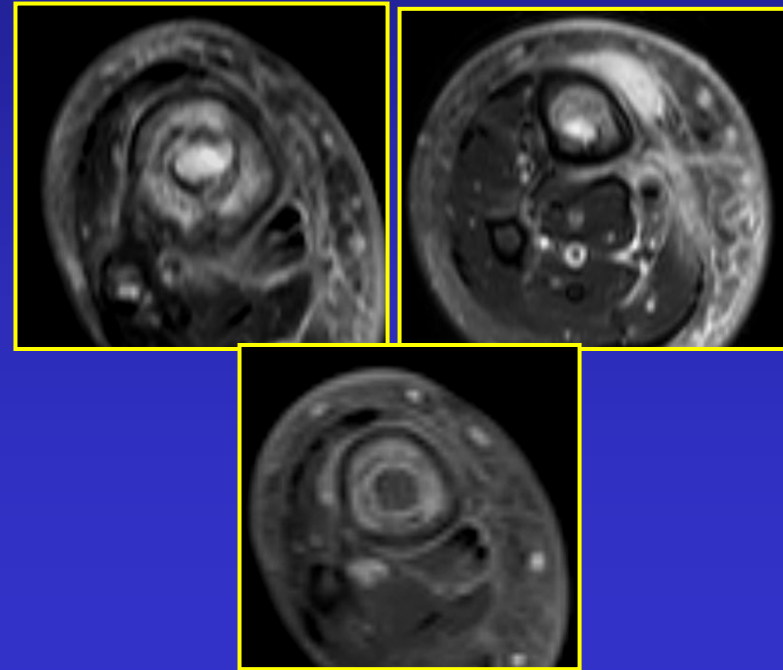
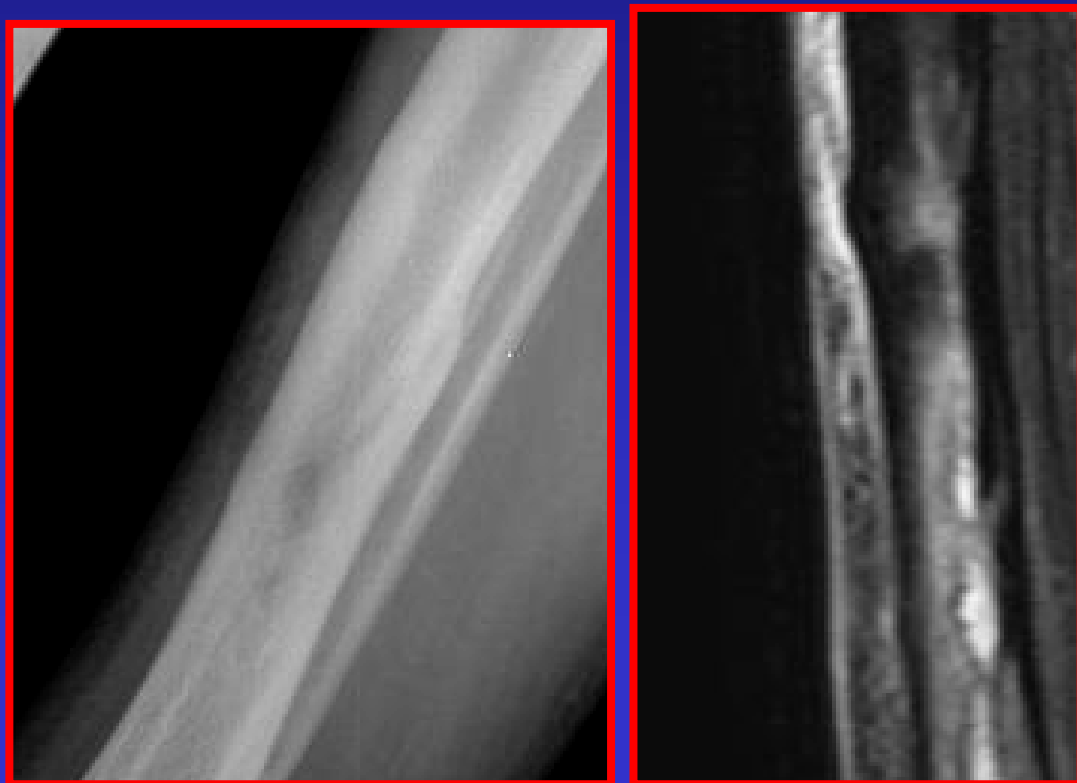
Bone and joint infection

- Osteomyelitis: Inflammation of bone and marrow caused by infection, a pyogenic organism - bacterial
 - fungi, parasites, viruses
- Infective (suppurative) osteitis: isolated contamination of cortical bone or concomitant with osteomyelitis
- Infective periostitis
- Soft tissue infection : tendon, bursa, abscess....
- Arthritis



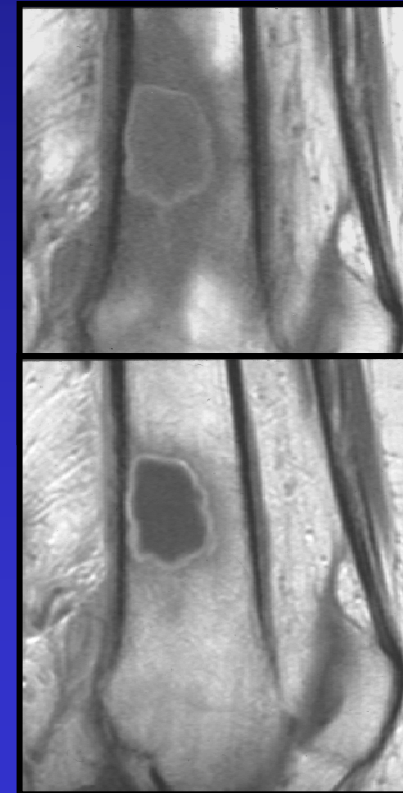
Osteomyelitis: terminology

- Vascular changes and edema of soft tissue
- Infectious penetration of periosteum with soft tissue abscess formation
- Soft tissue swelling with obliteration of soft tissue planes



Osteomyelitis: terminology

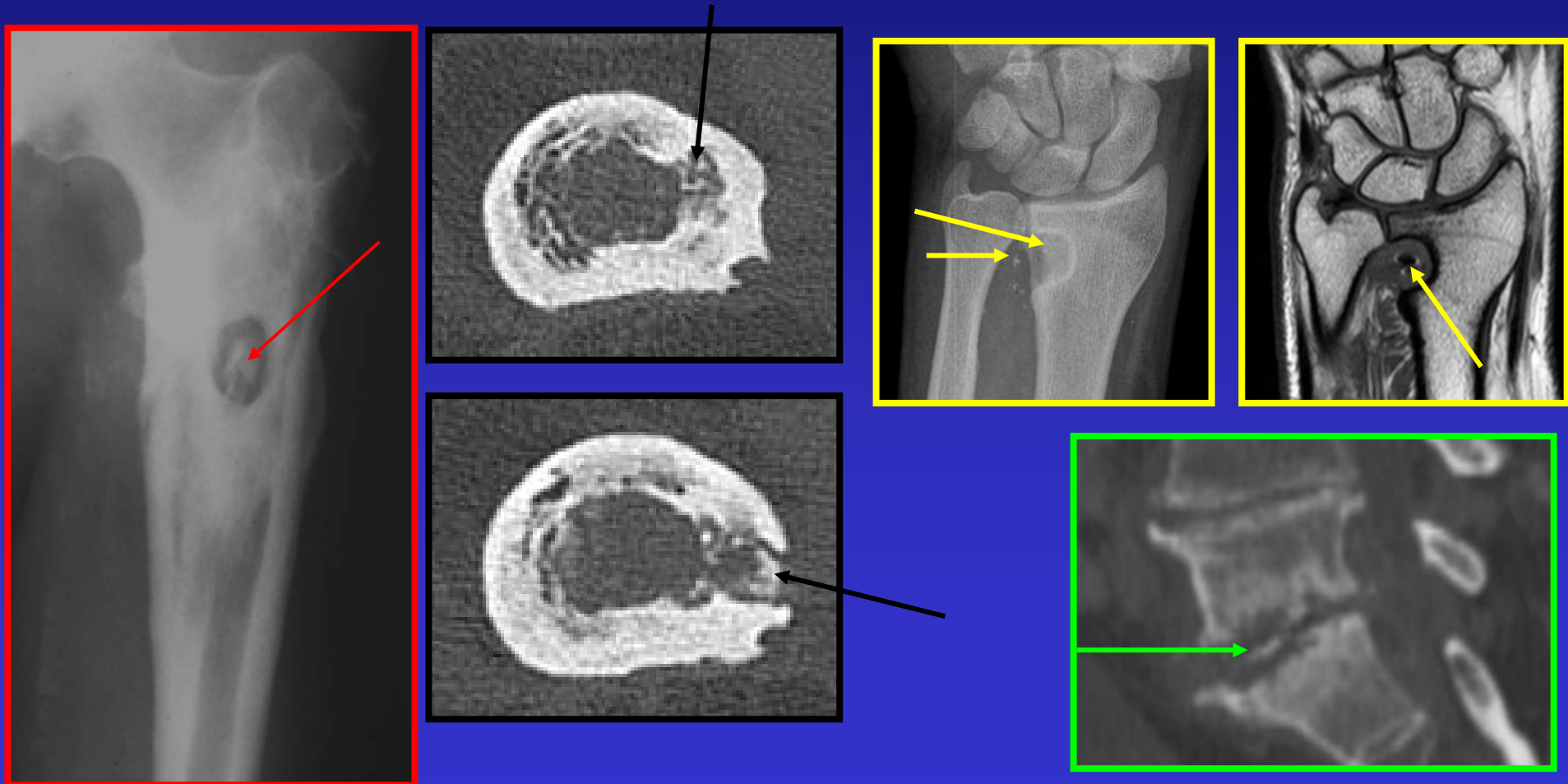
- Infection in medullary space with hyperemia, edema, abscess formation, and trabecular destruction
- Infection in haversian and trabecular destruction
- Localized cortical and medullary abscesses
- Osteoporosis, bone lysis, cortical or medullary lesions with or without surrounding sclerosis



Osteomyelitis: terminology

-Deprivation of blood supply to cortex due to thrombosis of metaphyseal vessels and interruption of periosteal vessels, cortical necrosis.

-Sequestration

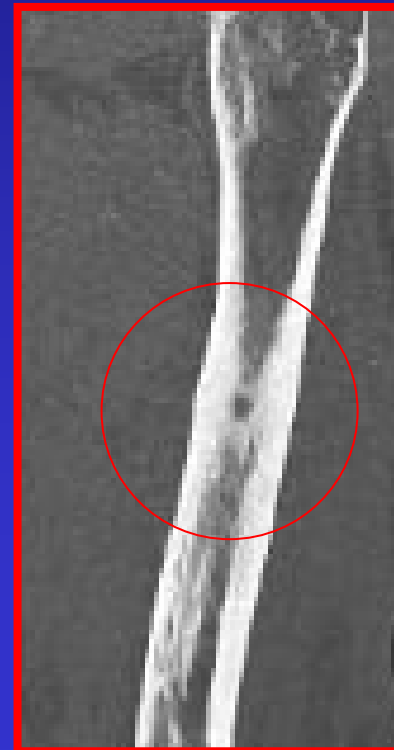
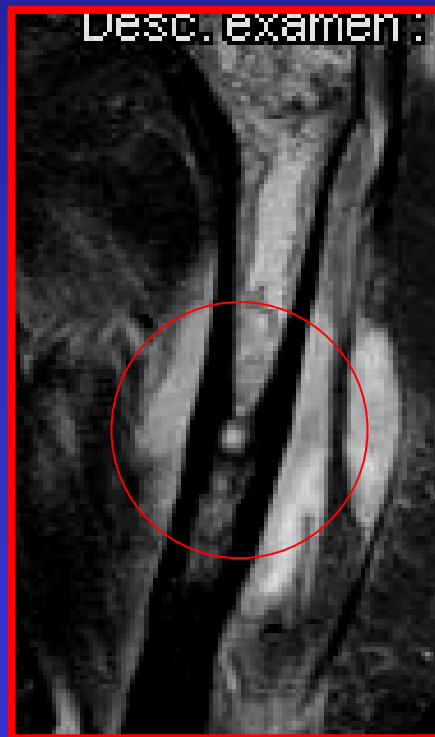
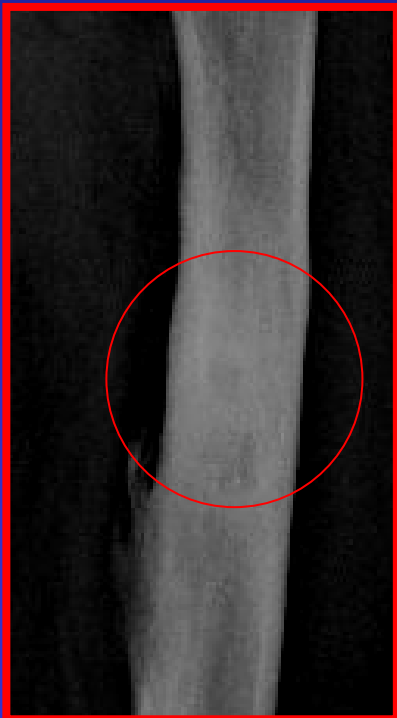


Osteomyelitis: terminology

-Brodie's abscess: « cystic » osteomyelitis

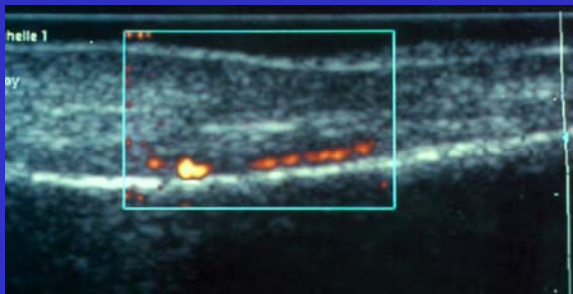
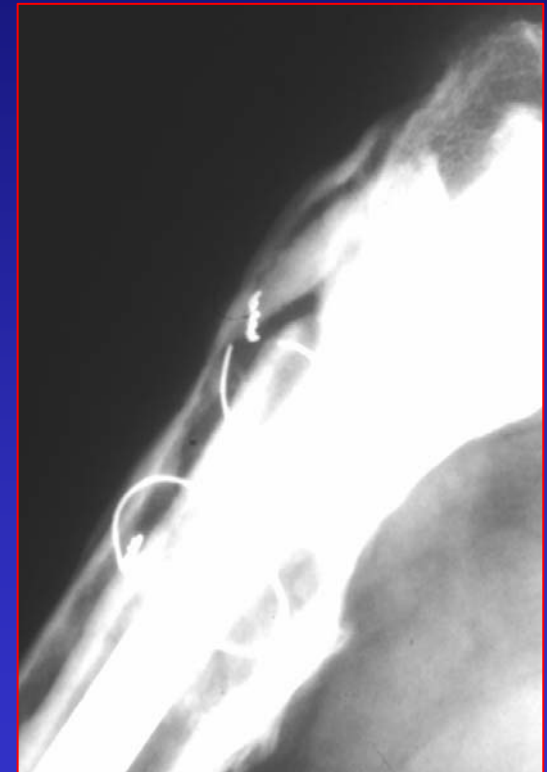
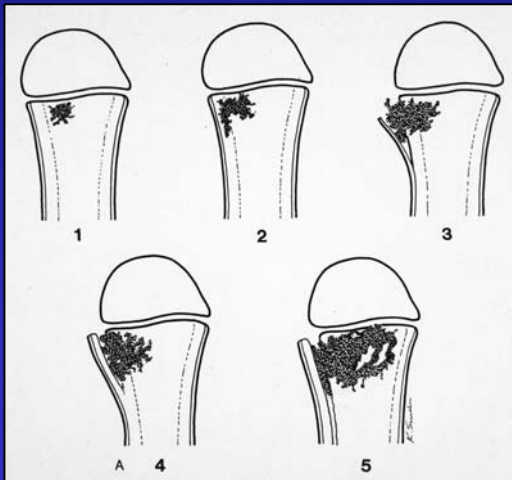
- Subacute and chronic osteomyelitis
- Typically in young adult males (75% less than 25 years old)
- Staphylocococcus
- Reduced virulence of the infective organism, increased resistance to infection: host bone reaction.

-Osteoporosis, bone lysis, cortical or medullary lesions with surrounding sclerosis



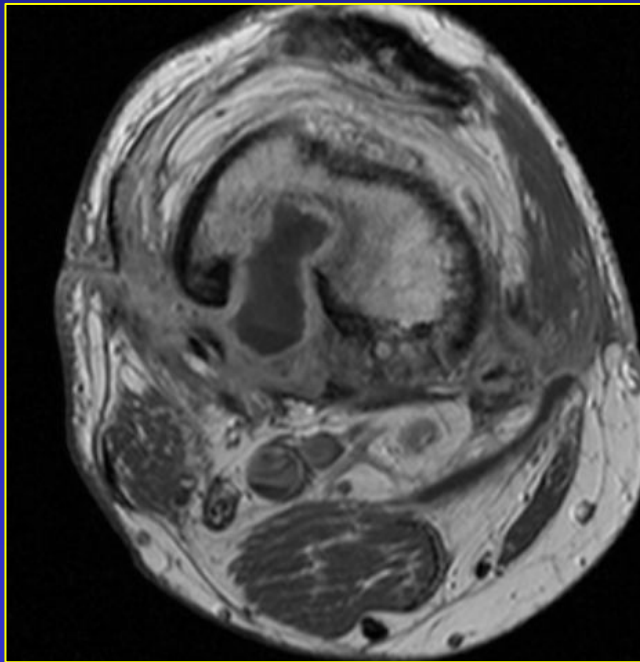
Osteomyelitis: terminology

- Subperiosteal abscess formation with lifting of the periosteum and bone formation.
- Involucrum: layers of healing bone surrounding a sequestrum or under elevated periosteum
- Periostitis, involucrum



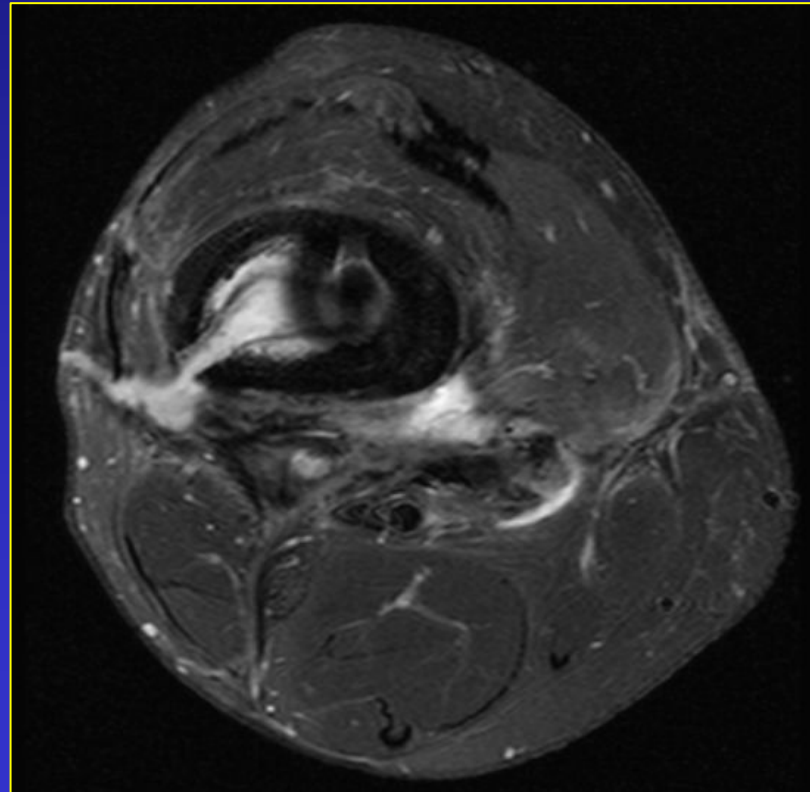
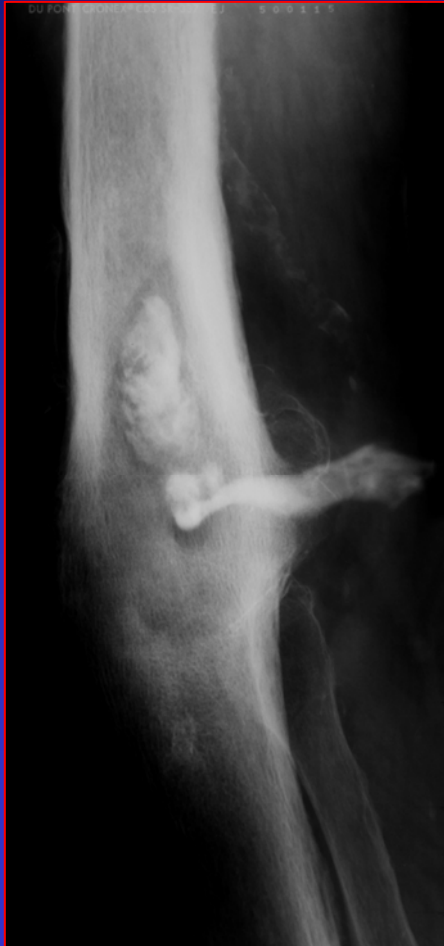
Osteomyelitis: terminology

- External migration of dead pieces of cortex with breakdown of cortex.
- Cloaca: opening in the involucrum, through it the granulation tissue and sequestra can be discharged



Osteomyelitis: terminology

- External migration of dead pieces of cortex with breakdown of skin and subcutaneous tissue.
- Sinus tracts



Arthritis: RX- Pathologic correlation

Edema and hypertrophy of synovial membrane with fluid
Joint effusion, soft tissue swelling

Pannus destruction of bone

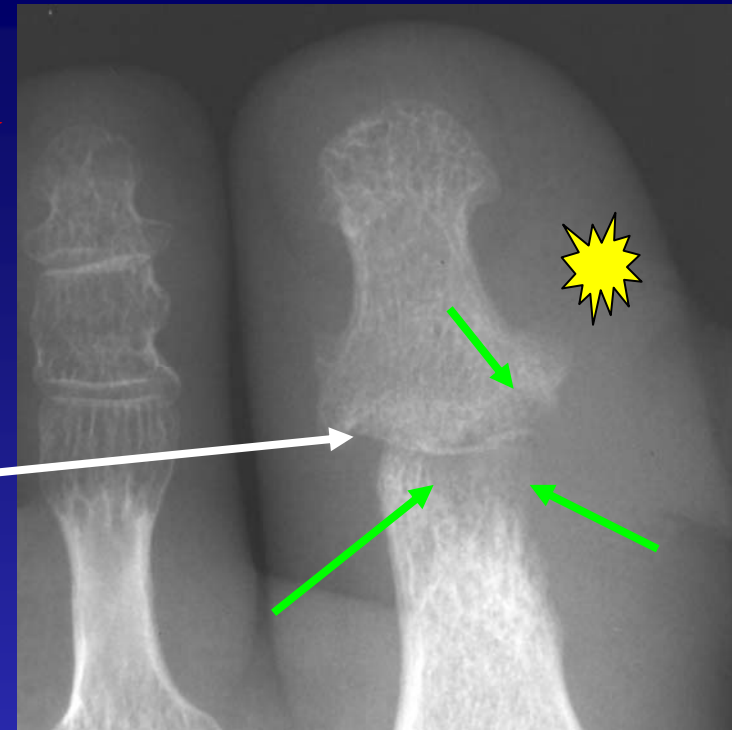
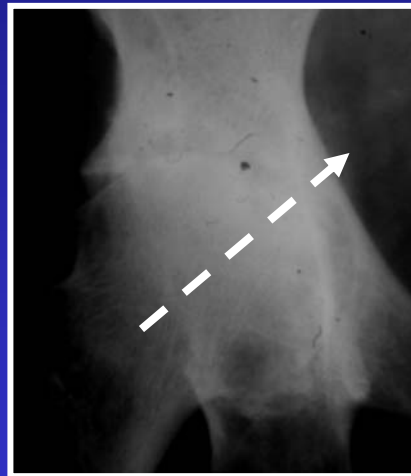
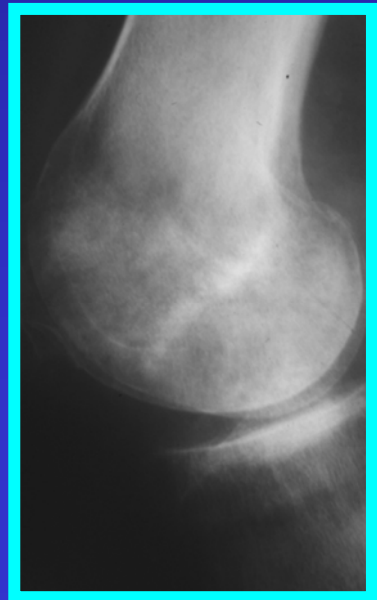
Marginal and central osseous erosion

Inflammation pannus with chondral destruction

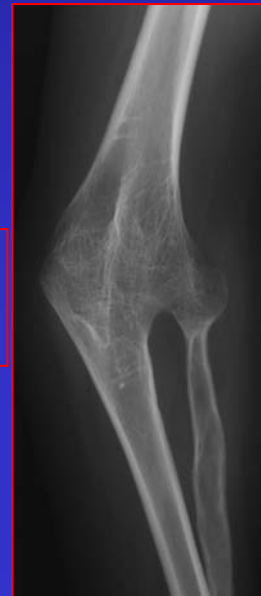
Joint space loss

Hyperemia

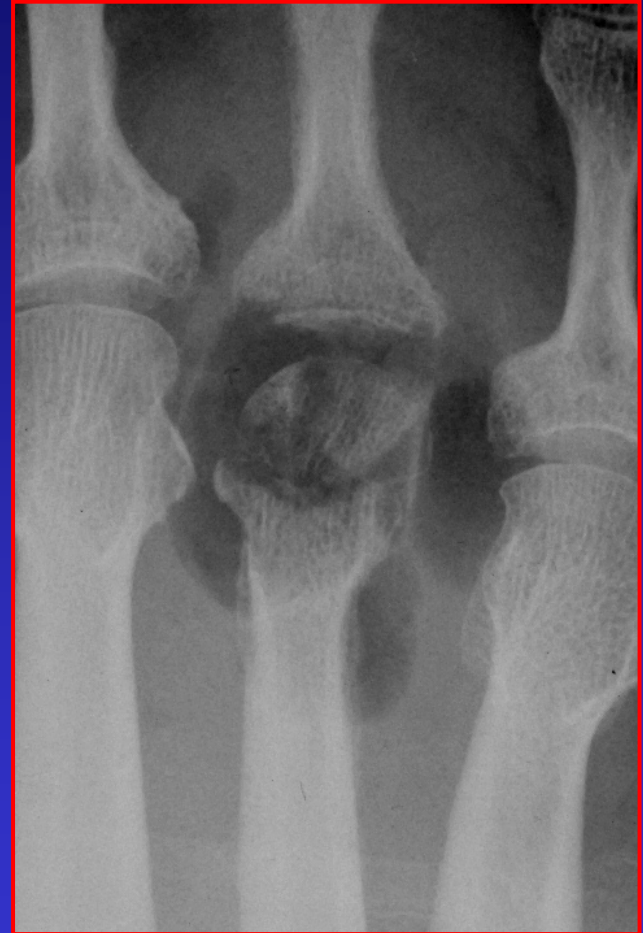
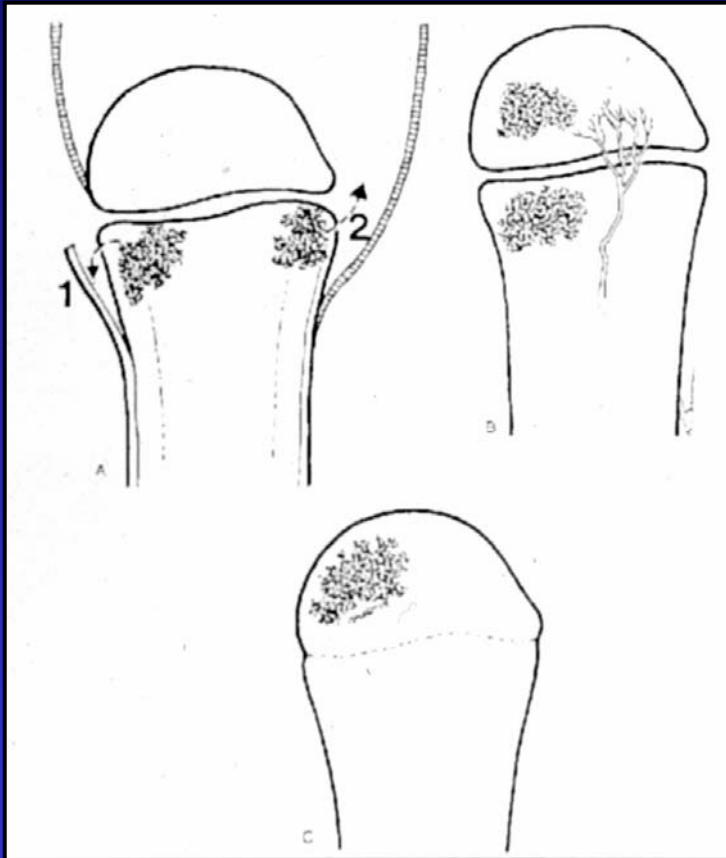
Osteoporosis



Fibrous or bony ankylosis
Bony ankylosis

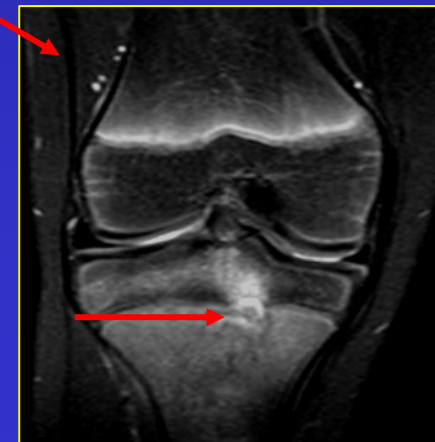
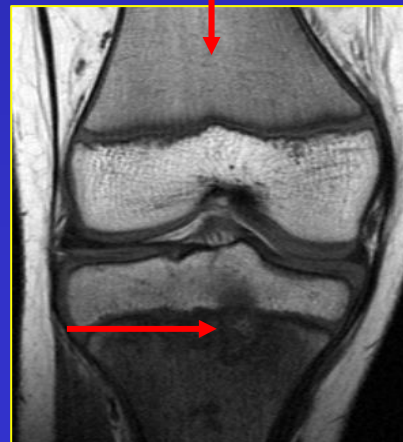
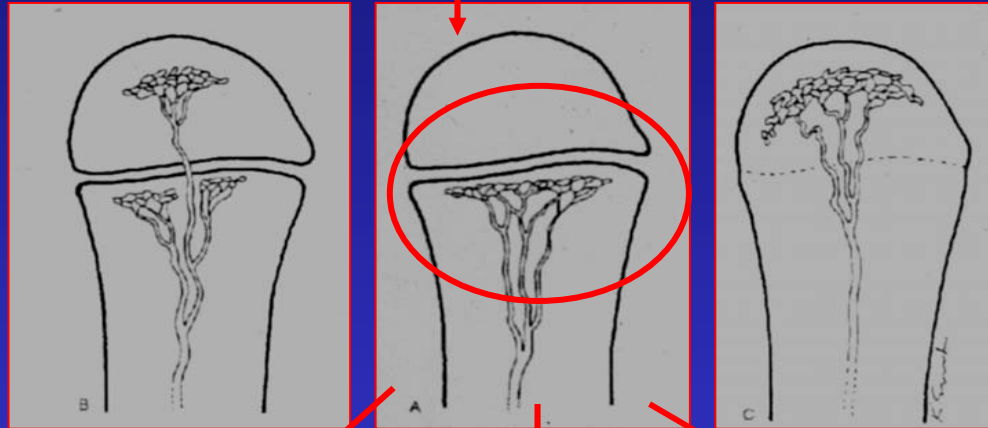


Osteomyelitis - arthritis



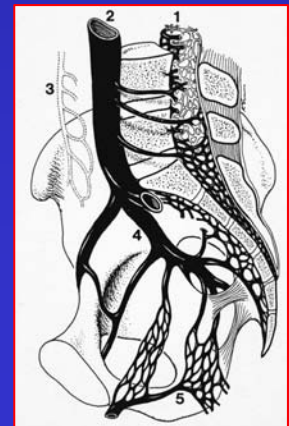
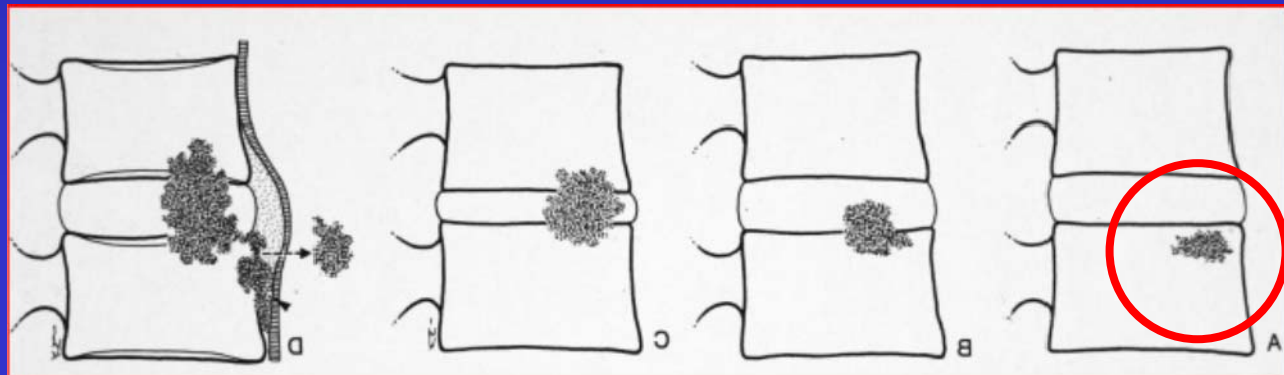
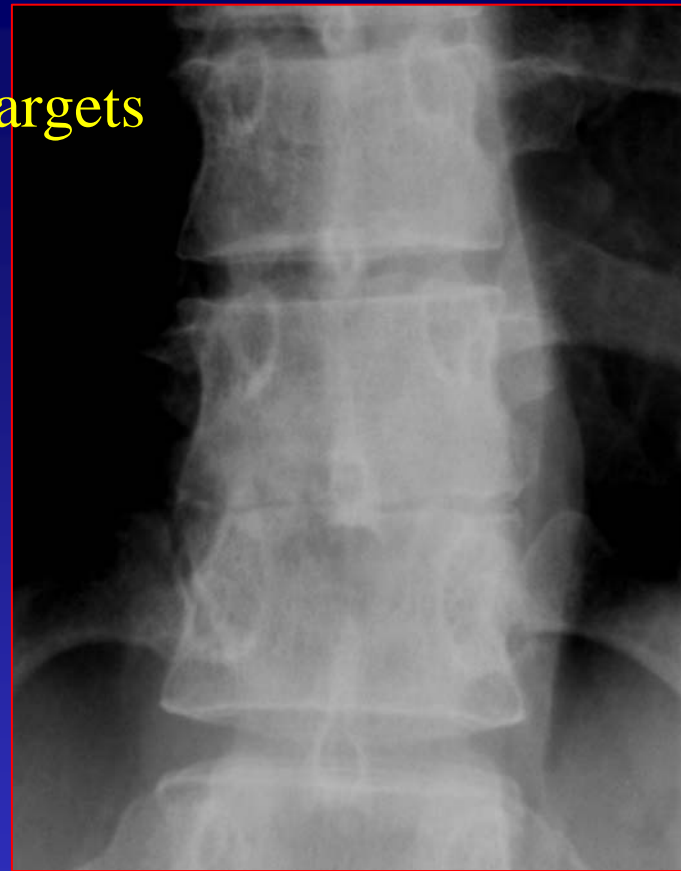
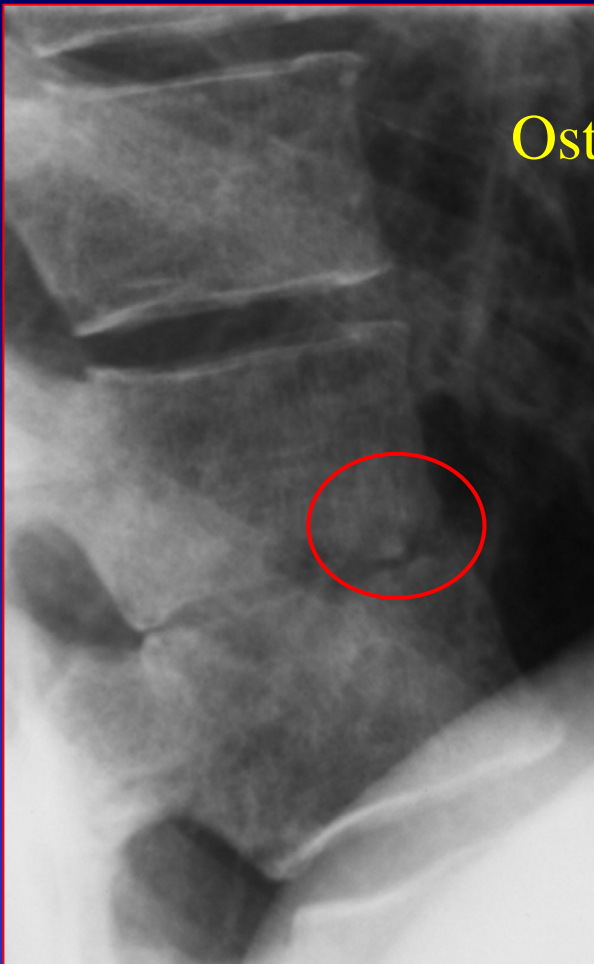
Osteomyelitis: Special targets

	infant 1 year	Child 1year>fusion	adult
Localisation	Metaph with epiphys extent	metaph	epiphys



Osteomyelitis: Special targets

The spine



Osteomyelitis: Special targets

The spine

MRI***

MRI is to-day the imaging procedure of choice to detect early infection and to fully evaluate the extent of the disease affecting the spine.

T1: vertebral body appears hyposignal as well as the disk with de-differentiation between bony structure/ disk

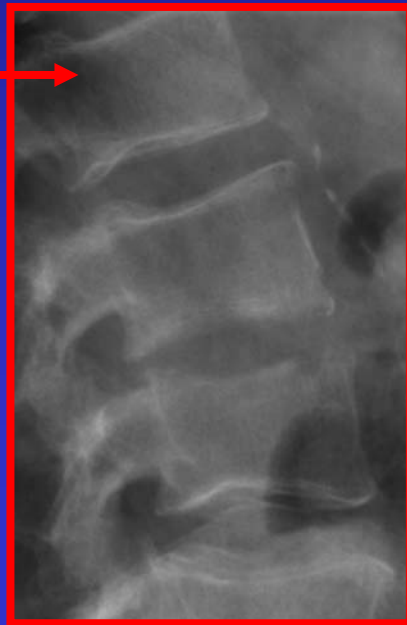
T2: Hypersignal of the vertebral body and fluid collection within the disk space

T1 + Gd: enhancing vertebral body (mind the so-called « effacement » phenomenon in elderly patient when the bony marrow is fatty...) and better delineation of fluid collection...

+Gd



1 month



The spine

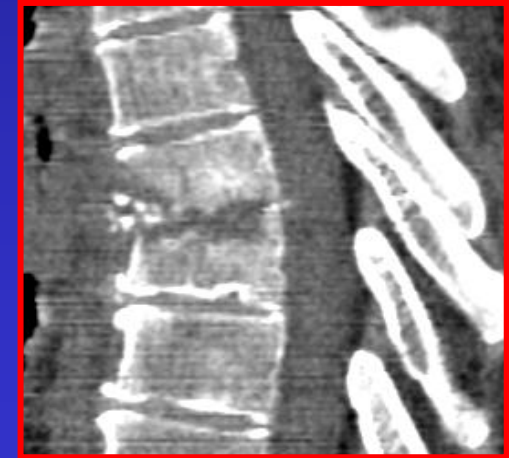
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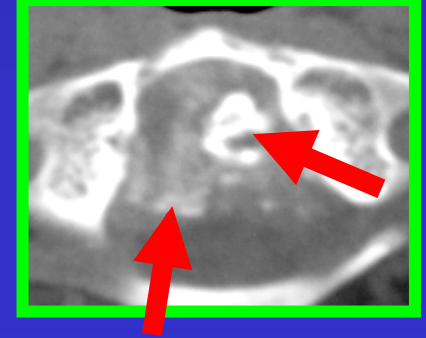
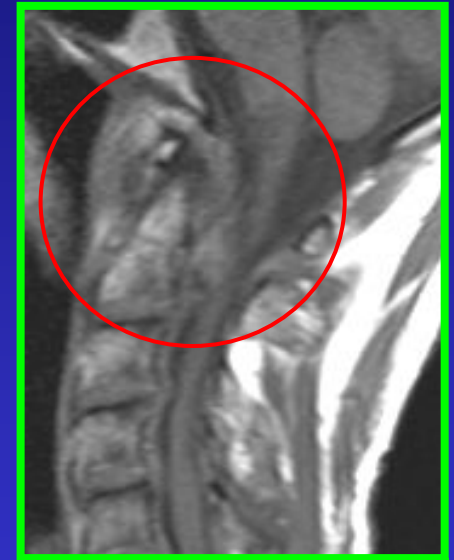
Collapsing bone



The spine

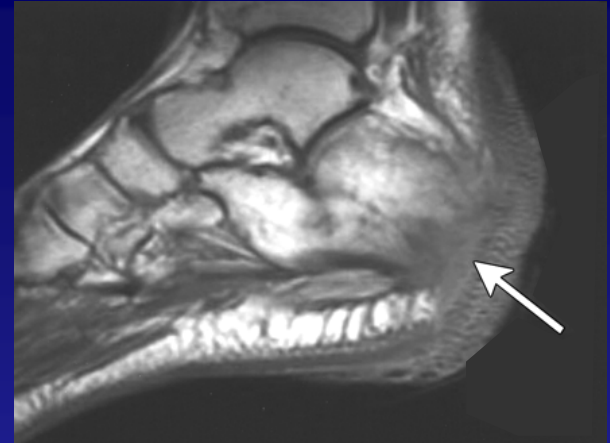
DD

- Erosive pattern of degenerative disease (inflammatory)
- **Cristal deposition**
- **Hemodialysis - Amyloidosis**
- Neuropathic
- **Seronegative spondylarthropathy (inflammatory)**
- Secondary and primary (chordoma) tumoral infiltration



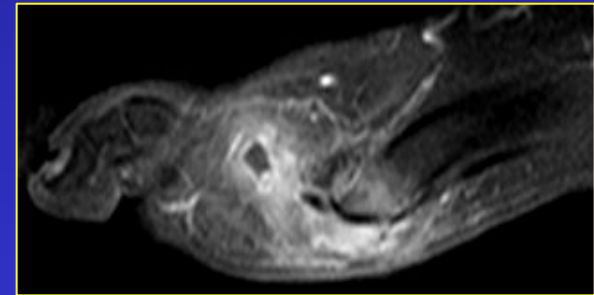
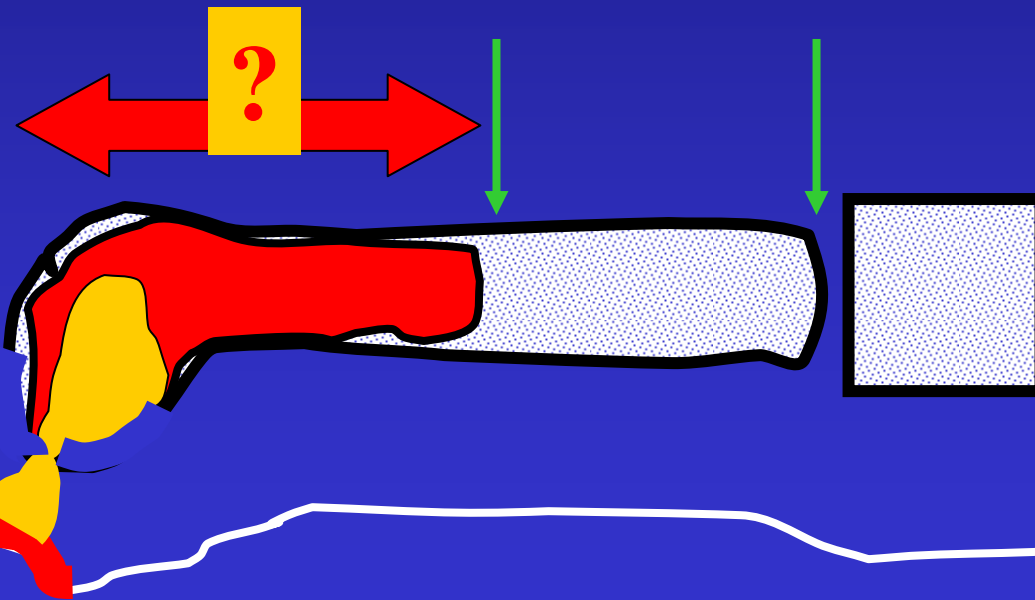
Osteomyelitis: Special targets

The diabetic foot



MR

- NPV: Bone invasion
- PPV: Bone invasion and ulceration and sinus tract.

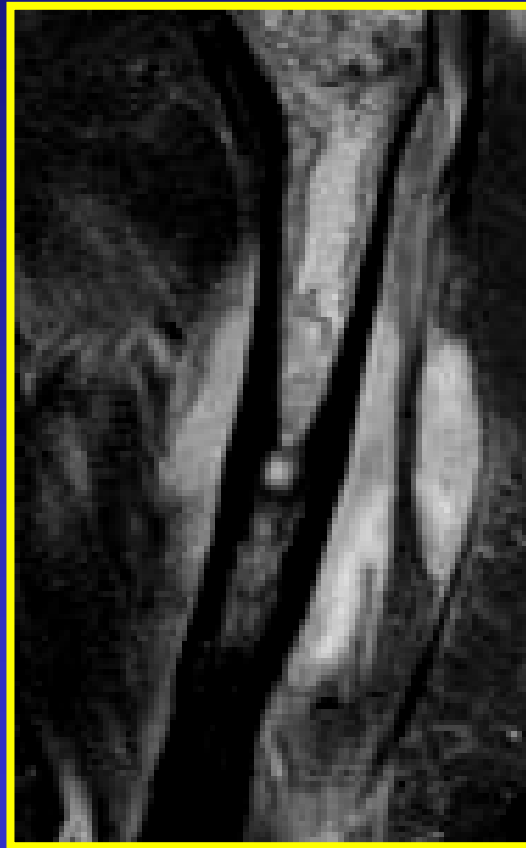


The purpose of the radiologist is

1) To diagnose



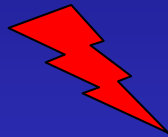
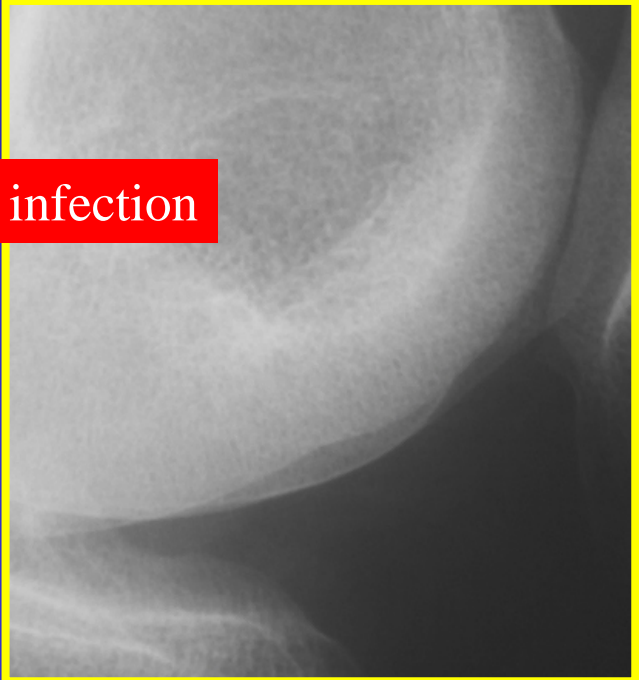
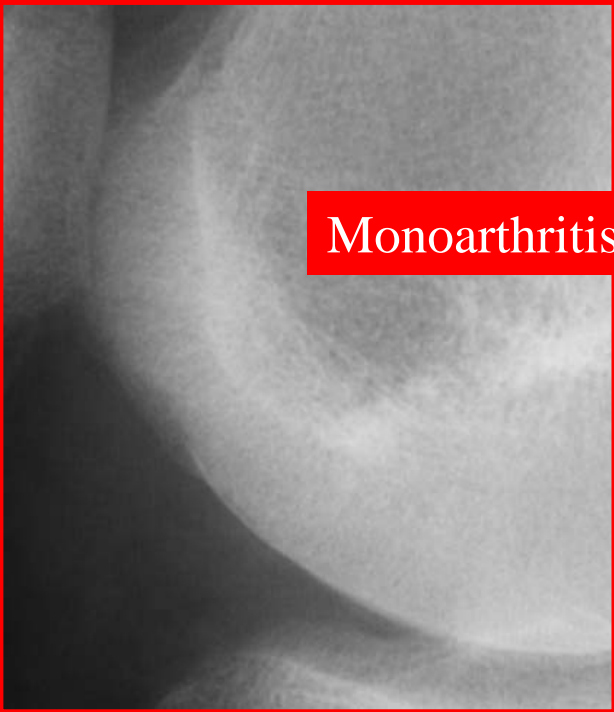
RADIOGRAPHY



MR is more accurate but radiography plays an important diagnostic rôle

Back pain

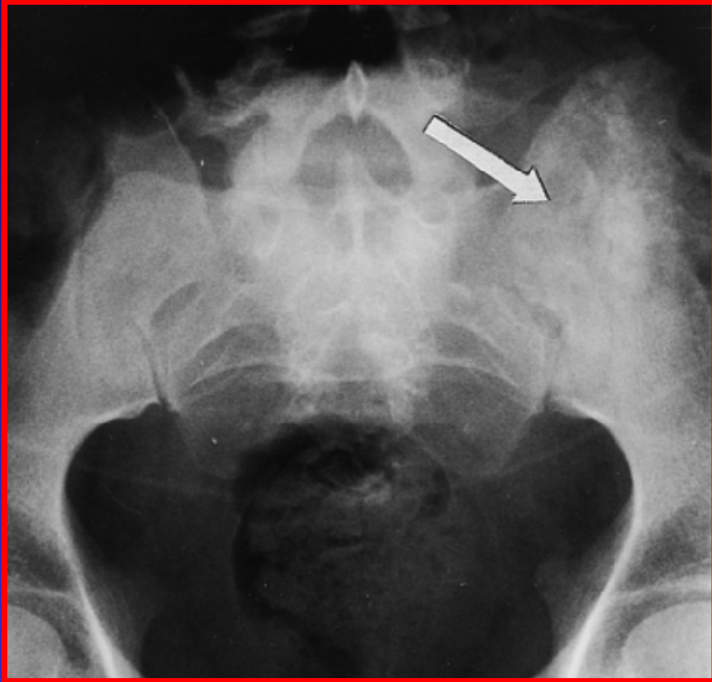




Monoarthritis: think always infection



Paraarticular tumor can mimic arthritis



EWING paraarticular

- « Tumors about the knee misdiagnosed as athletic injuries. »

Muscolo DL J Bone Joint Surg Am. 2003
Jul;85-A(7):1209-14

Also true for infectious diseases



DO NOT avoid Radiography

se

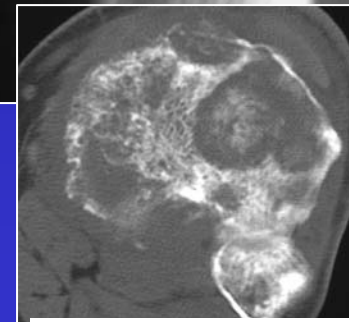
Knee pain:
Arthroscan
without plain films:
Arthroscopic
procedure for
meniscal « tear »:

← 30-y-old

20-y-old →

Tumor? think always osteomyelitis

osteomyelitis



Lymphoma

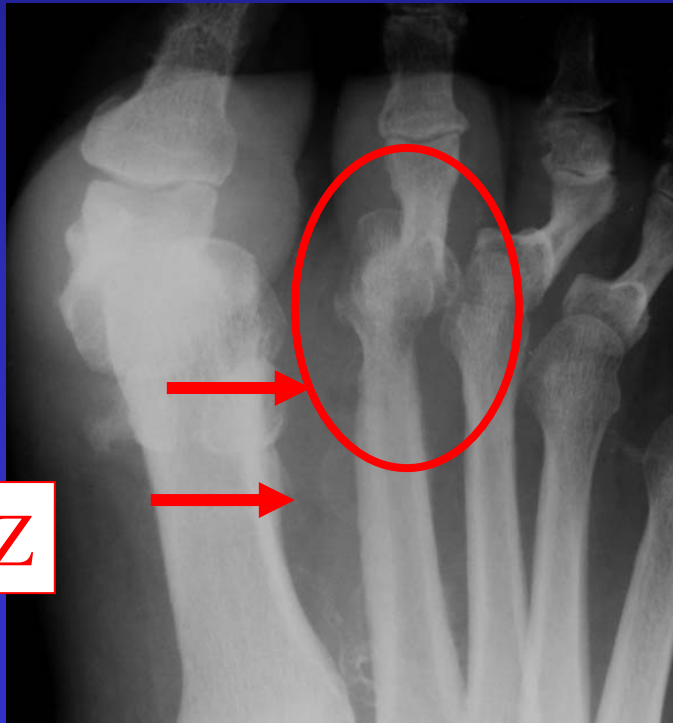
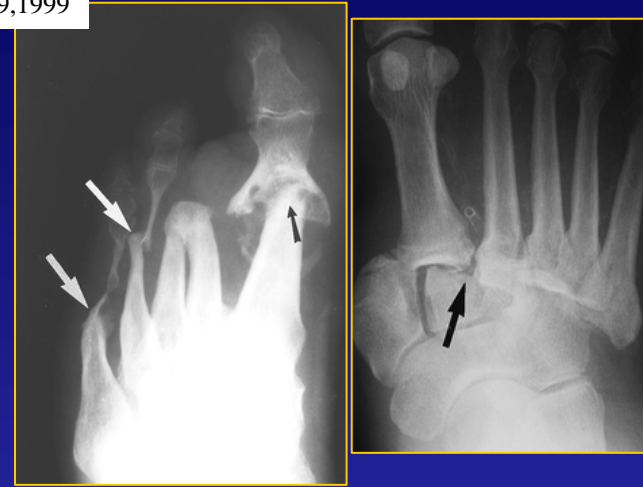
Also for the diabetic foot

VPN, VPP: 70%

Enderlee. Diabetes Care 22:294-299,1999

- Local overview
 - Deformation - fractures
 - **Charcot**
 - Post - op.
- Reproductive
- Gaz

Follow-up

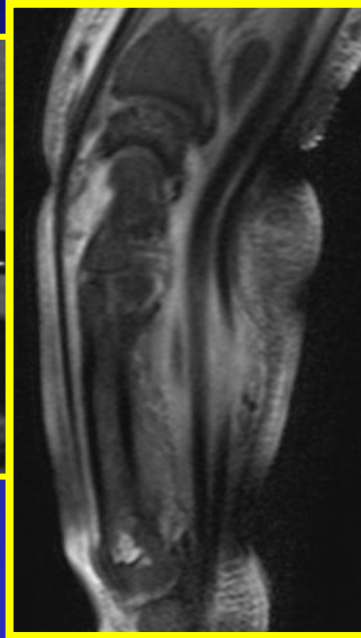


The purpose of the radiologist is

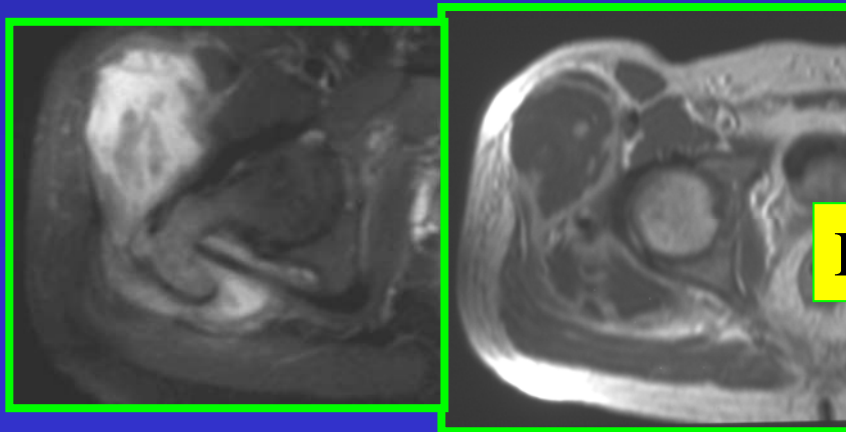
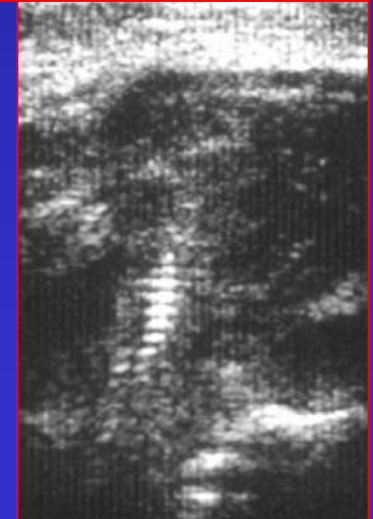
2) To look around the bone or the articulation



Tendon



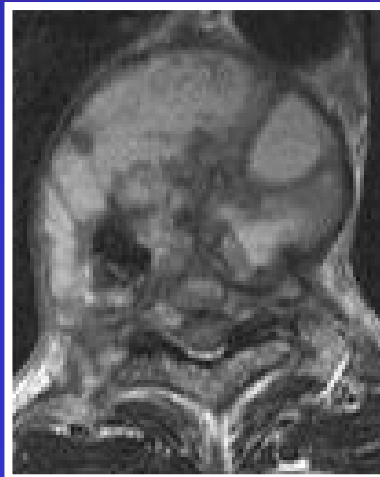
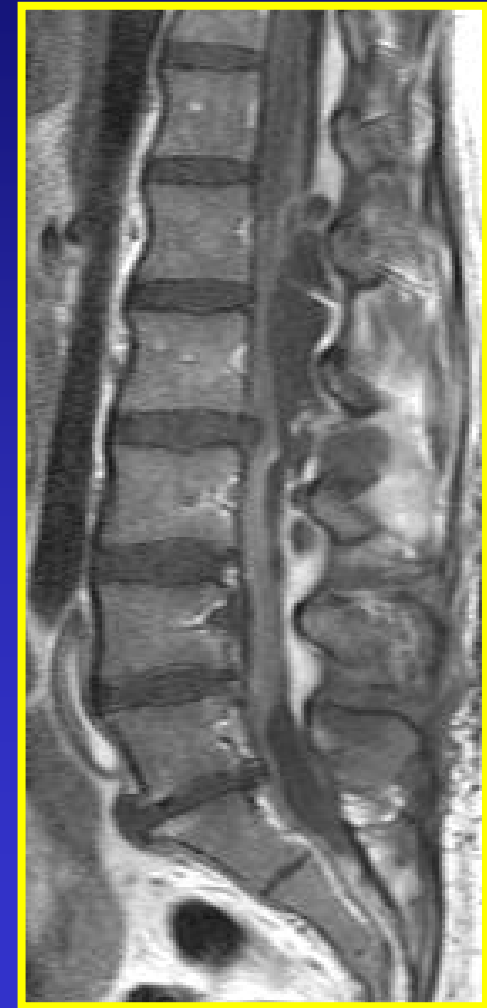
Screw



Bursa

Spinal infection

Do not forget the canal:
epi and sub dural abscess



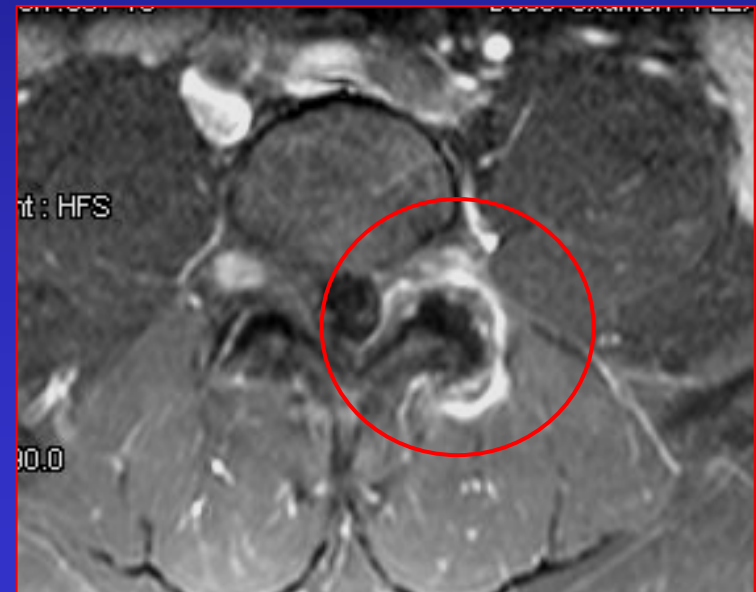
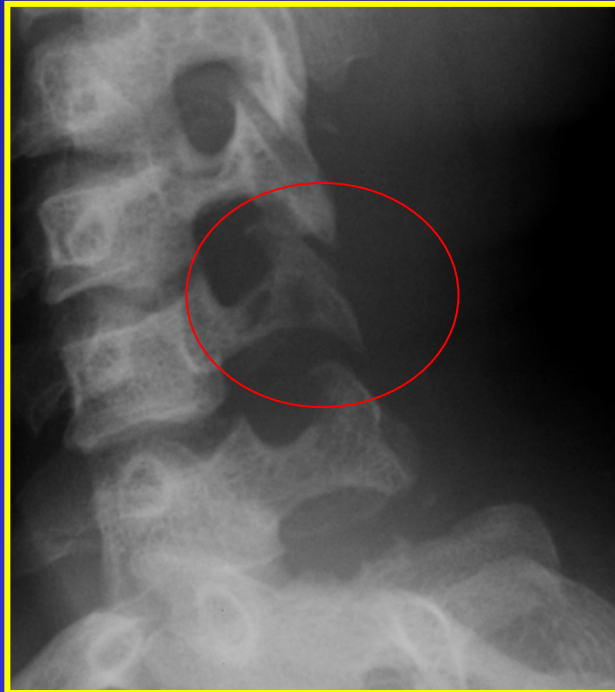
Spinal infection

Do not forget the posterior part and synovial joints of the spine:

Facet

Costovertebral

atlas - axis



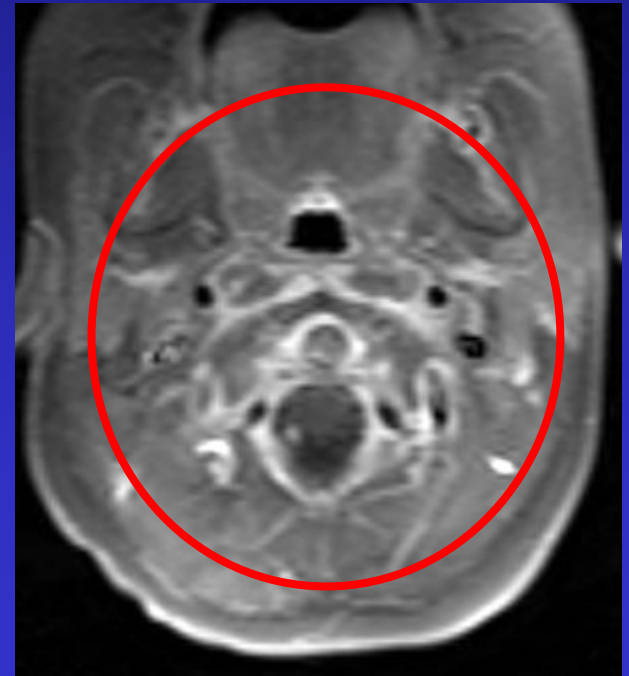
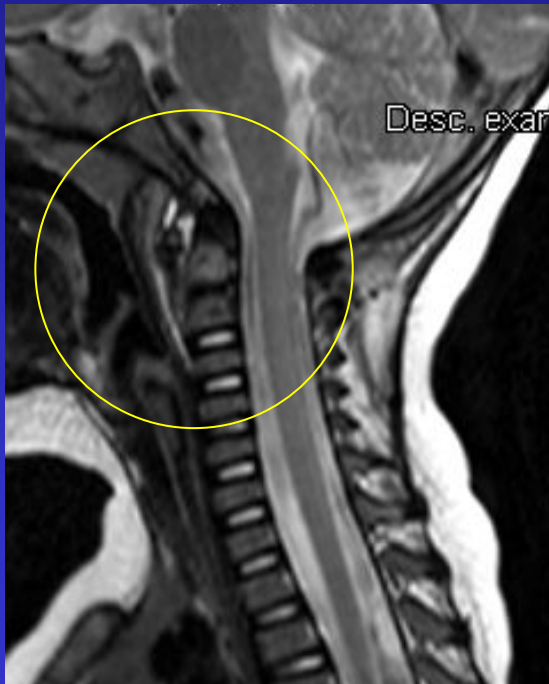
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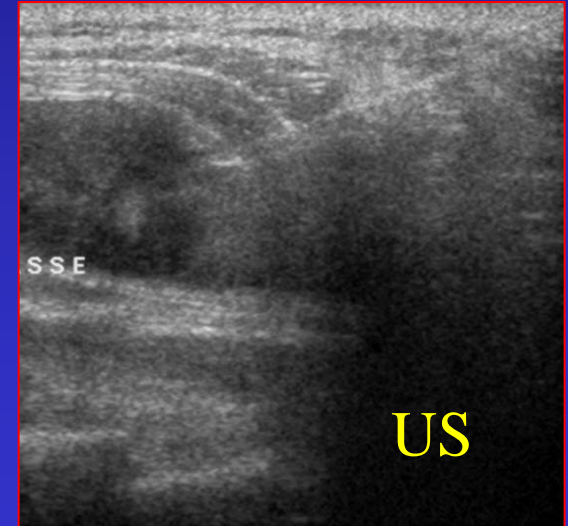
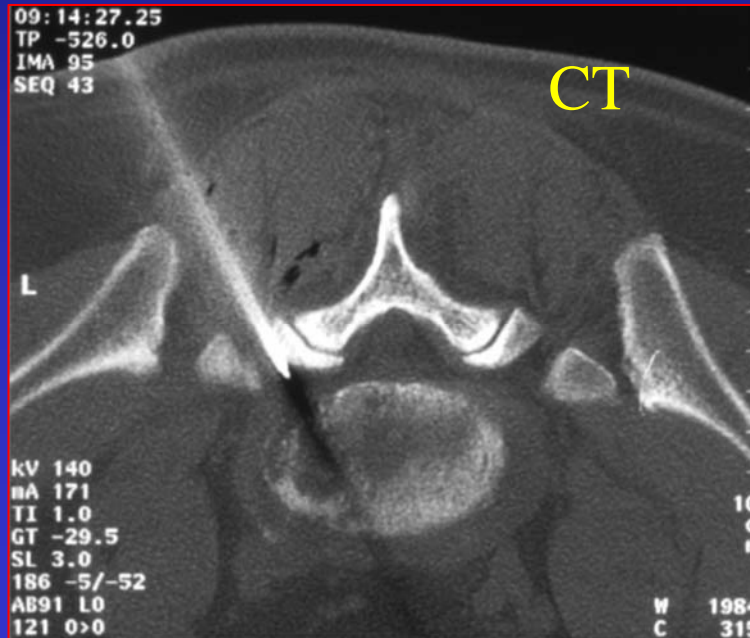
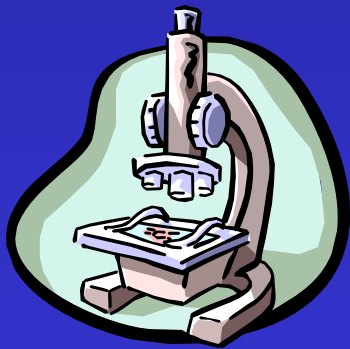


Grisel's syndrome

The purpose of the radiologist is

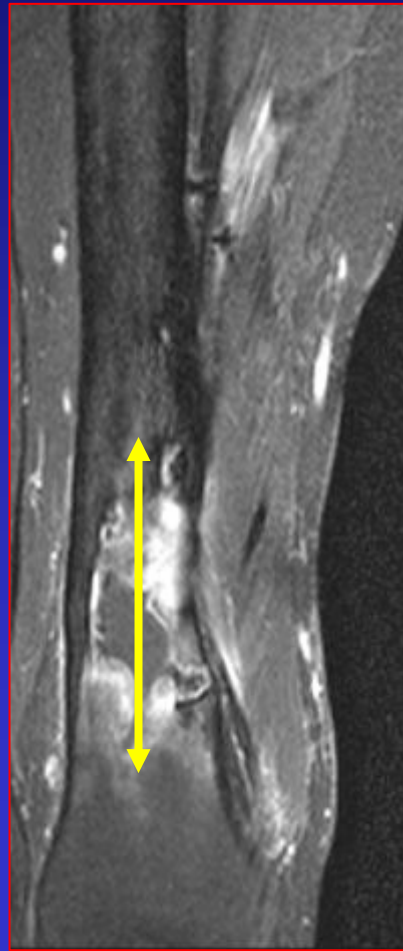
3) to put a needle as soon as possible (arthritis)

Always pathology (TBC TUMOR)

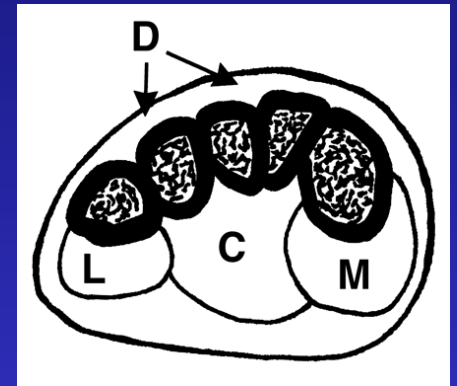
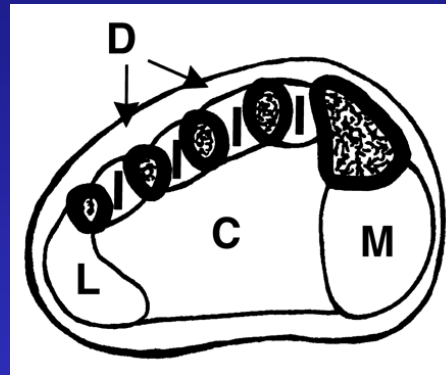
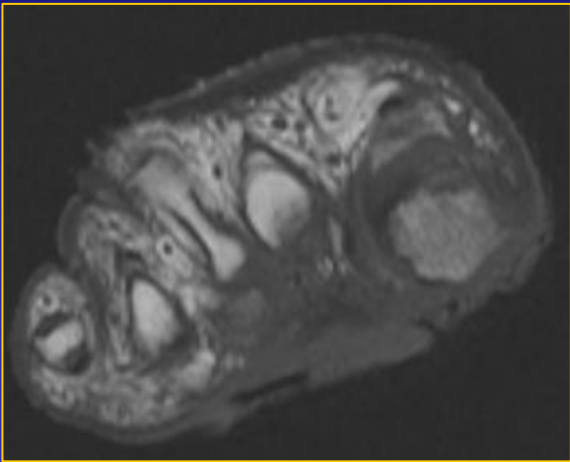


The purpose of the radiologist is

4) To determine the extension of the disease for surgery



4) To determine the extension of the disease for surgery
Also for diabetic foot



Ledermann.AJR2002;178:605-612

The purpose of the radiologist is

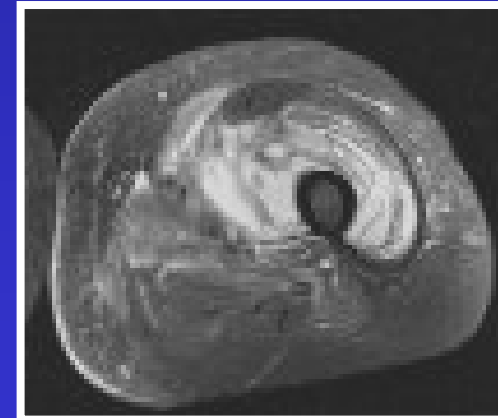
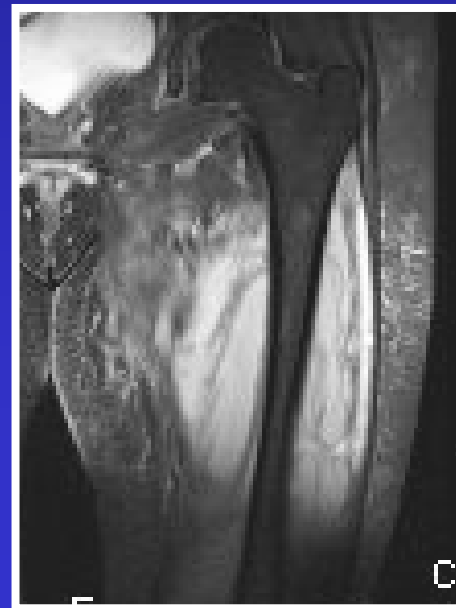
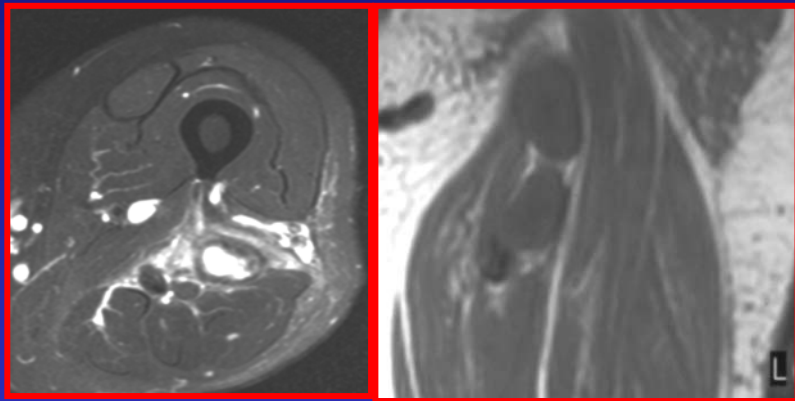
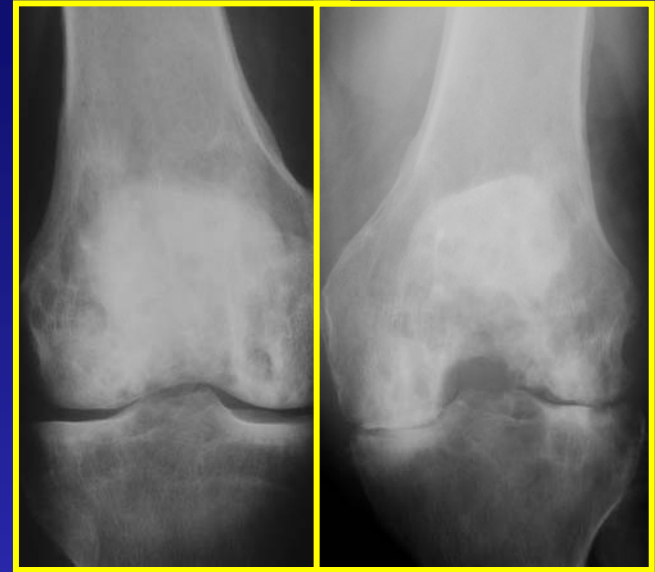
5) Specificity?

Candida

Echinococcus

Nocardia: Abscess, grafts

Loasis

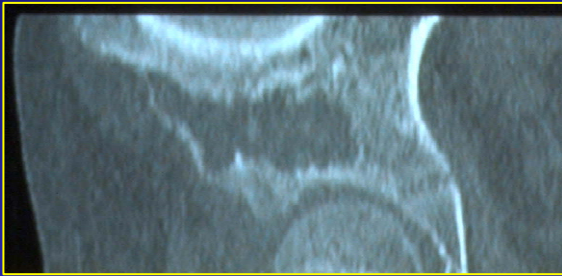


Specificity?

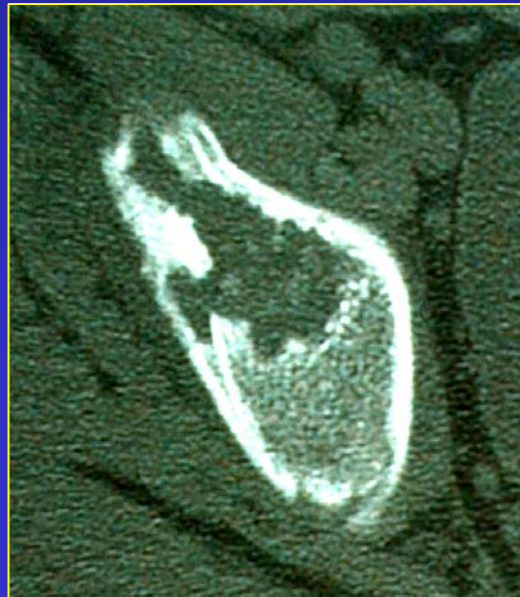
Granulomatous infection: Tuberculous disease

- Tbc **osteomyelitis**

(cystic TBC, tuberculosis dactylitis: spina ventosa)

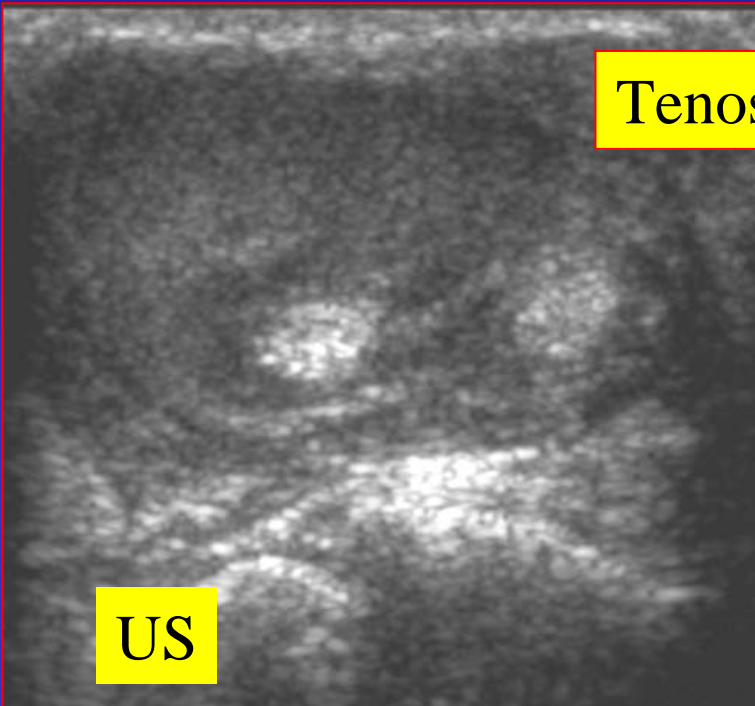


Multifocal

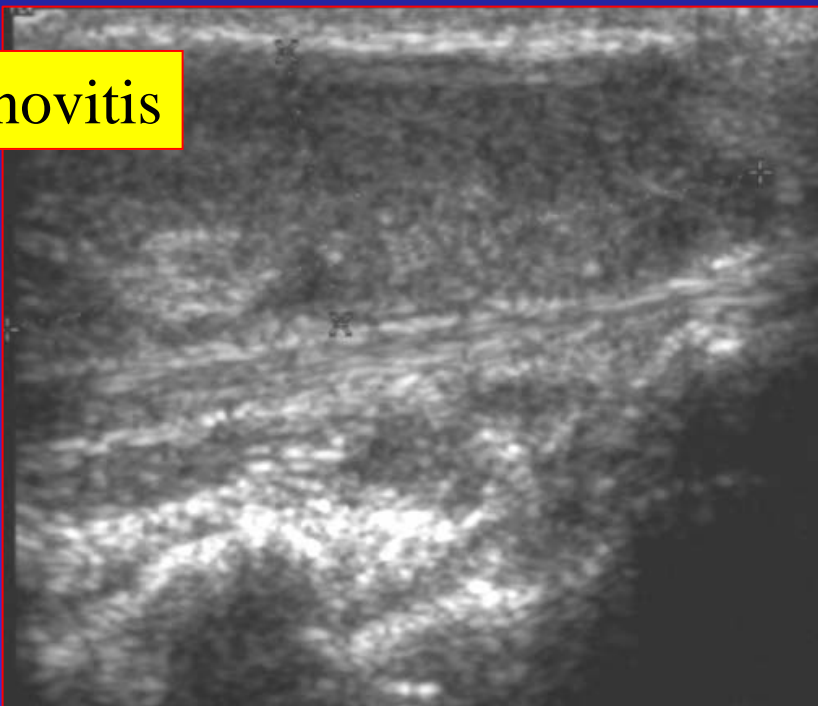




Arthritis



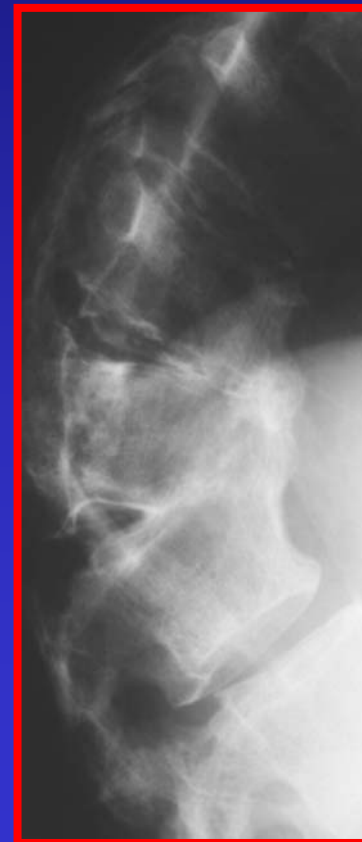
Tenosynovitis



- Spondylodiscitis often multifocal. The disc space is often affected in a later stage and is less affected compared to the huge destructive lesions seen in the vertebral bodies responsible for severe spine deformities, gibosity ...
- « spondylitis » presentation without any disc involvement located in the posterior part of the vertebral body. Sometimes, multifocal lesions, pseudotumoral forms (immunodepressed patient or african/asians)

MRI: hypersignal on T1, variable on T2

CT: calcifications



Spondylodiscitis
Pott

Spondylodiscitis: Rules

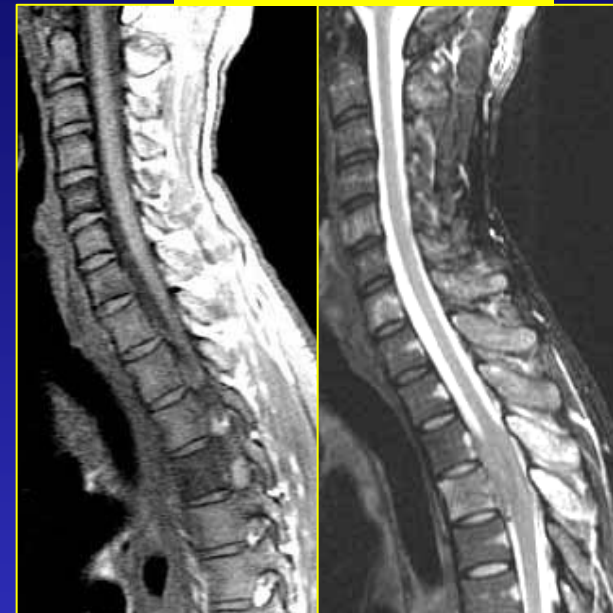
abscesses



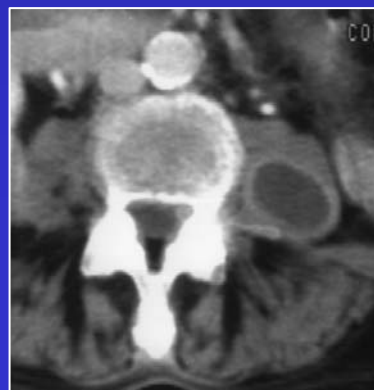
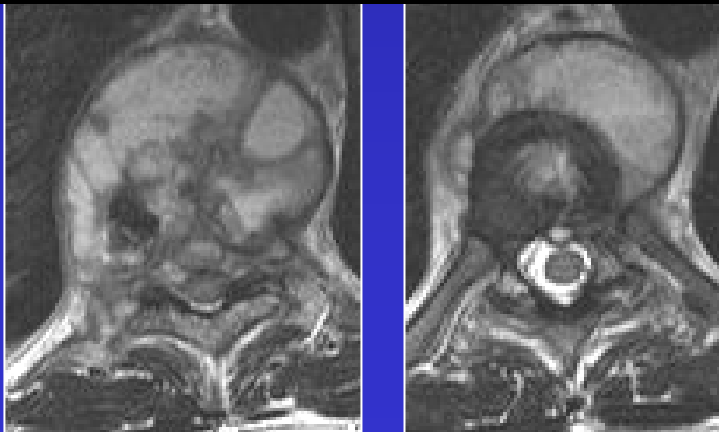
levels



osteomyelitis



epidural and paraspinal extension



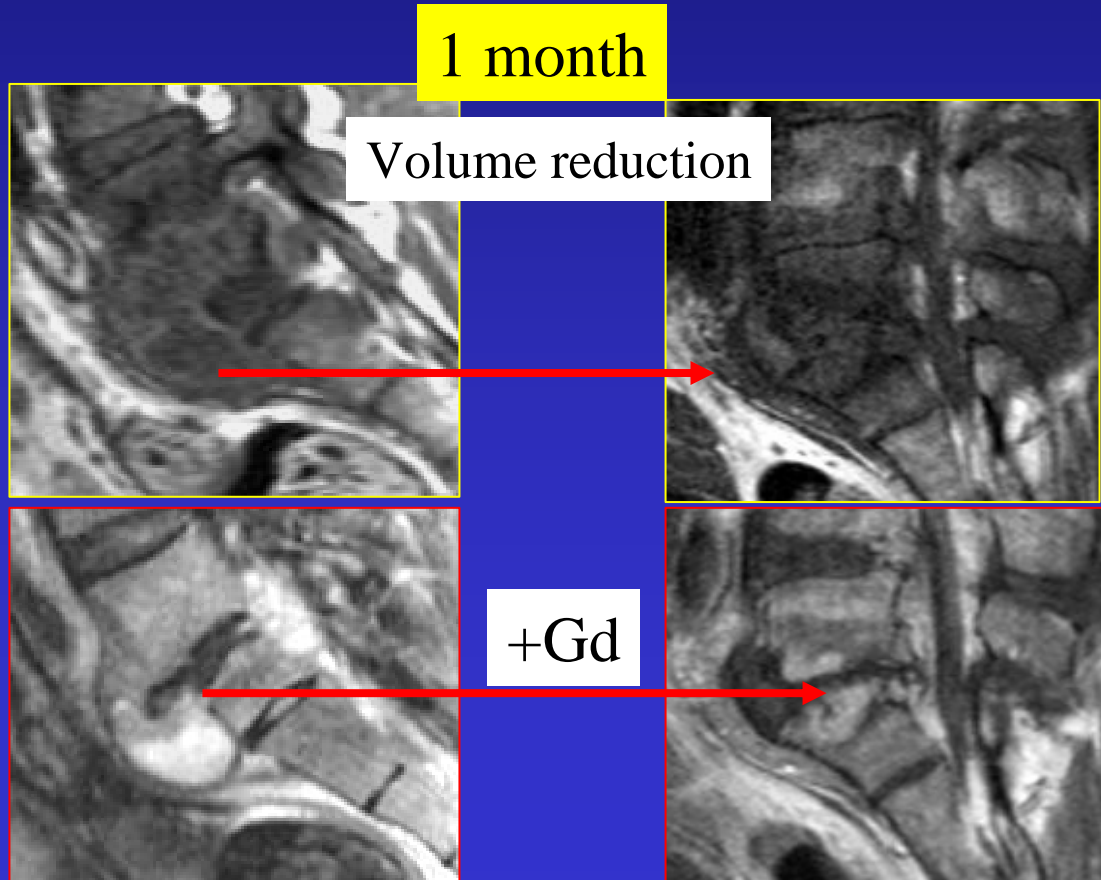
DD: Brucellosis

The purpose of the radiologist

6) follow-up

Immediate volume reduction of the abscess.

On the other hand, please note that contrast enhancement may persist for several months!



6) follow-up

Imaging does not predict the clinical outcome of bacterial vertebral osteomyelitis

Zarrouk V. Rheumatology 2006; Jul 28

Recalcitrant septic knee arthritis due to adjacent osteomyelitis in adults

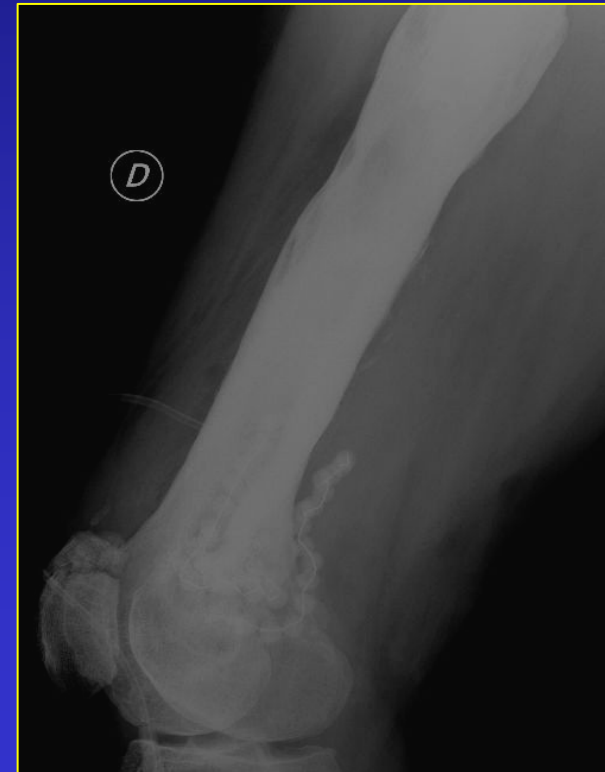
Zalavras C. Clin Orthop 2006;451: 38-41

6) follow-up

- **Chronic osteomyelitis: FDG PET**

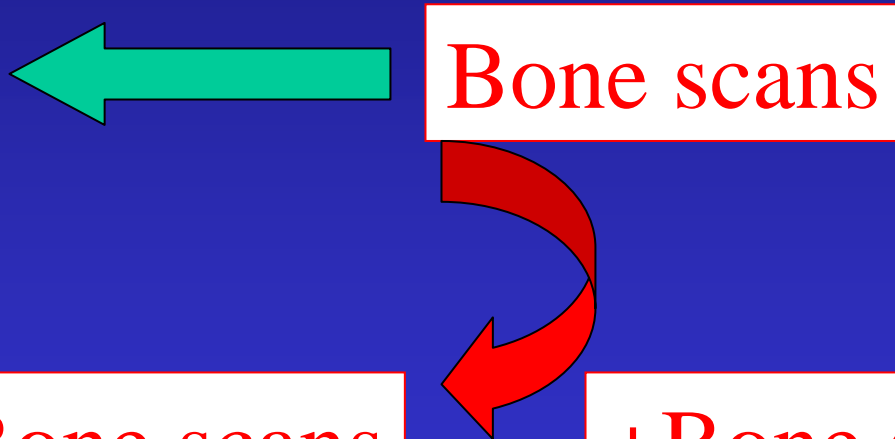
The accuracy of diagnostic imaging for the assessment of chronic osteomyelitis:
a systematic review and meta-analysis
Termaat MF JBJS 2005;87:2464-2471

- **Post operative, traumatic: DEATH**



CONCLUSION

- **RX (sens: 43-75; spec: 75-83)**
- **(CT)**
- **US (Prosthetic)**



- **Bone scans**
 - **Sensitivity: 82-100%**
 - **Specificity: 75-96%**

Termaat MF JBJS 2005;87:2464-2471
Becker Q J Nucl Med. 1999 Mar; 43(1):9-20
Lipman Clin Nucl Med. 1998 Feb;23(2):77-82
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