OVERVIEW OF RADIOLOGICAL MODALITIES FOR ORTHOPEDICS

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INTRODUCTION

- Various imaging modalities available to evaluate the **presence, type and extent** of bone, joint and soft-tissue abnormalities
- The choice of techniques dictated by **clinical presentation** as well as **equipment availability, expertise, and cost**
- X-ray findings help decide further line of diagnostic algorithm and management in most cases

IMAGING MODALITIES

Radiographs

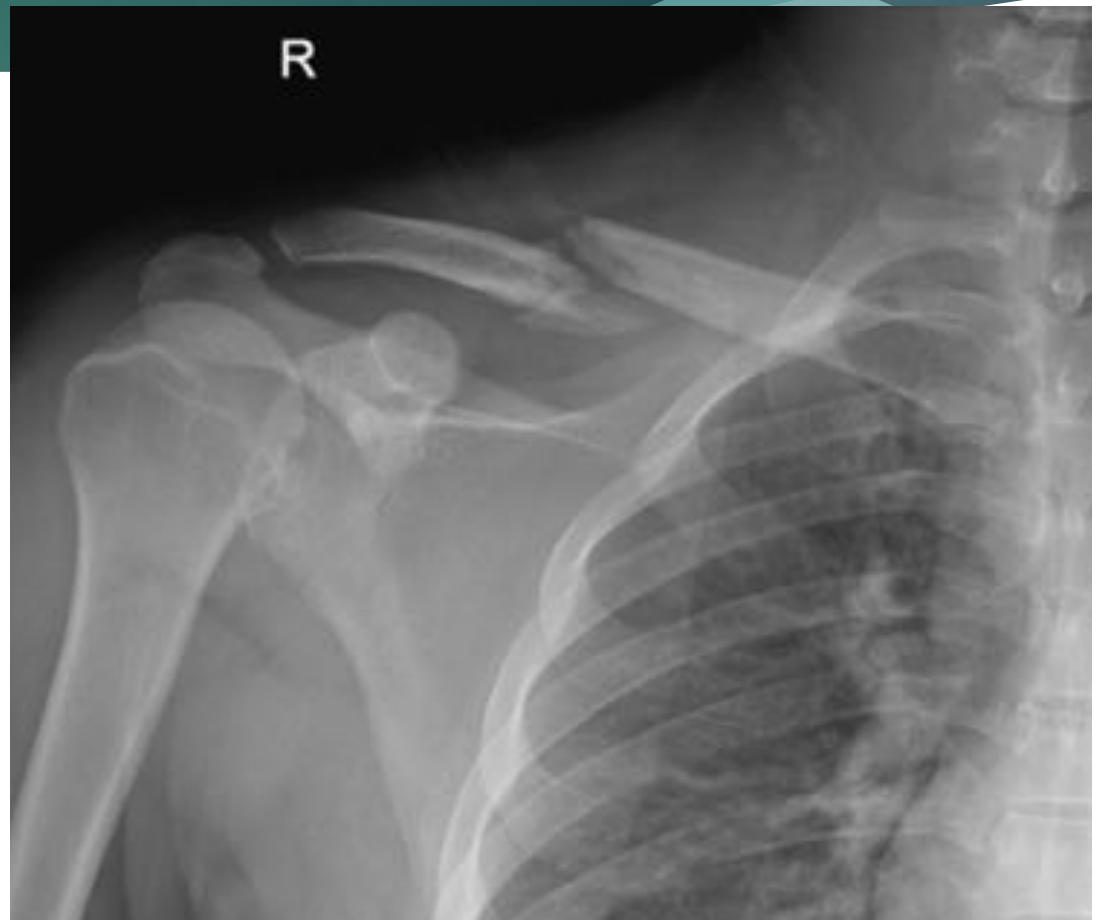
- Most frequently used as initial investigation

-TRAUMA

-TUMORS

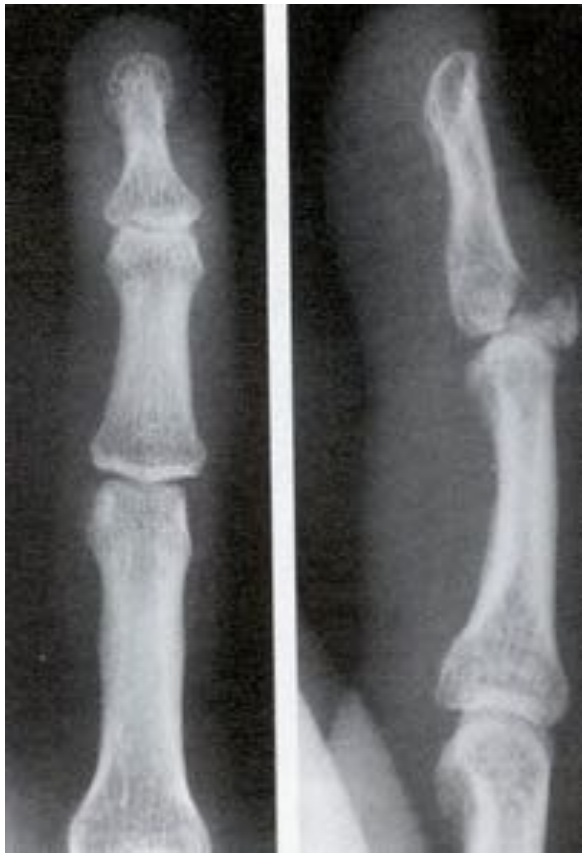
-ARTHRITIS

- Convenient
- Inexpensive
- 2D technique
- Radiation +



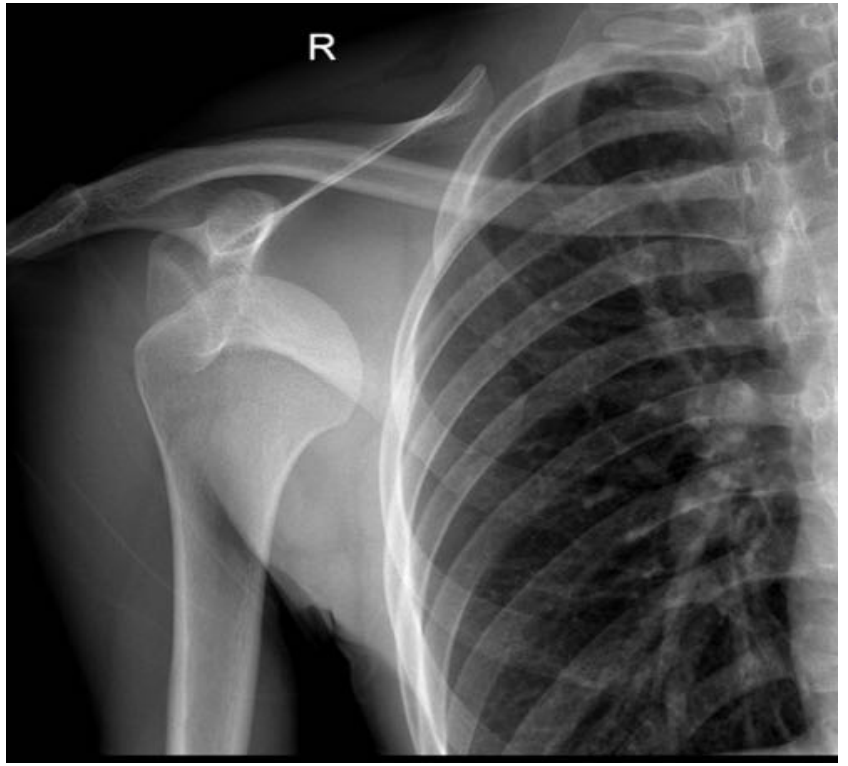
Radiographs

Obtain at least two orthogonal views including two adjacent joints

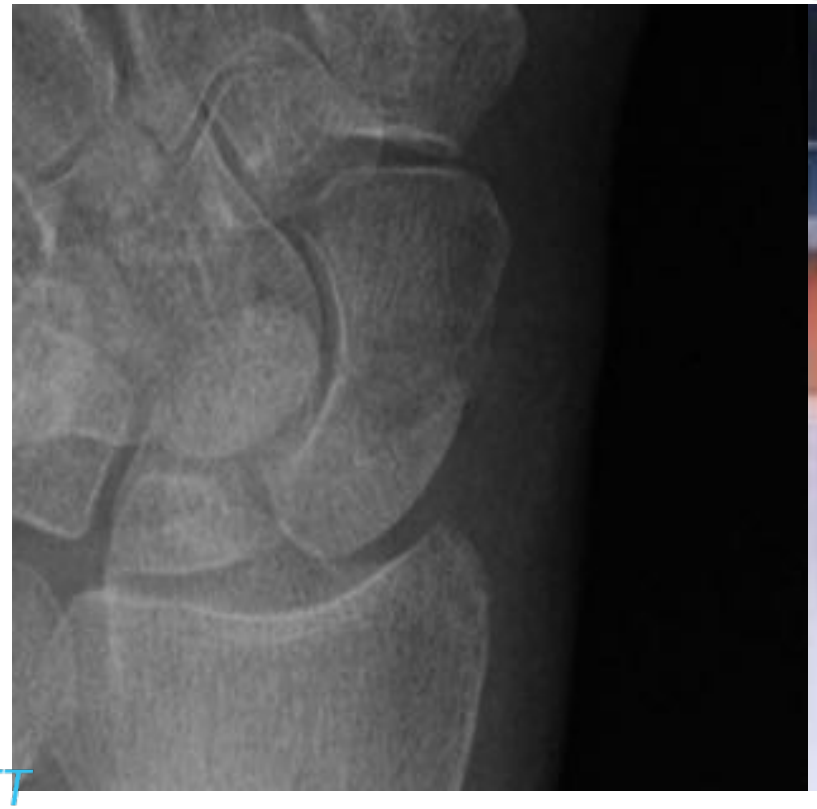


Radiographs

- Oblique and special views, particularly in evaluating complex structures
- Weight-bearing view for a dynamic evaluation of the joint space under the weight of the body
- Radiograph of the normal unaffected limb for comparison is needed in paediatrics

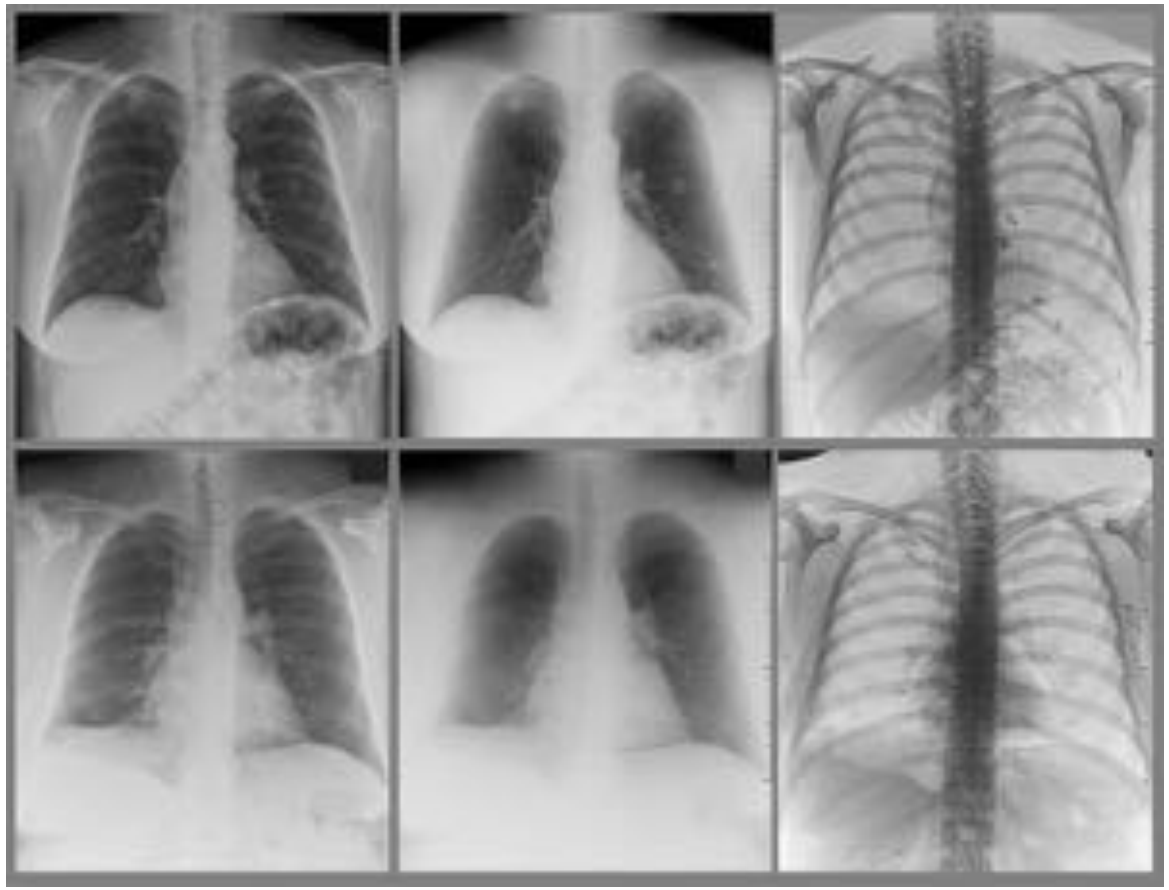


OBLIQUE VIEW



Digital Radiography

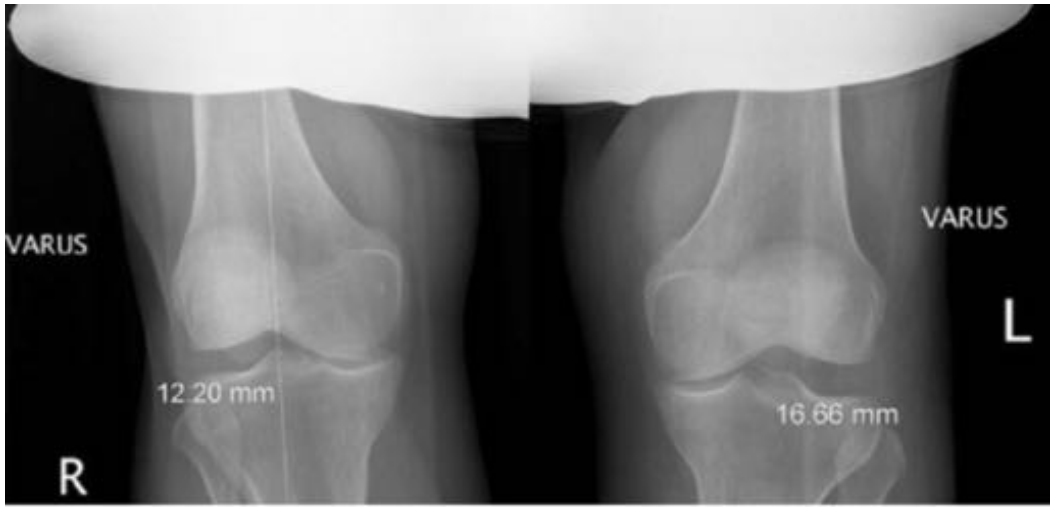
- Used routinely nowadays
- Post-processing ++
- Contrast and brightness optimization
- Quantitation of image information
- Facilitation of examination storage and retrieval
- Energy subtraction imaging possible to reconstruct a soft-tissue-only image or a bone-only image.



Edge enhancement

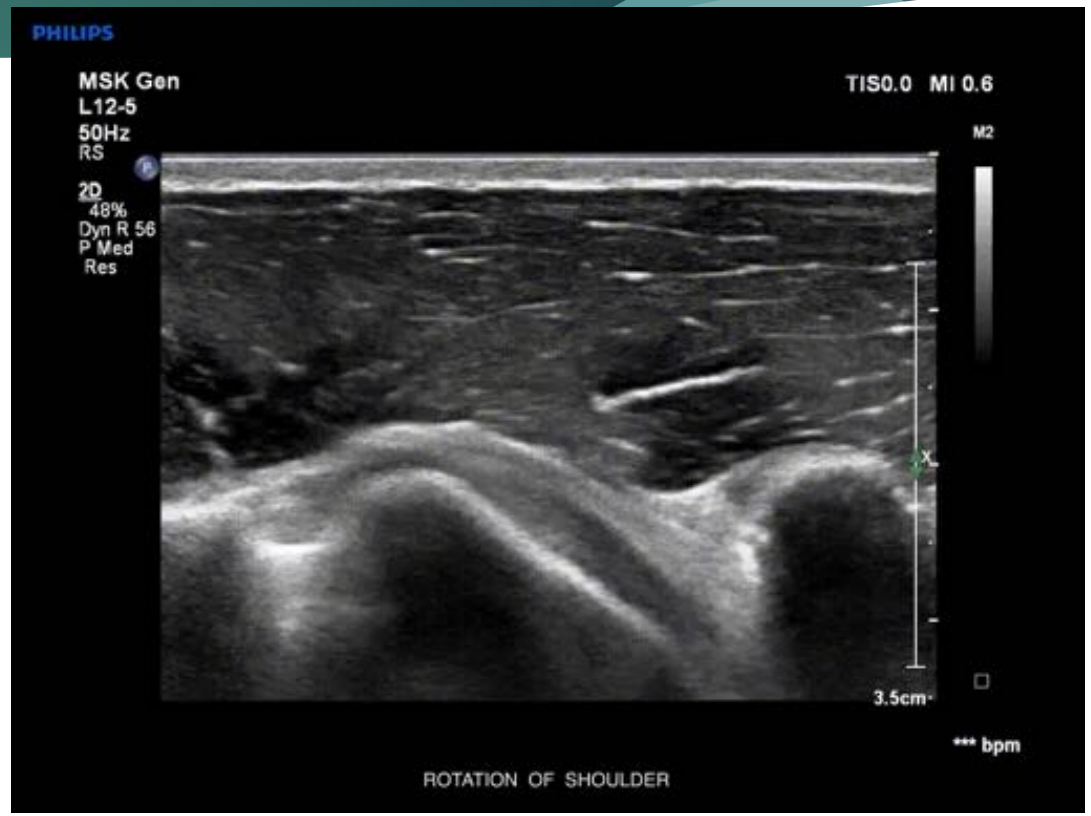
Stress Views

- Important in evaluating ligamentous tears and joint stability
- Abduction-stress film of the thumb for gamekeeper's thumb
- The evaluation of knee and ankle instability caused by ligament injuries

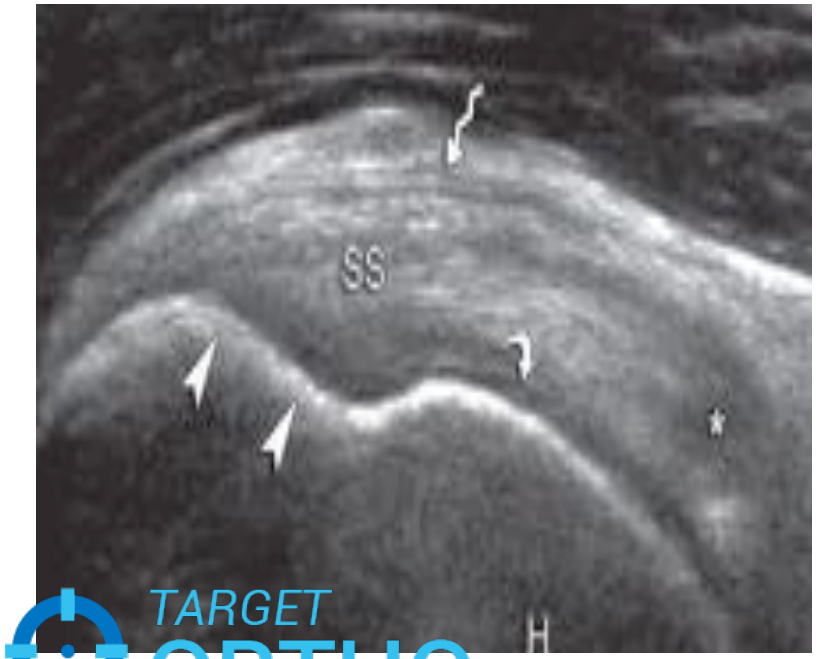


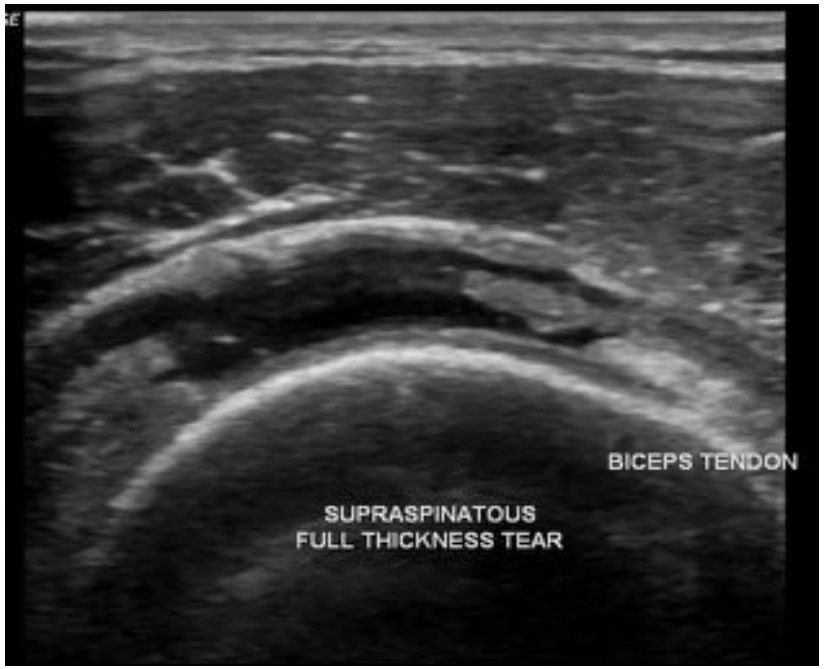
USG

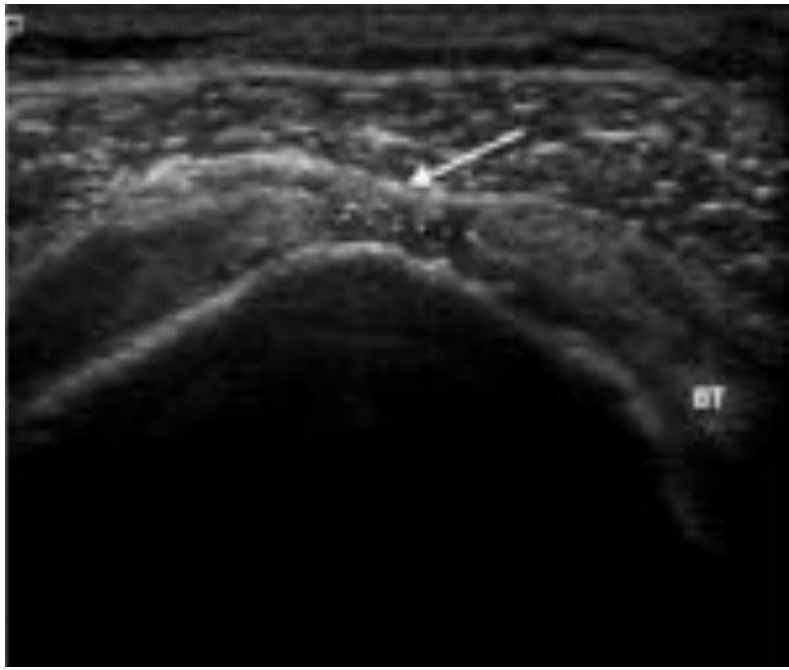
- Readily available
- Inexpensive
- Dynamic evaluation possible
- No radiation
- User-dependent
- Excellent for superficial soft tissues such as tendons and muscles
- Solid vs cystic
- Best for image guided procedures



USG of tendons

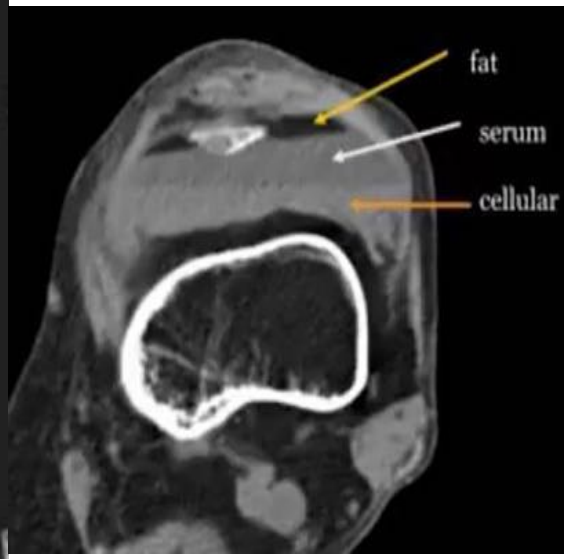






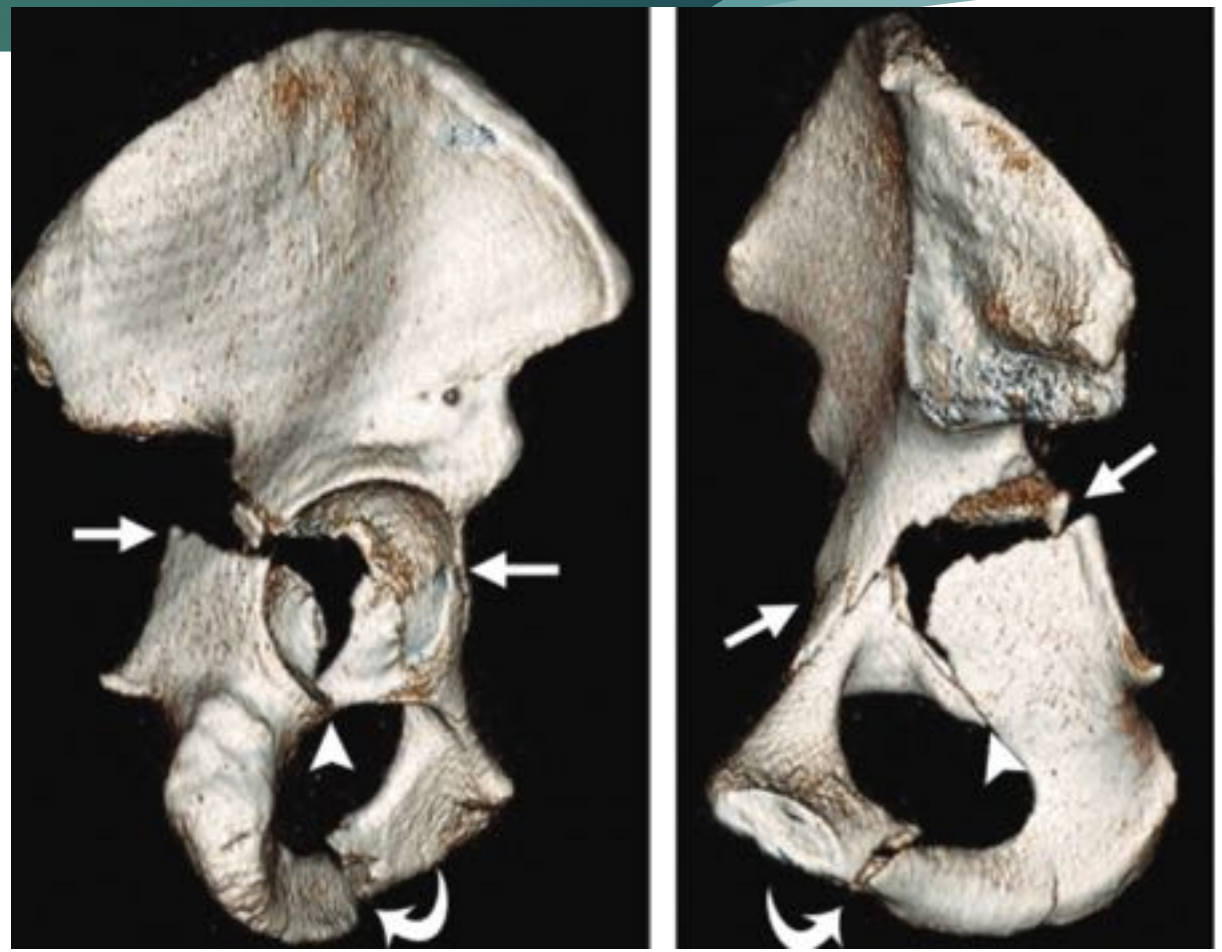
CT

- Excellent for bone and cortical evaluation
- Readily available
- Involves radiation
- High contrast resolution
- Post-processing, VRT imaging
- CT Angiography allows evaluation of associated vascular injury



VRT

- 3D volume rendered images
- Volumetric data can be reconstructed in any plane
- Suitable for 3D printing



MRI

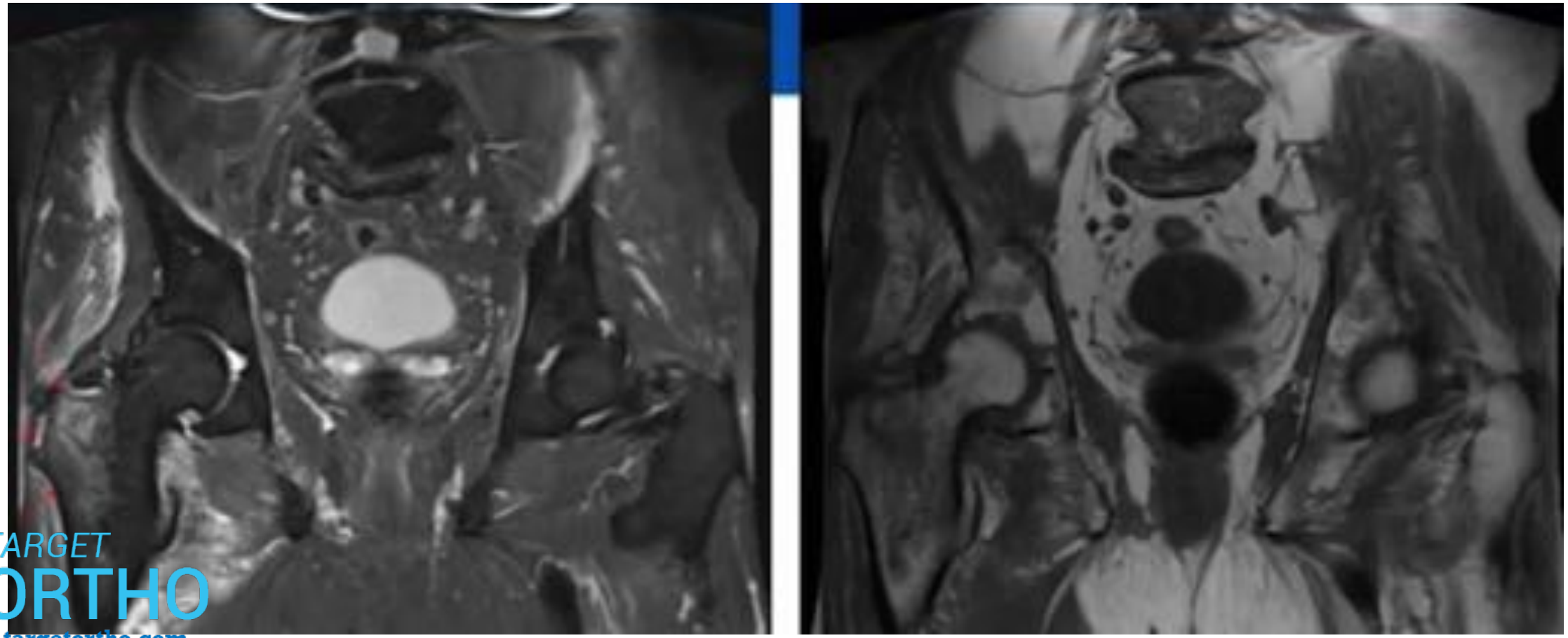
- Highest soft tissue contrast resolution
- No radiation
- Expensive
- Not readily available
- Gold standard for most conditions

MRI

- Best for soft tissue evaluation such as ligaments, cartilage
- Best to pick up occult fractures
- Sensitive to pick up bone marrow edema, acute osteomyelitis

Persistent right hip pain

Persistent right hip pain



Bone Scan

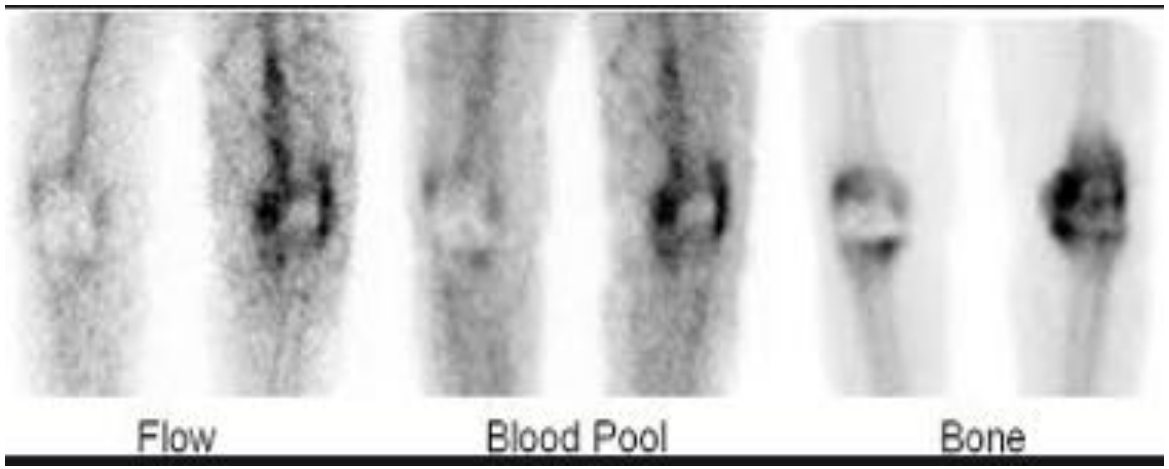
- Tc99-Methylene diphosphonate
- 3-4hr delayed scan
- Multiple phase scan possible
- Sensitive study for bony pathologies such as:

-Osteomyelitis

-Metastases

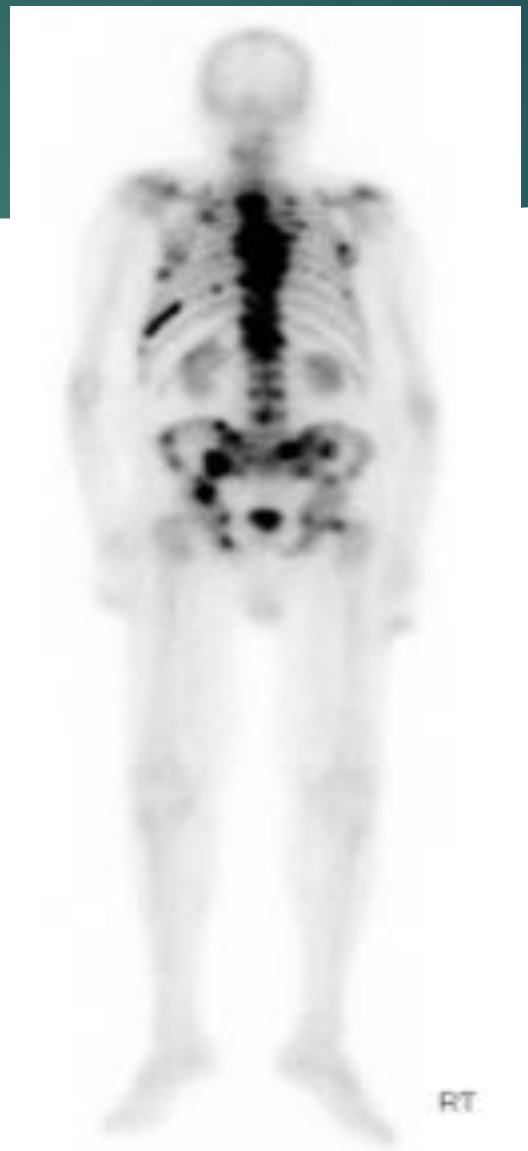
-Occult fracture

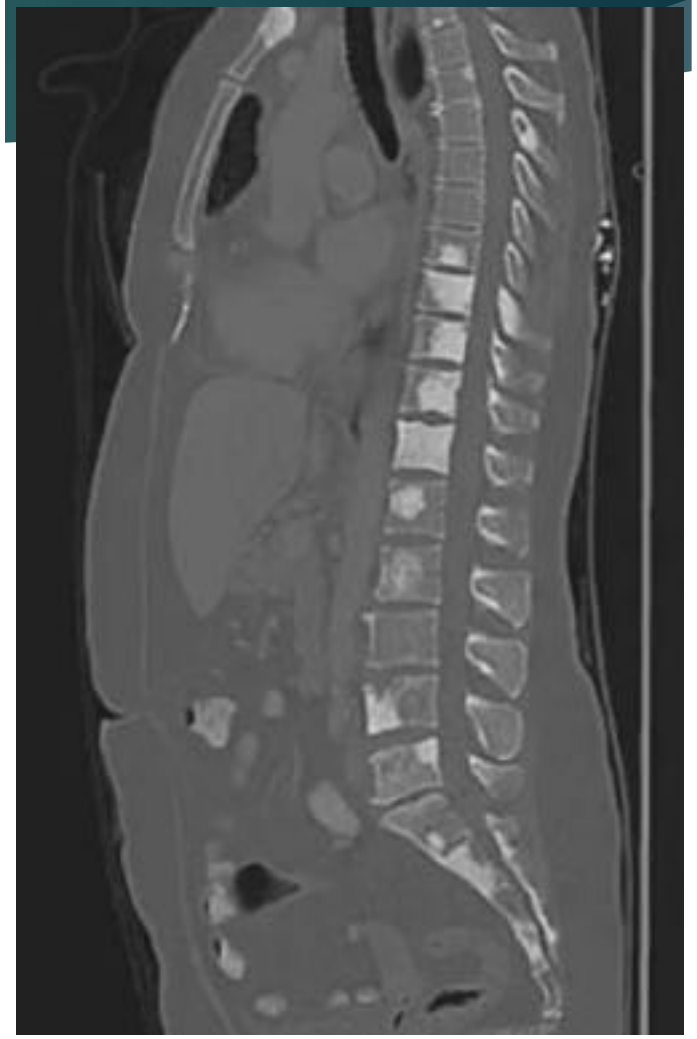
- Cold spot: Multiple myeloma
- Usually non-specific as an isolated test
- Time-consuming
- Radiation --



Bone metastases

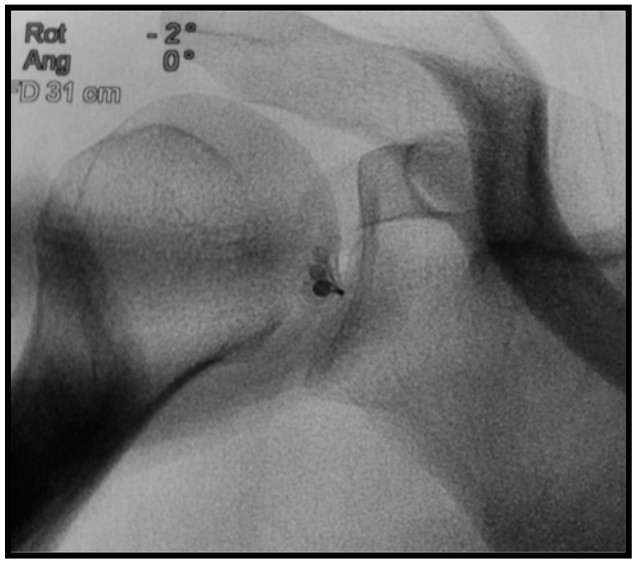
NaF PET
18-FDG PET
MRI
Bone scan





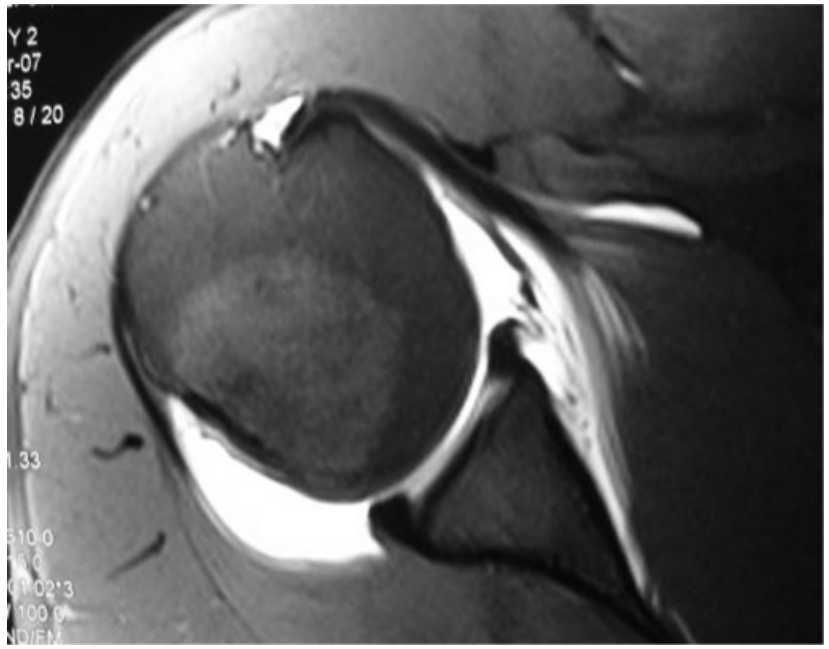
Arthrography

- Localise joint space under fluoroscopy
- Insert needle into joint along axis of xray beam
- Confirm intraarticular position by injection of contrast
- Iohexol used most commonly
- Volume of total contrast depends on joint (5-20cc)



MR Arthrography

- 0.1ml Gadolinium mixed with 5ml iodinated contrast media and 10ml saline and may be 5ml 1% lidocaine
- Adds to conventional MR imaging by delineating intraarticular structures such as labrum, cartilage, capsule and ligaments
- Contrast solution distends the joint capsule, outlines intraarticular structures, fills tears and leaks through them into the extra articular space



SPECIFIC CONDITIONS

IMAGING ARTHRITIS

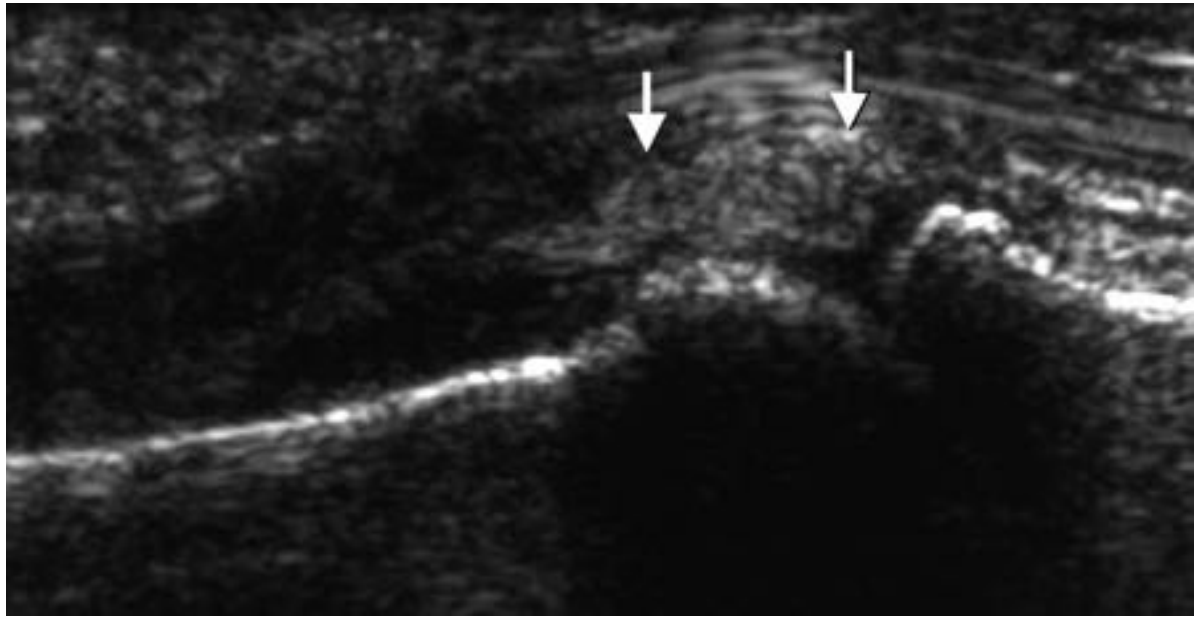
Xray:

- Still the most widely used investigation
- Skeletal survey – disease distribution
- Treatment monitoring
- Not sensitive for early disease

IMAGING ARTHRITIS

USG:

- Joint effusion
- Synovial thickening & hypervascularity
- Erosions
- Monitor disease activity & progression
- Guided aspiration & injections



IMAGING ARTHRITIS

CT

- Limited role
- Imaging of CV junction
- Better demonstration of new bone formation and bony ankylosis

IMAGING ARTHRITIS

MRI

- Gold standard for synovial imaging
- Detection of active synovitis
- Bone marrow changes
- Early detection of erosions

(MRI erosions progress to radiographical erosions with in 2 yrs)

IMAGING TUMORS

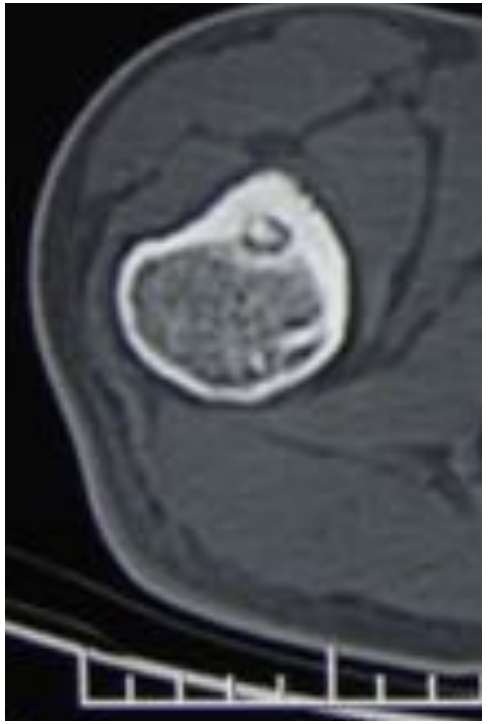
Xray:

- Most important modality for diagnosis
- Location
- Matrix
- Pattern of destruction
- Periosteal reaction
- Solitary or multiple

IMAGING TUMORS

CT:

- Complex skeletal anatomy (e.g., spine, pelvis, scapula)
- Superior delineation of cortical
- Detection of subtle matrix calcifications



IMAGING TUMORS

MRI:

- Extent of tumor in marrow and soft tissues
- Neurovascular bundle involvement
- Skip lesions
- Joint involvement
- Assessing response to chemotherapy
- Tumour recurrence

IMAGING NERVES

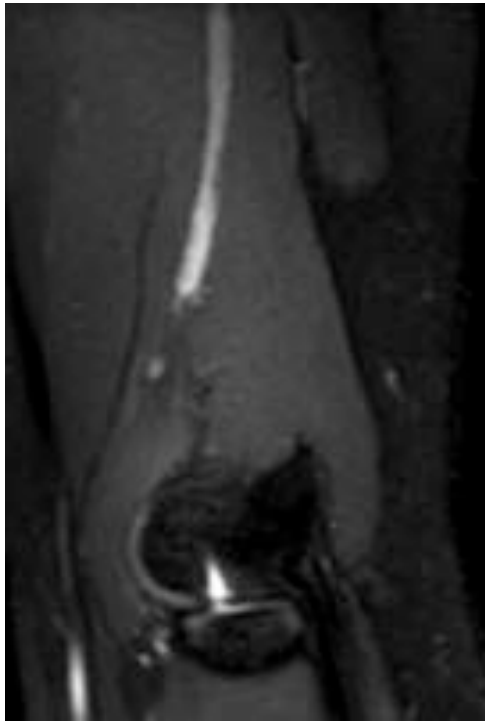
ULTRASOUND

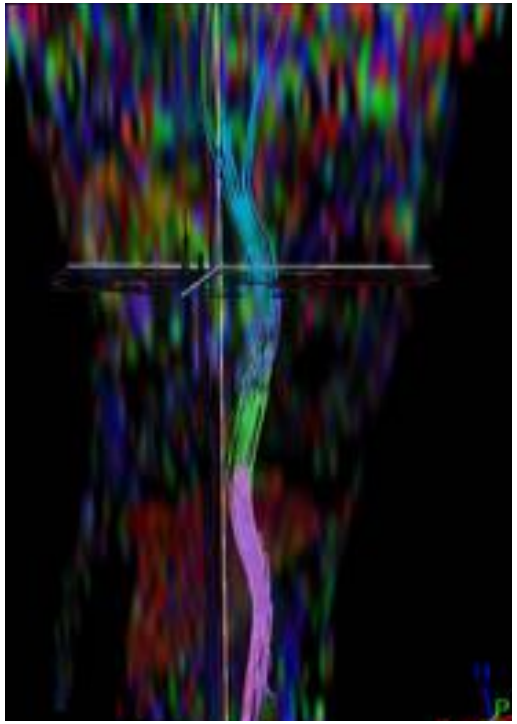
- Higher spatial resolution
- Real time dynamic evaluation, especially in entrapment syndrome.
- Longer coverage (entire nerve) in short time.
- Comparison with contralateral side – easy.

IMAGING NERVES

MRI

- High diagnostic confidence
- Not operator dependent
- Areas of dense scarring/ architectural distortion
- Secondary denervation changes.





Conclusion

- Wide array of investigations available at disposal
- Key to choose the best examination will depend on clinical manifestations and findings on initial investigation
- X-ray: Initial investigation of choice
- USG: Useful for dynamic evaluation of joints, solid vs cystic evaluation, guiding interventions
- CT: Best for evaluating fractures, cortical thickening
- MRI: Best for soft tissues, cartilage, ligaments, bone marrow edema
- Bone scan: Role in occult fractures, acute osteomyelitis, metastases
- Fluoroscopy: Guides interventions such as biopsy, angiography, arthrography

Thank you!