



Case Report

Mycobacterium tuberculosis joint infections: A case series

Gui Luo*, Jinshui Yang, Qianqian Zhao, Jian Zhu, Jianglin Zhang, Zheng Zhao*



Department of Rheumatology and Immunology, The First Medical Center, Chinese PLA General Hospital, Beijing 100853, China

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ABSTRACT

Tuberculosis is a chronic infectious disease, caused by *Mycobacterium tuberculosis*, that seriously endangers human health. Skeletal tuberculosis is the most common type of extrapulmonary tuberculosis and tuberculous arthritis is the second most common type of skeletal tuberculosis. We report a case series of patients with tuberculous arthritis, two of whom had no joint disease in the past and presented as monoarthritis. The final patient had a history of rheumatoid arthritis, with polyarthritis that was aggravated during treatment with glucocorticoids and immunosuppressive drugs. This series of cases can contribute to early diagnosis and treatment with appropriate infection control measures.

1. Introduction

According to World Health Organization data, an estimated 10.6 million people were newly infected with tuberculosis in 2022 [1]. Tuberculous arthritis is the second most common skeletal tuberculosis. Although rare, it is clinically challenging because of its rare location, non-specific symptoms, and ability to mimic multiple diseases, which delay diagnosis and treatment [2]. We report a case series of patients with tuberculous arthritis in the First Medical Center of the Chinese PLA General Hospital in China. The clinical manifestations of these patients were joint swelling and pain. The aim of this case report is to focus awareness on this clinical spectrum, which is significant in the differential diagnosis of arthritis.

2. Case series

The three patients with confirmed tuberculous arthritis were all female, with a median age of 41 years (32–51 years). All patients had no clinical manifestations of pulmonary tuberculosis and no underlying co-

morbidities (with the exception of one patient with a history of rheumatoid arthritis). All patients had an elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels and were ultimately confirmed to have *Mycobacterium tuberculosis* infection through joint cavity puncture to obtain synovial tissue or synovial fluid for histopathology or meta-genomic next-generation sequencing (mNGS; details of the mNGS protocol are provided in Supplementary Data S1). The clinical and laboratory data are summarized in Supplementary Table S1.

3. Observation 1

A 32-year-old female patient without a past history of disease sought care for swelling and pain of the right ankle joint. She had a fever during the disease course.

On admission, her right ankle joint was swollen and tender with a limited range of motion, pigmentation, and increased local skin temperature (Fig. 1A). The muscles of the right lower limb were atrophic with muscle strength of only level 4.

Abbreviations: RA, rheumatoid arthritis; WCC, white-cell count; HB, hemoglobin; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; UN, urea nitrogen; NA, not available; CT, computed tomography; MRI, magnetic resonance imaging; mNGS, meta-genomic next-generation sequencing.

* Corresponding authors.

E-mail addresses: jinglansa2011@163.com (G. Luo), sisyzz1979@126.com (Z. Zhao).

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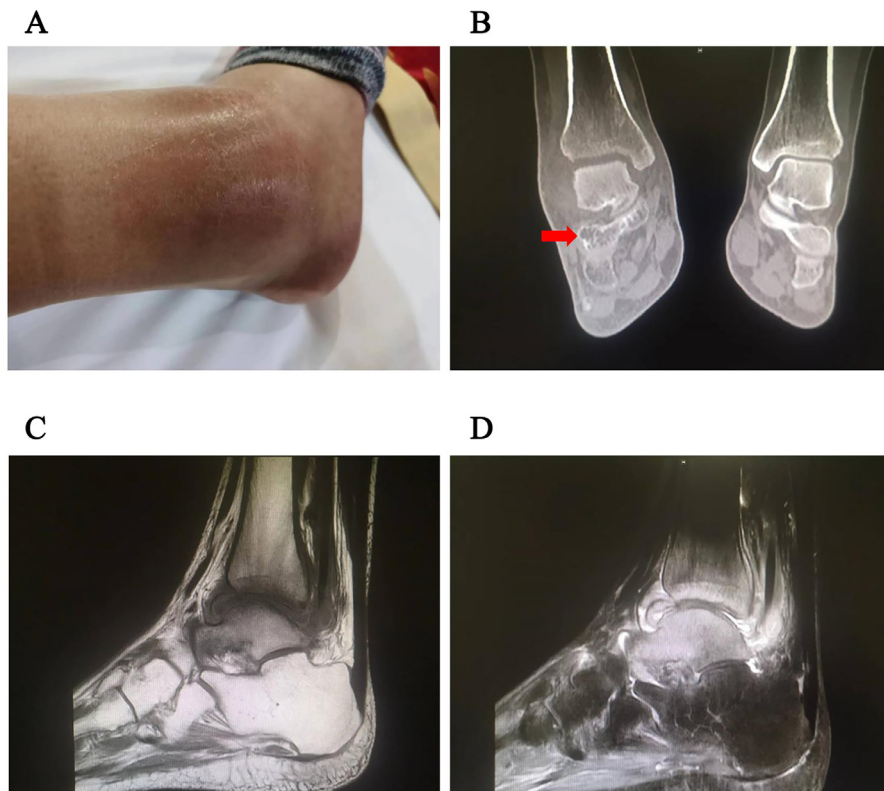


Fig. 1. A 32-year-old female patient with *Mycobacterium tuberculosis* infection of the right ankle joint. (A) Swelling and pigmentation of the right ankle joint. (B) Computed tomography (CT) of the right ankle joint: reduced bone density below the articular surface (red arrowhead) and swelling of the joint capsule and soft tissue. (C) Sagittal magnetic resonance imaging (MRI) T1-weighted image. (D) Sagittal MRI T2-weighted image with fat suppression demonstrates diffuse bone marrow edema in the tibia, fibula, and talus, accompanied by thickened and swollen synovium.

Computed tomography (CT) and magnetic resonance imaging (MRI) of the joint showed in Fig. 1B, C and D.

Finally, the patient was diagnosed with *Mycobacterium tuberculosis* infection through right ankle joint puncture. She started receiving anti-tuberculosis treatment (isoniazid, rifapentine, pyrazinamide, amikacin, and levofloxacin), after which the joint swelling and pain were markedly relieved.

4. Observation 2

A 40-year-old female patient without a past history was initially admitted for pain and dysfunction of the right hip joint. In daily life, the patient needed to use crutches when walking and, during the course of the disease, experienced erythema nodosum in the lower limbs.

On examination, the right hip joint was found to have limited internal rotation, external extension, and flexion. The muscles in the right gluteal area were atrophied. The muscle strength of the right lower limb was at level 4.

MRI of the hip joints showed in Fig. 2A and B.

The pathology of the synovial tissue in the right hip joint showed chronic synovial inflammation, focal necrosis, multinucleated giant cell infiltration, and granuloma formation. *Mycobacterium tuberculosis* was detected by mNGS in the synovium of the right hip joint. Anti-tuberculosis treatment (isoniazid, rifampicin, pyrazinamide, and moxifloxacin) was started and the patient is regularly followed up.

5. Observation 3

A 51-year-old female patient with a past history of rheumatoid arthritis sought care for fever and aggravated swelling and pain in multiple joints. In the past 12 years, she has received long-term therapy with glucocorticoids, immunosuppressive drugs, and a TNF- α inhibitor, with a history of repeated knee joint cavity injection of medication. The patient often experienced fever in the afternoon, with a maximum temperature of 38.4°C, as well as night sweats, fatigue, poor appetite, and weight loss.

On examination, a tough mass of approximately 3 cm \times 3 cm was observed around the left elbow joint. Her right hip joint was tender and had limited mobility. There was a mass accompanied by positive wave motion on the outer side of the right hip joint. The right knee joint was swollen and tender. Further, there was a palpable 5 cm \times 4 cm mass at the right popliteal fossa with positive wave motion.

CT of the right knee joint showed in Fig. 3A and B, and MRI of the hip joints showed in Fig. 3C and D.

In the end, the diagnosis of *Mycobacterium tuberculosis* infection of the left elbow, right shoulder, and right hip joint was sufficiently definite. The diagnosis of tuberculous arthritis of the right knee joint was based on clinical symptoms and imaging results. Anti-tuberculosis treatment (isoniazid, pyrazinamide, ethambutol, linezolid, and levofloxacin) was started and the patient is regularly followed up.

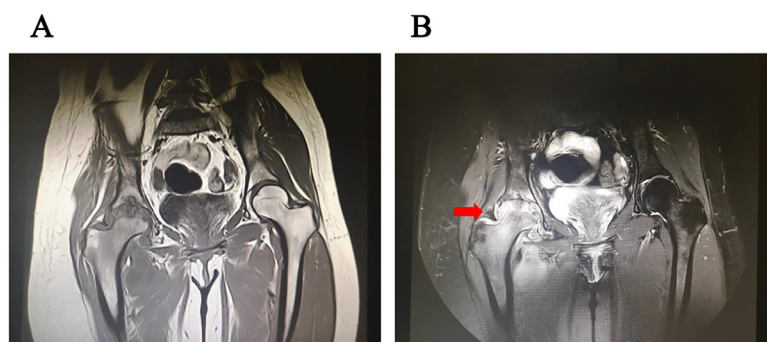


Fig. 2. A 40-year-old female patient with right hip joint *Mycobacterium tuberculosis* infection. (A) Coronal MRI T1-weighted image. (B) Coronal MRI T2-weighted image with fat suppression demonstrates abnormal morphology of the femoral head, multiple areas of bone marrow edema, synovial swelling, and fluid accumulation, accompanied by atrophy of the surrounding soft tissue (red arrowhead).

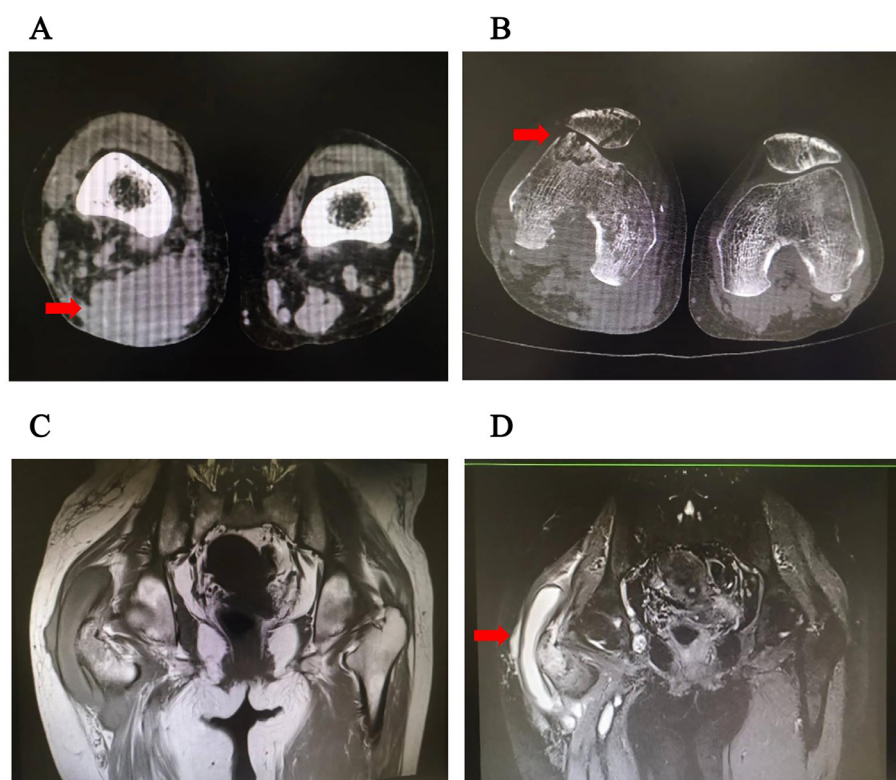


Fig. 3. A 51-year-old female patient with right knee joint and right hip joint *Mycobacterium tuberculosis* infection. (A) Axial CT soft tissue window image shows a popliteal abscess involving the skin (red arrowhead). (B) Axial CT bone window image shows destruction of the bone in the patella, lower femur, and upper tibia (red arrowhead). (C) Coronal MRI T1-weighted image. (D) Coronal MRI T2-weighted image with fat suppression demonstrates bone marrow edema of the femoral trochanter and ischial tuberosity, and surrounding soft tissue inflammation and abscess formation (red arrowhead).

6. Discussion

Tuberculous arthritis usually involves a single joint; however, in approximately 10% of patients, it may involve multiple joints [3,4]. The most commonly affected joints are hip and knee joints, followed by sacroiliac joint, shoulder, elbow, and ankle joint [5]. Only about 30% of cases experience systemic symptoms such as fever and weight loss [6]. The hip joint is the most commonly affected joint, but tuberculous arthritis of this joint is difficult to diagnose and has the greatest impact on the patient's daily activity [7]. During the course of the disease, the second case of hip joint involvement lasted for a maximum of 60 months, confirming that the diagnosis of hip joint tuberculosis infection was the most difficult.

MRI is very sensitive for tuberculous arthritis, but it is not specific. The MRI features of tuberculous arthritis include bone marrow edema, cortical erosion, synovitis, joint effusion, tendon synovitis, soft tissue involvement,

and myositis [4,8]. All three patients underwent joint MRI, which showed synovitis, joint effusion, and bone marrow edema. In the third case, the soft tissue around the right hip joint was involved and a local abscess had formed. This suggests that when the imaging manifestations of synovitis, bone marrow edema, and obvious bone erosion are observed, and the inflammation extends beyond the anatomical boundary to affect the surrounding soft tissues and muscles, it is necessary to consider the possibility of tuberculous arthritis.

The diagnosis is usually confirmed by biopsy of granuloma tissue. Sixty-four percent to ninety percent of patients can be identified with a positive histological result. Therefore, biopsy is crucial for diagnosing tuberculous arthritis [9,10]. In this case series, synovial biopsy was performed in all three patients. Pathological examination confirmed necrotizing granuloma inflammation, which supported the diagnosis of tuberculous arthritis.

The sensitivity and specificity of mNGS for the diagnosis of infectious diseases were 50.7% and 85.7%,

respectively, which was superior to the traditional culture method with obvious advantages for the diagnosis of tuberculosis, fungi, and viruses [11,12]. Through mNGS, *Mycobacterium tuberculosis* was detected in the joint fluid/synovial tissue of all three patients, providing a pathogenic basis for the diagnosis of tuberculous arthritis.

The diagnosis of tuberculous arthritis is difficult. However, physicians must comprehensively search for non-specific systemic manifestations (fever, emaciation, and erythema nodosum) based on the characteristics of arthritis. Imaging features by CT and MRI—like synovitis, osteomyelitis, or even inflammation involving surrounding soft tissues and muscles across anatomical boundaries—can facilitate the diagnosis. It is crucial to perform pathological examination of the synovium. mNGS of the synovial membrane or synovial fluid can improve the detection rate of *Mycobacterium tuberculosis*.

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Author contributions

G.L. and Z.Z. were the major contributors in writing the manuscript and performing the literature review. Z.Z. provided critical revision of the manuscript. J.S.Y. and Q.Q.Z. were responsible for data collection, and analysis and interpretation of the data. J.Z. and J.L.Z. provided administrative support and supervision. All the authors have read and agreed to the published version of the manuscript.

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Declaration of competing interest

The authors declare no conflicts of interest.

Data available statement

Data available on request due to privacy restrictions. The data presented in this case study are available on request from the corresponding author.

Ethics statement

Not applicable.

Informed consent

Not applicable.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.imj.2024.100107](https://doi.org/10.1016/j.imj.2024.100107).

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