

UNCOMMON UPPER-LIMB TUBERCULOSIS: MRI SPECTRUM OF ARTICULAR, TENOSYNOVIAL AND OSSEOUS DISEASE

Radiology

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ABSTRACT

Upper-limb musculoskeletal tuberculosis is uncommon and may resemble inflammatory arthritis, pyogenic infection or other chronic musculoskeletal disorders on both clinical examination and imaging. We describe three microbiologically confirmed cases that demonstrate distinctly different MRI patterns of upper-limb tuberculosis. The first patient, a 22-year-old man, presented with destructive tuberculous arthritis of the right shoulder. MRI demonstrated glenohumeral synovitis and effusion, numerous rice bodies, cortical erosions, marrow oedema and cartilage loss. GeneXpert testing of aspirated joint fluid confirmed tuberculosis. The second patient, a 35-year-old man, showed extensive flexor tenosynovitis of the right wrist and hand, with enhancing tendon-sheath collections extending from the distal forearm to the proximal phalanges. The third patient, a 44-year-old woman, had tuberculous osteomyelitis of the fourth metacarpal associated with a soft-tissue abscess, interosseous myositis and extensor tenosynovitis. These cases illustrate the broad imaging spectrum of upper-limb tuberculosis. MRI is particularly useful for defining the anatomical extent of disease and identifying an appropriate site for aspiration or biopsy. Recognition of these uncommon patterns can help raise suspicion of tuberculosis earlier, although microbiological confirmation remains essential.

KEYWORDS

Tuberculosis, magnetic resonance imaging, shoulder, wrist, hand, tenosynovitis, osteomyelitis, rice bodies

INTRODUCTION

Osteoarticular tuberculosis is an uncommon form of extrapulmonary tuberculosis. Its indolent course and non-specific presentation often delay diagnosis, particularly in peripheral joints, tendon sheaths or unusual bones. Imaging may overlap with inflammatory arthropathy, pyogenic infection and neoplastic disease (Agashe et al. ; 2009, Agashe et al. ; 2020).

Tuberculosis of the shoulder is particularly uncommon. MRI may show synovial thickening, joint or bursal effusion, osseous erosions, marrow abnormalities and joint destruction (Kapukaya et al. ; 2006, Kul-karni et al. ; 2022, Tuan et al. ; 2024). Rice bodies may occur within the joint or adjacent bursae. Although non-specific, they should raise suspicion in chronic monoarthritis (Pimprikar and Kekatpure; 2014, Tuan et al. ; 2024).

Tuberculous tenosynovitis of the wrist and hand is uncommon and often diagnosed late because symptoms may remain mild. MRI demonstrates the extent of tendon-sheath involvement, synovial thickening, collections, rice bodies and associated osseous disease (Sueyoshi et al. ; 1996, Hsu et al. ; 2004, Bagir and Sayit; 2019).

Tuberculous osteomyelitis of small or long bones in the upper limb can be even more difficult to recognise. Marrow abnormalities, cortical changes, periosteal reaction and adjacent soft-tissue collections may closely resemble pyogenic osteomyelitis or a bone tumour (Agashe et al. ; 2009, Khaleel et al. ; 2026).

This series describes three microbiologically confirmed patterns of upper-limb tuberculosis involving the shoulder joint, flexor tendon sheaths of the wrist and hand, and fourth metacarpal, highlighting MRI features that may prompt targeted microbiological confirmation.

MATERIAL AND METHODS

This retrospective descriptive series included three patients with microbiologically confirmed upper-limb tuberculosis. Clinical information, MRI examinations and available microbiological results were reviewed after removal of all patient identifiers.

MRI of the right shoulder was performed in the first patient, MRI of the right wrist and hand in the second patient and MRI of the left hand in the third patient.

The examinations were reviewed for joint and tendon-sheath effusion, synovial thickening, discrete collections, articular cartilage loss, marrow signal abnormality, cortical changes, periosteal reaction and involvement of the surrounding muscles and soft tissues.

Only microbiological findings documented in the available patient records have been included. The exact microbiological assay was available for the first patient but was not documented in the records available for the second and third patients.

Written informed consent was obtained from all three patients for publication of anonymised clinical information and radiological images.

RESULTS

Case 1: Tuberculous Arthritis of the Shoulder with Rice Bodies

A 22-year-old man presented with pain and restricted movement of the right shoulder.

MRI demonstrated moderate narrowing of the glenohumeral joint space with diffuse thinning of the articular cartilage. Multiple partial- and full-thickness chondral defects were present along the humeral head and glenoid.

Extensive cortical erosions involved the humeral head, with underlying subchondral marrow oedema and small cystic changes. Patchy subarticular marrow oedema was also present in the humeral head and glenoid.

A moderate glenohumeral joint effusion was associated with diffuse synovial thickening. Additional fluid was present in the subcoracoid recess/bursa.

Multiple intra-articular bodies demonstrated iso- to mildly hyperintense signal on T1-weighted images and relatively low signal on T2/STIR images, compatible with rice bodies.

Mild marginal osteophytes were present along the humeral head. Mild fraying of the anterosuperior labrum was noted. A small, low-grade partial-thickness insertional tear of the supraspinatus tendon, measuring approximately 4 mm, was present with mild supraspinatus and subscapularis tendinosis.

Several mildly enlarged right axillary lymph nodes were seen, the largest measuring approximately 10 × 16 mm.

The included portion of the right hemithorax demonstrated fibronodular scarring with coarse calcification, fibrobronchiectatic changes and calcified hilar and mediastinal lymph nodes, consistent with previous granulomatous infection.

The combination of chronic destructive monoarthritis, synovitis, erosions and multiple rice bodies raised strong suspicion of tuberculous arthritis. Aspiration of the shoulder joint was subsequently

performed, and GeneXpert testing of the aspirate was positive for *Mycobacterium tuberculosis*, confirming the diagnosis.

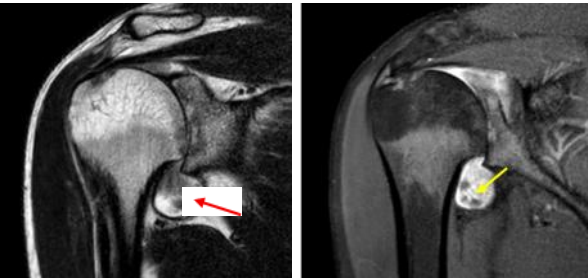


Figure 1a and 1b: Coronal MRI of the right shoulder demonstrating glenohumeral effusion and synovial thickening (red arrow), with an intra-articular rice body (yellow arrow) in the inferior recess and associated erosive changes.

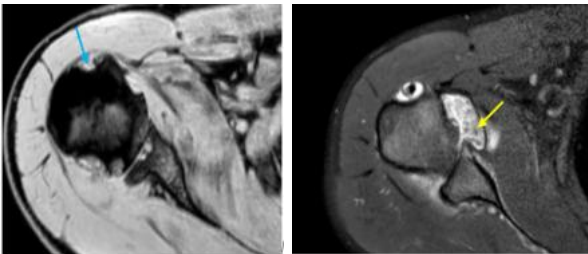


Figure 2a and 2b: Axial MRI of the right shoulder demonstrating glenohumeral synovitis and effusion with multiple intra-articular rice bodies (yellow arrow) and adjacent erosive change (blue arrow).

Case 2: Tuberculous Flexor Tenosynovitis of the Wrist and Hand

A 35-year-old man underwent MRI of the right wrist and hand.

The examination demonstrated extensive heterogeneously T2/STIR-hyperintense collections with peripheral enhancement and associated synovial thickening along the flexor tendon sheaths. The abnormality extended longitudinally from the distal forearm through the wrist and into the hand up to the proximal phalanges. Mild surrounding soft-tissue oedema was present.

A small wrist joint effusion was also noted. The extensor tendons were intact, without tear or significant tendon-sheath fluid. The median and ulnar nerves appeared unremarkable.

A small, well-defined chondroid lesion measuring approximately 12 × 5 mm was incidentally noted in the midshaft of the fourth metacarpal and was considered most consistent with an enchondroma.

The long-segment flexor tendon-sheath involvement and associated collections suggested an infective tenosynovitis. Tuberculosis was considered because of the chronic pattern and extent of involvement.

Subsequent microbiological testing confirmed tuberculosis. The precise microbiological assay was not documented in the clinical information available for review.

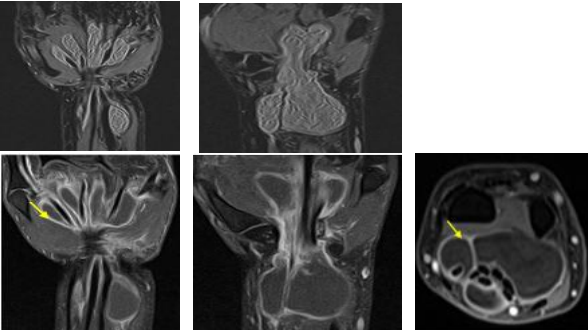


Figure 3a-e: Coronal STIR images (a and b) and contrast-enhanced T1-weighted fat-suppressed images in coronal and axial planes (c-e) of the right wrist and hand, demonstrating extensive fluid collections with synovial thickening and enhancement (yellow arrow) along the flexor tendon sheaths, extending from the distal forearm to the proximal phalanges, with mild adjacent oedema.

Case 3: Tuberculous Osteomyelitis of the Fourth Metacarpal with Extensor Tenosynovitis

A 44-year-old woman presented with pain and swelling of the left hand without a history of preceding trauma.

MRI demonstrated STIR-hyperintense marrow oedema involving the shaft of the fourth metacarpal with an associated solid periosteal reaction. No displaced fracture was identified, and no definite cortical breach was seen.

A well-defined T2/STIR-hyperintense collection measuring approximately 2.5 × 1.1 cm was present adjacent to the involved metacarpal and extended into the subcutaneous tissues, consistent with a soft-tissue abscess.

Diffuse oedema was present in the adjacent interosseous muscles, in keeping with myositis. Fluid along the extensor tendon sheaths was consistent with associated extensor tenosynovitis.

The flexor tendons were unremarkable. No significant joint effusion or articular involvement was identified

The overall MRI appearance was consistent with osteomyelitis of the fourth metacarpal complicated by an adjacent soft-tissue abscess, interosseous myositis and extensor tenosynovitis.

Microbiological evaluation subsequently confirmed tuberculosis. The exact assay used for confirmation was not available in the records reviewed.



Figure 4a-c: Coronal, sagittal and axial MRI of the left hand demonstrating STIR-hyperintense marrow oedema involving the shaft of the fourth metacarpal (red arrow), in keeping with osteomyelitis. A well-defined T2/STIR-hyperintense collection is seen adjacent to the fourth metacarpal (yellow arrow), extending into the subcutaneous plane with oedema in the adjacent interosseous muscles and associated extensor tenosynovitis.

Table 1: Summary of the Three Cases

Feature	Case 1	Case 2	Case 3
Age/Sex	22-year-old male	35-year-old male	44-year-old female
Site	Right shoulder	Right wrist and hand	Left fourth metacarpal
Dominant MRI pattern	Erosive glenohumeral arthritis with synovitis and rice bodies	Long-segment flexor tenosynovitis with enhancing tendon-sheath collections	Fourth-metacarpal osteomyelitis with abscess, myositis and extensor tenosynovitis
Microbiology	Shoulder aspirate GeneXpert-positive for tuberculosis	Positive for tuberculosis; exact assay not documented	Positive for tuberculosis; exact assay not documented
Key imaging clue	Chronic erosive monoarthritis with rice bodies	Extensive chronic flexor tendon-sheath involvement	Metacarpal marrow disease with adjacent abscess and tenosynovitis

DISCUSSION

These cases demonstrate the varied MRI appearance of upper-limb tuberculosis: articular disease in one patient, flexor tenosynovitis in another, and predominantly osseous disease with secondary soft-tissue and tendon-sheath involvement in the third.

This variation is clinically important because none of these appearances is completely specific for tuberculosis. Depending on the site and stage of disease, the differential diagnosis may include pyogenic infection, inflammatory arthritis and, particularly in osseous disease, neoplasia (Agashe et al. ; 2009, Agashe et al. ; 2020).

Shoulder Tuberculosis

The first case showed destructive glenohumeral disease with synovial thickening, effusion, rice bodies, cortical erosions, marrow oedema and cartilage loss.

Tuberculosis of the shoulder has long been recognised as an uncommon form of osteoarticular tuberculosis. Previous series have described pain and progressive restriction of movement as common presenting features, while imaging may demonstrate osseous erosion, joint-space alteration and periarticular soft-tissue abnormality (Kapukaya et al. ; 2006, Kulkarni et al. ; 2022).

Rice bodies were particularly conspicuous in our patient. Similar findings have been reported in tuberculous arthritis and subdeltoid bursitis of the shoulder (Pimprikar and Kekatpure; 2014, Tuan et al. ; 2024). Rice bodies themselves are not pathognomonic and may also occur in rheumatoid arthritis and other chronic inflammatory synovitides. However, when numerous rice bodies occur in association with a slowly progressive erosive monoarthritis, tuberculosis should be actively considered.

The additional evidence of previous granulomatous disease in the imaged thorax further supported this possibility in our case, although the diagnosis was ultimately established by a GeneXpert-positive shoulder aspiration.

Tuberculous Tenosynovitis

The second case was characterised by extensive flexor tenosynovitis extending continuously from the distal forearm into the hand.

Tuberculous involvement of the wrist and hand tendon sheaths has been described as a chronic process with marked synovial thickening and tendon-sheath fluid (Sueyoshi et al. ; 1996). Hsu et al. (2004) similarly demonstrated that tuberculous infection of the wrist may involve both tendon sheaths and synovial structures and may be accompanied by small low-signal foci, erosions or osteomyelitis.

More recent reports continue to emphasise the value of MRI in defining the extent of tenosynovial involvement (Bagir and Sayit; 2019).

In our patient, the longitudinal extent of the abnormality was particularly striking. MRI showed disease extending from the distal forearm across the wrist and into the proximal phalanges. This information is difficult to obtain from clinical examination alone and is useful when planning aspiration, biopsy or surgical drainage.

Nevertheless, imaging distinction from pyogenic or inflammatory tenosynovitis may remain difficult. For this reason, microbiological confirmation should be sought whenever tuberculosis is suspected.

Tuberculous Osteomyelitis

The third patient illustrates a different diagnostic problem. The dominant abnormality was centred on the fourth metacarpal, with marrow oedema, periosteal reaction and an adjacent abscess. Associated interosseous myositis and extensor tenosynovitis indicated spread into the surrounding soft tissues.

In isolation, this appearance could readily be interpreted as pyogenic osteomyelitis. Tuberculous osteomyelitis, however, may involve unusual bones and can mimic both infection and neoplasia. Similar diagnostic difficulty has recently been described in tuberculosis of the ulnar shaft (Khaleel et al. ; 2026).

The absence of a characteristic single MRI sign means that the diagnosis often depends on recognising an unusual combination of findings in the appropriate clinical setting and obtaining tissue or fluid for microbiological analysis.

Role of MRI and Microbiological Confirmation

The principal strength of MRI in musculoskeletal tuberculosis lies in its ability to define disease extent. It can demonstrate synovitis, tendon-sheath involvement, cartilage damage, marrow abnormalities, cortical change, muscle involvement, and soft-tissue collections within a single examination.

This information is also useful when selecting the most appropriate site for aspiration or biopsy.

Osteoarticular tuberculosis is often difficult to confirm from imaging alone. Microbiological diagnosis therefore remains important, particularly because treatment decisions may be influenced by drug susceptibility. Culture and molecular techniques have complementary roles in the diagnosis of osteoarticular tuberculosis (Agashe et al. ; 2009, Agashe et al. ; 2020).

In the present series, GeneXpert provided microbiological confirmation in the shoulder case. The remaining two cases were also microbiologically confirmed, although the exact laboratory techniques were not documented in the records available to us.

MRI does not replace microbiological diagnosis; it raises suspicion, defines disease extent and helps direct sampling.

CONCLUSION

Upper-limb tuberculosis has a broad MRI spectrum and may involve joints, tendon sheaths, bone and surrounding soft tissues in very different ways.

Erosive glenohumeral arthritis with rice bodies, extensive flexor tenosynovitis and metacarpal osteomyelitis with an adjacent abscess and extensor tenosynovitis represent three uncommon but important patterns.

Because these appearances overlap with more common inflammatory and pyogenic disorders, tuberculosis should remain in the differential diagnosis when the clinical course is indolent or the pattern of involvement is unusual.

MRI is valuable for defining the anatomical extent of disease and guiding aspiration or biopsy. Definitive diagnosis, however, should be supported by microbiological confirmation wherever possible.

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