VOLUME-8, ISSUE-2, FEBRUARY-2019 • PRINT ISSN No 2277 - 8160

Original Research Paper

Radiodiagnosis

TUBERCULOSIS IN MUSCULOSKELETAL SYSTEM: MR IMAGING & ITS DIFFERENTIAL DIAGNOSIS - HOW TO CONQUER CHALLENGES

Dr. Kishan Ashok Bhagwat Professor, Department of Radiodiagnosis, SSIMS&RC/ RGUHS, India

Dr. Vinay. M Junior Residents, Department of Radiodiagnosis, SSIMS&RC/ RGUHS, India

Dr. Aisha M Manzoor Junior Residents, Department of Radiodiagnosis, SSIMS&RC/ RGUHS, India

ABSTRACT Musculoskeletal tuberculosis has high incidence and is seen with high frequency by health care professionals working in India. Tuberculosis of bones and joints can have varied radiological appearances. — Conventional radiographs are the usual initial imaging modality. MRI is the imaging modality of choice for musculoskeletal tuberculosis. CT can be an alternative tool when MR is not available and for guided interventions. Multi-modality imaging helps in accurate diagnosis with the help of clinico-laboratory correlation and aids the treating physician/surgeon for the further management. MRI is a non-invasive, non-ionizing and sensitive imaging modality which has become a key diagnostic tool in the field of radiology. The aim of our study is to highlight the importance of MRI in the evaluation of the musculoskeletal tuberculosis by the radiologists to aid treating physician in the correct diagnosis and manage them for better outcome. Total of 50 cases were included in the study/At the end of our study we were to conclude that MRI helps in accurately identifying the pathologies of musculoskeletal tuberculosis and thereby helping in its effective management.

KEYWORDS : MRI, Musculoskeletal, tuberculosis, Pott's spine, spina ventosa, spondylodiscitis, spondylitis, Tuberculous arthritis.

INTRODUCTION:

Musculoskeletal tuberculosis is almost always secondary to the pulmonary tuberculosis [1] The prevalence of the disease is around 30 million globally and 1-3% of the 30 million have involvement of their bones and/or joints .The disease affects patients of all ages, although it is rare in the 1st year of life [2].

Pathophysiology:

Mycobacterium tuberculosis is the causative agent and it is an acid fast thin slightly curved bacillus.

It belongs to the family of Mycobacterium tuberculosis complex. It is an obligate aerobic bacterium [1].

Tuberculosis is airborne transmitted disease and is usually confined clinically to the respiratory system. However, it can affect any organ system, particularly in immunocompromised individuals. From the lungs, spread to other organs is haematogenous. The most common method of spread to the vertebral body is through the prevertebral venous plexus of batson. [2]

Osteoarticular tuberculosis is reported in various sites including:
1. Spine (50%) - Thoracic (50%) ; Lumbar (25%) ;Cervical (25%)
2. Pelvis
3. Hip
4. Knee
5. Ankle and shoulder
6. Long and flat bones - Tubercular osteomyelitis
7. Short bones - Tubercular dactylitis
8. Tendon sheath & bursae [3].

It has not been reported to affect the mandible or the temporomandibular joint [4]. Pulmonary tuberculosis is contagious, non-pulmonary tuberculosis is not.

Risk factors of tuberculosis are as follows:
1. Protein-energy malnutrition
2. environmental conditions and living standards such as poor sanitation, overcrowded housing and slum dwelling.
3. immunocompromised status [5].

Clinical manifestations:

Along with constitutional symptoms
—Spine:
1. Deformity (gibbus, kyphus)
2. Neurological compromise (motor>sensory)
3. Muscle spasm
— Joints:
1. Swelling
2. Stiffness
3. Locking
4. Loss of function
— Bones:
1. Sinuses
2. Swelling
3. deformity

Although there are no pathognomonic radiologic features of musculoskeletal tuberculosis, in this article, we discuss and illustrate the radiologic features of tuberculosis involving the musculoskeletal system which may help in reducing the time to diagnosis and hence the associated morbidity.

Aims and objectives:

1. Bone and joints tuberculosis presentation
2. Assessment and work up by Magnetic resonance Imaging for bone and joint tuberculosis
3. Differential diagnosis for bone and joint tuberculosis

Methods and materials:

The Study was carried out at SSIMS & RC, Davangere, India. Study was given ethical clearance from the ethical committee of the above mentioned institution. MR images depicting the tubercular pathologies of the musculoskeletal system, stored in InstaRISPACS system in Department of Radio diagnosis, SSIMS &RC, Davangere during the period of 2017 March to 2017 April were retrospectively reviewed and datas were retrieved. 30 cases of MR images of musculoskeletal tuberculosis were reviewed.

All images presented in this article were obtained using GE 1.5T MRI scanner.

Results:

In our review of 30 cases, 18 were male population and 12 were females. 17 out of 30 cases were of age more than 40 years,11 cases were between 20-40 years of age and the remainder were less than 20 years of age.

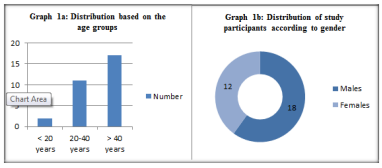

Figure 1a and 1b: Bar graph and pie chart showing the demography of cases.

The musculoskeletal tubercular pathologies encountered in our study were classified as follows:

Orbital Pathologies	Number of cases
Spine	18
Sacro-iliac joints	5
Hip joints	2
Knee	2
Ankle	1
Shoulder	2

Musculoskeletal tuberculosis:

1. Pott's spine:
Spine is involved in about 50% of skeletal tuberculosis (6).

Most commonly affected segments are the lower thoracic and upper lumbar levels. (6 – 8).

The disease process is thought to result from hematogenous spread via the venous plexus of Batson. Infection usually begins in the anterior part of the vertebral body adjacent to the end plate. The spread of infection is seen along the adjacent endplates involve the adjacent disc material which is followed by the dissemination of infection more widely into spinal segments, resulting in the classic pattern of involvement of more than one vertebral body together with the intervening disc.

The paraspinal soft tissues are not spared, resulting in the formation of a paravertebral abscess. Calcification within the abscess is virtually diagnostic for tuberculosis (3).

The complications of pott's spine include vertebral collapse and anterior wedging, leading to kyphosis and gibbus formation. With healing, ankylosis of the vertebral bodies occurs with reduction in the intervertebral disc space.

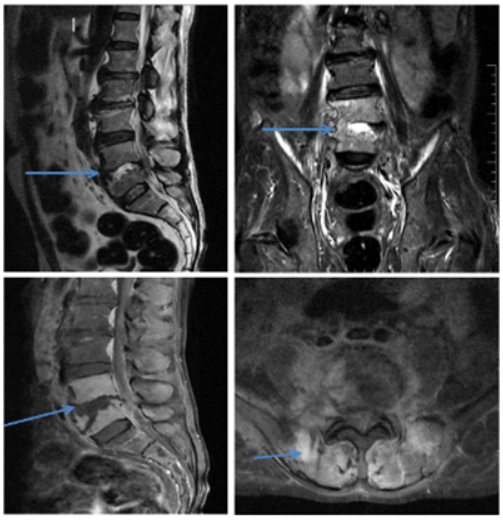

Fig 2: 60 year old elderly male presented with low back ache, radiating to both lower limbs since 5 months. A) Sag T2WI B) Coronal STIR MR images shows, T2 hyperintense collection seen in L4/L5 intervertebral disc space with irregularity and destruction of adjacent vertebral end plates. There is irregular destruction of L5 vertebral body with reduction in height.

C) and D) Post-contrast Sag and axial T1W images shows, abnormal peripheral enhancement around fluid collection, peri-vertebral soft tissues including bilateral psoas major muscles, L4, L5 vertebral bodies and pedicles. Enhancing epidural soft tissue component noted impinging bilateral traversing and exiting nerve roots and causing severe spinal canal stenosis – Features are of tubercular spondylodiscitis.

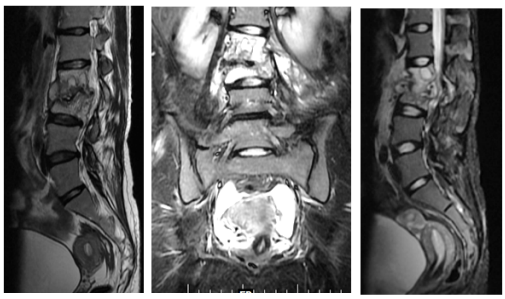

Fig 3: 19 year old adolescent girl presented with fever, pain and swelling in the lower back for 1 week. A) Sag T2WI B) Coronal STIR MR images shows, Abnormal T2 and STIR high signal intensity is seen involving L2, L3 vertebral body with involvement of disc vertebral complex with destruction of the vertebral bodies and endplates predominantly involving L3 causing 70-80 % reduction in the vertebral height with mild retropulsion of the L3 vertebrae indenting the anterior thecal sac .

C) Post-contrast Sag T1 MR image shows Abnormal enhancing anterior epidural, pre and bilateral paravertebral soft tissue collection/component noted with tracking of the collection along the bilateral psoas muscle and left iliacus, there is organised collection noted in the left half of the pelvis measuring around 3 x 2.5 cms. Anterior epidural soft collection is seen indenting the thecal sac, causing bilateral neural foraminal stenosis and impinging the cauda equina nerve roots - Features are of tubercular spondylodiscitis.

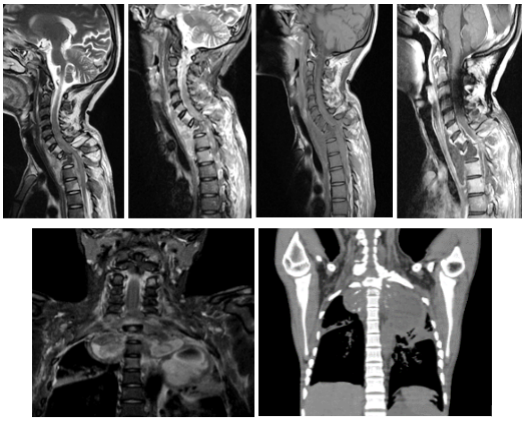

Fig 4: 18 year old girl with history of fever, loss of weight and gibbus deformity. A – D MRI images of the cervico-dorsal spine shows, collapse with destruction of D1 to D2 vertebral bodies resulting in acute kyphosis of dorsal spine with retropulsion of bony fragments indents thecal sac causing compression of cord parenchyma opposite to D1-D3 level with spinal canal and altered signal intensity opposite to C6 to D5 levels. E Post-contrast Coronal T1Wi shows peripherally enhancing abscess in the prevertebral space from C6 to D5 level, epidural abscess (from C7 to D5 level), right paraspinal abscess and contiguous extension into right paravertebral abscess and left paravertebral abscess with air fluid level and thick wall. Amorphous calcification in the pre and paravertebral abscess, likely to be long standing disease process (CT correlated). Minimal inflammatory fluid along the Prevertebral space opposite D6-D9 levels. Altered marrow signal intensity from C6 to D5 vertebral bodies including posterior elements and costo-vertebral junction. Extensive bilateral paraspinal soft tissue edema at dorsal levels and root of neck - Features are of tubercular spondylodiscitis.

Differential diagnosis for tubercular spondylodiscitis are as follows:
1. Pyogenic
2. Fungal
3. Degenerative disk disease

4. Brucellosis
5. Neoplasms
6. Extramedullary haematopoiesis

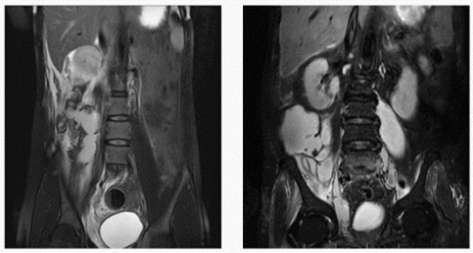

Fig 5: A) 19 year old haemophiliac male patient presented with lower abdominal pain with fever, Coronal STIR MR image reveals, large retroperitoneal hematoma involving the right psoas muscle.

B) 56 year old male patient presented with low back pain with fever, Coronal STIR MR image shows, L4-L5 infective spondylodiscitis of tubercular etiology with bilateral psoas abscess.

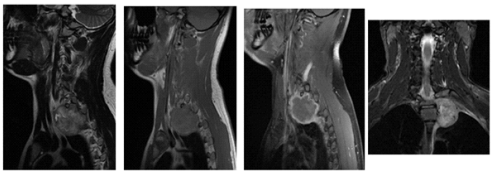

Fig 6: 21 year old male patient presented with the history of left upper limb pain and abnormal sensation since 2 months, MRI of cervical spine reveals, well defined rounded left paraspinal mass lesion with peripheral enhancement on post contrast study with bony destruction involving transverse process of D2 vertebrae - Imaging features are indicative of Malignant peripheral nerve sheath tumour.

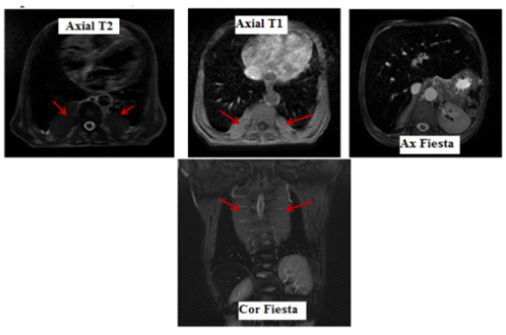

Fig 7: 36 year old male patient who is a known case of Thalassemia with history of repeated blood transfusions (Splenectomized), MR images shows extramedullary hematopoiesis.

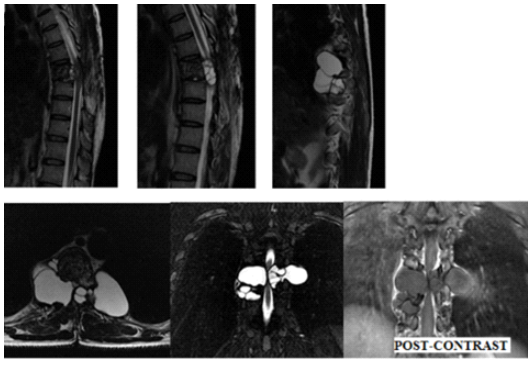

Fig 7: 40 year old male patient with history of back pain, MRI of cervico-dorsal spine reveals, multi-loculated cystic lesion involving the extramedullary and extradural location - Spinal hydatidosis.

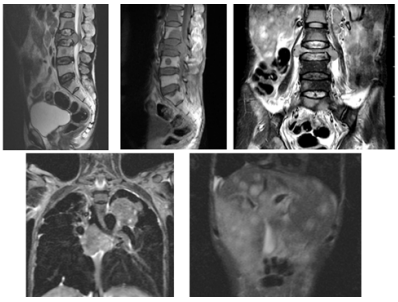

Fig 8: Patient came with the history of back pain, MRI of lumbar spine reveals, multiple T2 and STIR abnormal signal intensities involving the lumbosacral spine. Cor STIR of whole body revealed, Multiple varying sized hyperechoic lesions scattered in the both lobes of the liver and heterogenous mass lesion in the left upper lobe of the lung – Bronchogenic carcinoma with metastases to liver and lumbar spine.

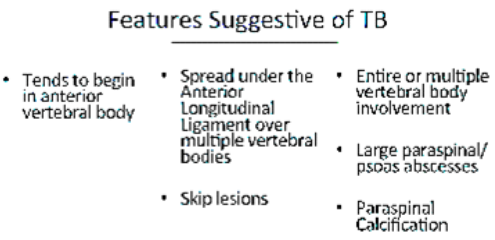

Table 1: Tabular representation of the features of pott's spine.

Degenerative spondylosis:
- Clinical findings (afebrile)
- Disc space usually not markedly narrowed or spared.
- On MR, disc dessication is manifested as low signal intensity on T2W images.
- After IV contrast infected disks enhance strongly whereas degenerated disks only occasionally enhance to a small degree.

Tuberculous versus pyogenic spondylitis:
- Chronicity and slow progression.
- Lack of sclerotic and reactive changes.
- On MR imaging: Relative preservation of disc

1. with involvement of multiple contiguous
2. more frequent involvement of posterior elements
3. a well-defined para-spinal lesion
4. disproportionally large para-spinal masses, especially with
5. calcification or a thick rim of enhancement
6. subligamentous spread to three or more vertebral levels and
7. presence of skip lesions favor a tubercular etiology

However, differentiation from pyogenic infection can at times be difficult.

Brucellosis:
Like tuberculosis the course is indolent.
Characteristic features of brucellar spondylitis include

1. Gas within the disc,
2. Only minimal associated paraspinal soft tissue mass,
3. Absence of gibbus deformity
4. Predilection for the lower lumbar spine.
5. On MR images, vertebral body morphology and cortical margins are intact despite evidence of osteomyelitis.

When a solitary vertebra is involved:
To consider:
Metastatic disease in adults
Eosinophilic granuloma in children

Spinal lesions:
Lymphoma
Neoplasms such as multiple myeloma and chordoma that involve contiguous vertebrae and disks can add to the diagnostic difficulty.

1. Sacro-iliac joint:

Tuberculous sacroiliitis should be differentiated from degenerative and post-traumatic arthritis; pyogenic infection of the sacroiliac joint; inflammatory diseases; connective tissue disorders; osteitis condensans ilii and metabolic conditions [9, 10, 11]

Pyogenic infection of the sacroiliac joint is usually hematogenously spread from skin infections. Because blood circulation is sluggish in the ilium, infections in this area may begin as osteomyelitis and then extend into the sacroiliac joint [9].

Generally, inflammatory and sero-negative arthritis of the sacroiliac joints is usually bilateral.

Sacroiliitis occurring early in the course of the disease is usually the hallmark of ankylosing spondylitis but it is bilateral. Osteitis condensans ilii is usually identified on radiographs in young multiparous women following pregnancy [9].

Definitive diagnosis is obtained by fine needle aspiration or open biopsy [12].

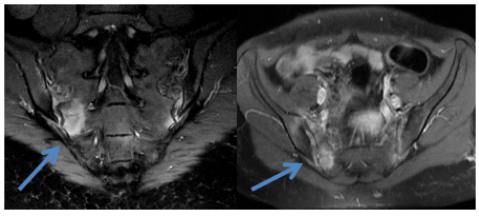

Fig 9: A 27 year old female patient H/o right SI joint pain – (TB ELISA positive). A) Cor STIR images show high signal intensity in the sacral side of the right sacro-iliac joint. B) Axial Post-contrast Axial T1WI shows significant enhancement of the sacral aspect of the right sacro-iliac joint. Unilateral sacro-ilitis – Infective sacro-ilitis – Tubercular etiology.

3. Knee Joint:

Extra-pulmonary manifestations of tuberculosis are reported in less than one in five cases with the knee affected in 8% after the spine and hip. Synovial proliferation associated with tuberculous arthritis is typically hypointense on T2-weighted images. This appearance, in conjunction with other peri-articular MRI features described, can help in distinguishing TB arthritis from other proliferating synovial arthropathies [13]

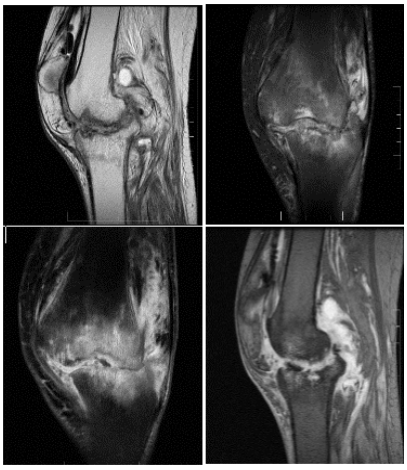

Fig 10: 65 year old elderly female presented with swelling of left knee joint for 3 months, MRI of left knee with contrast reveals,

Synovium of knee joint appears irregular and thickened with heterogeneous post contrast enhancement and gross thinning with loss of articular cartilage is seen at both medial and lateral femoral joint space and patellofemoral joint space.

Irregular thick walled collection noted involving distal epiphysis of femur. Marrow edema is seen involving lower epi-metaphyseal regions of both femur and tibia. Severe erosion and irregularity of articular surfaces of knee joint with reduction in the joint space. Mild knee joint effusion. Severe periarticular myo-tendinous edema with heterogeneous post contrast enhancement.

Synovial biopsy revealed, tubercular etiology.
Differential diagnosis:

- Juvenile rheumatoid arthritis
- Villonodular synovitis
- Osteochondritis dissecans
- Hemophilia

Biopsy of the synovial membrane and aspiration of the joint fluid followed by smear & culture can confirm the diagnosis.

4. Ankle Joint:

Tuberculosis of the foot and ankle is an uncommon presentation of skeletal tuberculosis.

Joint involvement occurs because of spread from a periarticular bony focus and in the mid-foot; the disease may spread to involve all the interconnected joints, leading to a stiff foot and residual deformities.

Bones involved are as follows:

- Calcaneum.
- Midtarsal aspect of the foot.
- Lisfranc joints.
- Ankle joint.

The most common radiologic finding is that of osteoporosis. CT and MRI may shows a cystic lesion with or without sequestrum when there is Cancellous bone involvement.

The uncommon site, lack of awareness and ability to mimic other disorders clinically and on radiographs, leads to diagnostic and therapeutic delays.

Because the disease is paucibacillary, a positive acid fast bacilli culture is rare and the diagnosis usually is confirmed by obtaining granulomatous tissue on biopsy [14].

Fig 11: 28year old female presented with pain in the left ankle and treated case of pulmonary koch's , H/o trauma 1 year back, MRI with contrast reveals, Multiple intraosseous and extra osseous pockets of infective collection are seen in and around calcaneum, talus and navicular bones causing moth eaten lytic destruction of calcaneum, talus and navicular bones. Extensive Synovitis with mild to moderate joint effusion seen involving ankle joint, subtalar joints, intertarsal and metatarso-tarsal joints with enhancing periarticular inflammatory soft tissue around the involved joints – Features are of tubercular arthritis.

Differential diagnosis for TB ankle:
- Osteochondritis desicans of talus
- Talo-calcaneal arthritis
- Charcot joint
- Madurella

5. Shoulder joint:

Tuberculosis of the shoulder joint also called as caries sicca, is rare and accounts for approximately only 0.9 to 1.7% of tubercular lesions of the skeletal variety occur in the shoulder joint.

The mean complaints were long duration of pain, stiffness of varying degree, and wasting of shoulder muscles. Cold abscess and sinus formation are the common complications [15].

Three types of affection are described:
Type I - Caries sicca the atrophic form,
Type II - Caries exudata with swelling and cold abscess formation
Type III - Caries mobile with good range of passive movements.

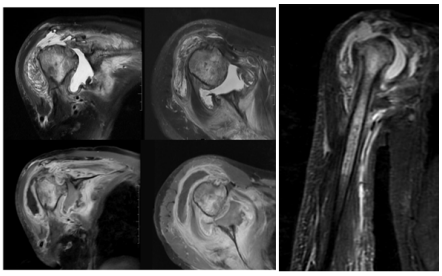

Fig 12: Caries exudate - 46 year old middle aged gentleman presented with swelling and restricted movements of Right shoulder joint since one year. MRI of right shoulder revealed,

- Erosions of the articular surfaces of the glenoid bone (labrum) and humeral head with subchondral edema.
- Marked gleno-humeral joint effusion with markedly thickened and enhancing synovium.
- On post-contrast images, there is peripheral enhancement of the collection with homogenous enhancement of the thickened synovium.
- Abnormal marrow signal seen from the head of humerus up to the middle one third of shaft of humerus, coracoid process, glenoid and spine of the scapula in keeping with edema.
- There is gross reactive joint effusion noted along the sub-scapular recess, sub-coracoid recess, coracoid-clavicular bursa, sub-deltoid bursa.
- Two collections noted along the proximal/mid one third of the humerus and just below the teres minor tendon.
- Diffuse myocutaneous and periarticular soft tissue edema.

Differential diagnosis for Tuberculosis of the shoulder joint:
- Peri-arthritis of the shoulder 50% of the cases are initially misdiagnosed as frozen shoulder.
- Rheumatoid arthritis
- Post-traumatic shoulder stiffness

6. Hip joint:

Tuberculosis (TB) of the hip is second most common in musculoskeletal tuberculosis. Due to delay in the diagnosis of the Tb hip, majority of the cases present in the advanced stage of the disease. In early stages of TB of hip, there is a diagnostic dilemma when plain X-rays are negative. By the time definite radiological changes appear on plain X-ray, the disease has moderately advanced. Now in the present scenario, imaging modalities like USG and MRI can be used in the diagnostic algorithm when radiographs are negative. The modern diagnostic facilities like ultrasonography (USG) of the hip joint, USG guided aspiration of synovial fluid can be performed for the tissue diagnosis and polymerase chain reaction. [16]

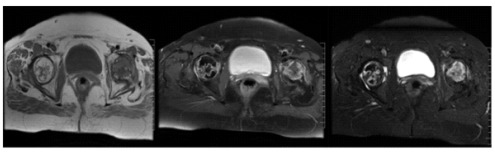

Fig 13: 62 year old female History of left hip pain with limping on ATT since 9 months, Ill-defined erosions noted in the heads of the bilateral femurs with peripheral enhancement of the edges of the erosion on post-contrast images – Tuberculosis of the bilateral hip joints.

Differential diagnosis:
- AVN
- Osteoarthritis

Biopsy of the synovial membrane and aspiration of the joint fluid followed by smear & culture can confirm the diagnosis.

7. Elbow joint:

Tuberculosis of the elbow joint is rare and accounts for 1-3% musculoskeletal tuberculosis. The diagnosis is difficult in most clinical situations because of the insidious onset, indolent process, and mild and non-specific local or systemic symptoms. Thus, the confirmatory diagnosis and effective treatment for tuberculous arthritis are delayed until the disease progresses to an advanced stage in many clinical settings [17].

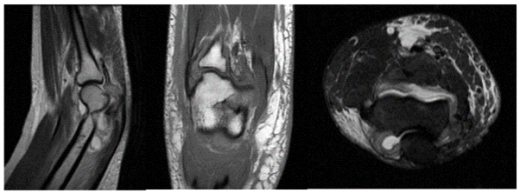

Fig 14: 52 year old female patient with history of inability to completely flex the elbow since 8 days with swelling of the left elbow joint. MRI of left elbow joint reveals, Significant synovial thickening involving most of the capsule of the elbow joint; involving the humero -radial, humero-ulnar as well as radio ulnar aspects. Minimal joint effusion.

Significant edema noted along the facial planes of the muscular compartment of the lower arm as well as the upper forearm.
Synovial biopsy revealed, tubercular etiology.

Differential diagnosis:
1. Osteochondritis desicans of the humeral condyle
2. Osteoid osteoma of the lateral condyle of the humerus which being intra articular in location can be mistaken for tuberculosis of the elbow joint.

Conclusion:

The clinical and radiologic features of musculoskeletal tuberculosis may mimic those of many other diseases. A high degree of suspicion is required, especially in high-risk populations. Although in many cases biopsy or culture specimens are still needed to yield the definitive diagnosis, it is important for radiologists and clinicians alike to understand the spectrum of imaging features of tuberculosis to aid in making an early diagnosis.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand

that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

REFERENCES:

1. Tuli SM. Tuberculosis of the Skeletal System. Anshan Publishers. (2004) ISBN:8180612708.
2. Davidson PT, Horowitz I. Skeletal tuberculosis: a review with patient presentations and discussion. Am J Med 1970;48(1):77–84.
3. Resnick D. Tuberculous infection. In: Resnick D, ed. Diagnosis of bone and joint disorders. 3rd ed. London, United Kingdom: Saunders, 2002; 2524–45.
4. Ridley N, Shaikh MI, Remedios D et-al. Radiology of skeletal tuberculosis. Orthopedics. 1999;21 (11): 1213-20.
5. www.cdc.gov Centers for Disease Control. Tuberculosis (TB) testing guidelines (MMWR June 2010) - Guidelines from CDC - United States.
6. Martini M, Ouahes M. Bone and joint tuberculosis: a review of 652 cases. Orthopedics 1988; 11(6):861–866.
7. Jain R, Sawhney S, Berry M. Computed tomography of vertebral tuberculosis: patterns of bone destruction. Clin Radiol 1993;47(3):196–199.
8. Weaver P, Lifeso R. The radiological diagnosis of tuberculosis of the adult spine. Skeletal Radiol 1984;12(3):178–186.
9. Bernard TN, Jr, Cassidy JD. The sacroiliac joint syndrome. Pathophysiology, diagnosis, and management. In: Frymoyer JW, editor. The adult spine: principles and practice. Philadelphia: Lippincott-Raven; 1997. pp. 2343–66
10. Davidson PT, Horowitz I. Skeletal tuberculosis. A review with patient presentations and discussion. Am J Med. 1970;48(1):77–84.
11. Ludmerer KM, Kissane JM. Clinicopathologic conference. Severe right hip pain in a 73-year-old woman. Am J Med. 1986;81(1):117–24.
12. Hendrix RW, Lin PJ, Kane WJ. Simplified aspiration or injection technique for the sacro-iliac joint. J Bone Joint Surg [Am] 1982;64(8):1249–52.
13. Sanghvi DA, Iyer VR, Deshmukh T, Hoskote SS. MRI features of tuberculosis of the knee. Skeletal radiology. 2009 Mar 1;38(3):267.
14. Dhillon MS, Nagi ON. Tuberculosis of the foot and ankle. Clinical Orthopaedics and Related Research (1976-2007). 2002 May 1;398:107-13.
15. Patel PR, Patel DA, Thakker T, Shah K, Shah VB. Tuberculosis of shoulder joint. Indian Journal of Orthopaedics. 2003 Apr 1;37(2):7.
16. Saraf SK, Tuli SM. Tuberculosis of hip: A current concept review. Indian journal of orthopaedics. 2015 Jan;49(1):1.
17. Jung SS, Lee MK, Lim SH, Kwon YM, Choi SS. Elbow pain proven to be tuberculous arthritis-A case report. Korean journal of anesthesiology. 2010 Feb 1;58(2):211-4.