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Case Report

Unusual presentation of *Mycobacterium Tuberculosis* Prosthetic Joint Infection (TBPJI) after Total Knee Arthroplasty (TKA) -A case report

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Abstract

Background: *Mycobacterium tuberculosis* infrequently causes Prosthetic Joint Infections (PJI). A rare infection, skeletal tuberculosis accounts for about 2% of cases of tuberculosis overall.
Aims: We report a case of tubercular prosthetic joint infection one year after Total Knee Arthroplasty (TKA), with no previous history of Tuberculosis (TB).
Methods: One year following a total knee replacement for osteoarthritis of right knee, a 51-years-old female patient complained of pain and swelling in the knee. On examination, her knee showed signs of swelling, warmth, and erythema. The initial blood investigations were abnormal (raised CRP and ESR). Mycobacterium tuberculosis infection was diagnosed by a subsequent culture and histological analysis of the synovial tissue. Debridement was done and Anti-Tubercular Therapy (ATT) started. The patient demonstrated a significant improvement in signs, symptoms, and functional outcomes and recovered uneventfully.
Results: High suspicion of prosthetic tubercular infection and timely intervention allowed the patient early and eventless recovery and could save the prosthesis and knee function.
Conclusion: Tubercular infection after total knee arthroplasty is a rare entity. A good clinical and functional outcome can be achieved by proper management, including ATT and, if necessary, surgical intervention. The detection of tuberculosis of the knee might be complicated particularly in patients without obvious pulmonary tuberculosis and discharging sinuses.
Keywords: Total Knee Arthroplasty (TKA); Tubercular Prosthetic Joint Infection (TBPJI); Anti-Tubercular Therapy (ATT); Debridement

INTRODUCTION

Of all cases of tuberculosis worldwide, 27% are in India [1]. The third most prevalent kind of extrapulmonary tuberculosis is bone and joint tuberculosis (incidence rate 10–15%) [2]. Knee joint tuberculosis is less common than other forms of bone and joint tuberculosis and it is more common in developing nations [3]. 0.97% for Total Hip Arthroplasty (THA) and 1.03% for Total Knee Arthroplasty (TKA) is the overall incidence of PJI based on data from multiple national studies [4]. It is extremely uncommon for PJI caused by mycobacterium tuberculosis to occur in people who have never had pulmonary or extra-pulmonary TB. The diagnosis of tubercular prosthesis infection usually takes longer since the early symptoms are identical to those of classical prosthesis infection. The primary source of TBPJI is local reactivation [5]. Regarding tubercular PJI, most cases happen in the first two years following surgery, and about 25% happen two years after the initial procedure [6].

CASE REPORT

A 51-years-old woman complained of continuing pain in her knee (right > left). Over the course of several years, her pain became worse, limiting her ability to walk and perform daily activities. Degenerative changes have been observed on radiographs in both knees. Bilateral osteoarthritis was determined to be the initial diagnosis (Figure 1).

There was no history of inflammatory rheumatologic illnesses, prior tuberculosis, direct tubercular contact exposure, or constitutional symptoms that could point to an occult infection. The immunocompromised state was absent, and subsequent HIV tests resulted in non-reactivity.

Hemoglobin (Hb) of 11 g/dl, Total Leucocyte Count (TLC) of 12100 cells/mm3, CRP of 8 mg/l, and an Erythrocyte Sedimentation Rate (ESR) of 28 mm/hour were all part of the pre-operative workup. Microscopy and urine culture were clear. The increased CRP and ESR did not have an identifiable cause, and the rheumatologic screen was normal.

In September 2021, a right-side cemented TKA was carried out, and intraoperative observations also supported the diagnosis of primary osteoarthritis (Figure 2).

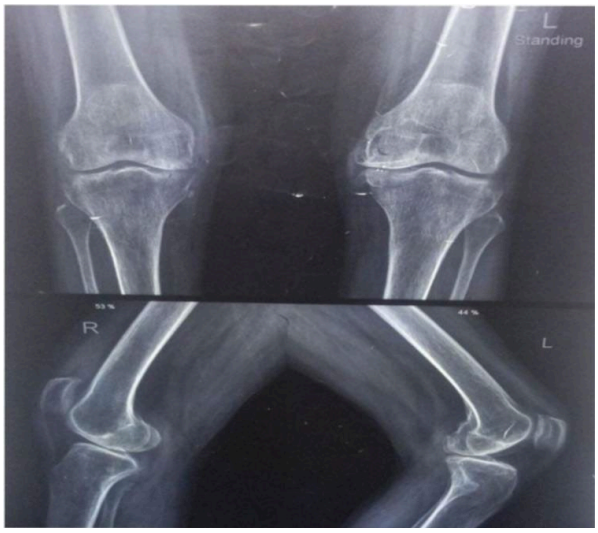

Fig 1. Pre -operative x-ray AP and lateral view of both knees

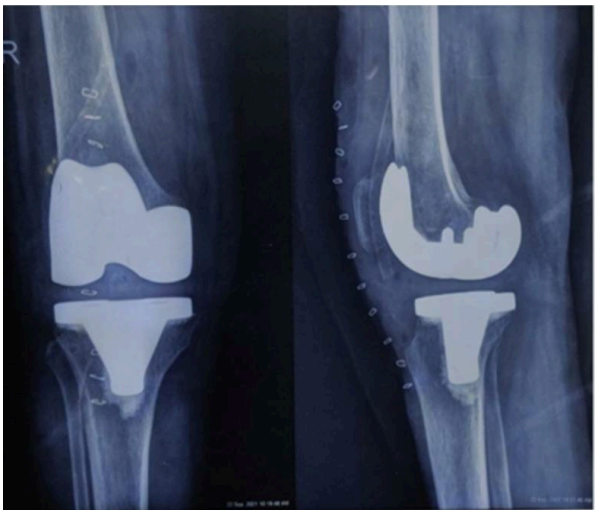

Fig 2. Post-operative x-ray of right knee, AP and lateral views

Post-operative recovery was uneventful, and at the 4-weeks follow-up she was able to perform most of the activities of daily living and she had active motion of her right knee with no pain and swelling.

In December 2022, she presented with painful swelling around the right knee and erythema on the lateral side of the knee. Her Hemoglobin was 10.2 g/dl, total leucocytes count 9300 cells/mm3, ESR of 36 mm/hour, and a CRP of 57 mg/l. She was admitted and knee aspiration was done and fluid was sent for culture sensitivity, Gram stain, and Cartridge Based Nucleic Acid Amplification Test (CBNAAT). Her illness worsened over the course of time, and she developed an abscess on the lateral side of her knee that eventually turned into a discharging sinus (Figure 3). Radiological assessment was also done (Figure 4).

Fig 3. Clinical images of right knee presented with tubercular prosthetic joint infection

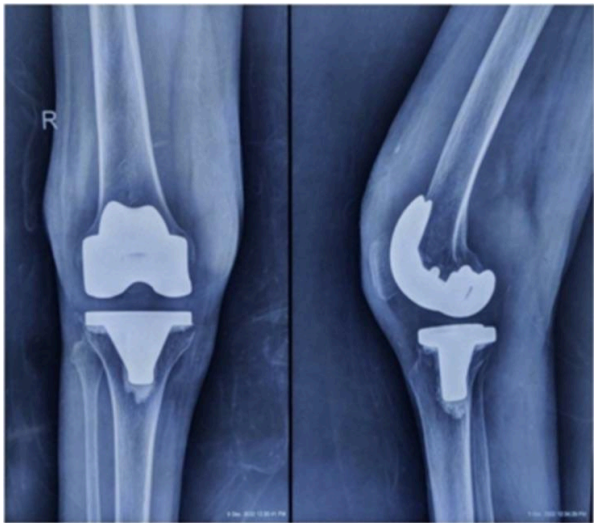

Fig 4. X-ray of right knee, AP and lateral views

Knee aspirate was negative for Gram stain and aerobic as well as anaerobic bacterial culture but the CBNAAT test detected Mycobacterium tuberculosis. Thereafter Anti-Tubercular therapy was started but no improvement was seen. So patient was taken up for surgical intervention and debridement was done. Intra-operative rice bodies were present. Post-operative Anti-Tubercular Therapy (ATT) was continued for 12 months, including (Isoniazid, Pyrazinamide, Rifampicin, and Ethambutol) once daily for two months during the intensive phase, then continuous phase for ten months utilizing isoniazid and rifampicin. It showed marked improvement in signs, symptoms, and functional outcomes of patients and good preservation of implant position on x-rays after 15 months of follow-up (Figures 5 and 6).

Fig 5. Clinical images of right knee after 15 months of follow up.

DISCUSSION

In our case, a 51-years-old female patient had an unusual presentation of extrapulmonary Mycobacterium TB, that was overlooked during early examinations. We may now investigate the orthopedic implant's behavior on a joint that is actively infected and undergoing therapy for TB due to the post-operative incidental diagnosis following TKA. Since TB of the bones and joints is rare, it is rarely considered during the first appointment. Furthermore, the majority of patients with joint tuberculosis do not experience systemic symptoms like fever, sweats at night, or weight loss. Instead, their clinical presentations are frequently atypical. In addition, like osteoarthritis, tuberculosis of the knee joint primarily manifests as knee joint pain, swelling and reduced joint mobility [7].

Wolfgang et al. reported the first case of TBPJI following TKA in 1978 [8]. Till date, there have been 48 case reports of TBPJI following TKA that do not have a history of extrapulmonary or pulmonary tuberculosis (Table 1) [5, 7].

The source of postoperative TB infection can be determined to be either of 2 factors: patient factors or surgical factors [9]. The primary patient factors include comorbidities that cause a state of immunosuppression, like old age, obesity, diabetes, autoimmune illnesses, severe burns, long-term steroid therapy, immunomodulatory drugs, or retroviral diseases (HIV). The act of surgery itself may trigger an inflammatory reaction that impairs the immune system's capacity to resist infection and may revive an inactive or latent tuberculosis infection.

Three potential causes of post-operative knee joint tubercular infection have been identified: (1) haematogenous spread

from a focus elsewhere; (2) active but undetected tubercular arthritis present at the time of surgery; or (3) most frequently, reactivation of latent tubercular arthritis following arthroplasty [9]. For decades, Mycobacterium TB can persist in granulomas and be unnoticed for a whole lifetime without exhibiting any clinical symptoms. According to certain research, surgical trauma promotes the colonization of Mycobacterium tuberculosis in granulomas, and the organisms can move hematogenously from granulomas to distant locations [10].

Fig 6. X-rays right knee AP and lateral views after 15 months follow up.

Due to the unusual clinical appearance of TBPJI, diagnosis is challenging in almost all instances [11]. The specificity of laboratory testing utilizing plasma for TBPJI is extremely low [12]. The present gold standard test for TBPJI diagnosis consists of a histopathological examination and an investigation of joint fluid or synovial tissue for acid-fast bacilli culture [13, 14]. Despite the fact that using CBNAAT/PCR testing, when available, allows for early detection of Mycobacterium tuberculosis [15].

Traditionally, debridement, arthrodesis, and resection arthroplasty have been the preferred treatments for active tuberculosis in joints. But appropriate anti-TB treatment (ATT) employing regimens for extra-pulmonary infections is also recommended [16]. The research states that debridement with implant retention is utilized for patients with significant pain, swelling and a stable prosthesis. Some studies also suggest that the treatment with antitubercular medications (ATT) alone had a good success rate. According to recent research, if the prosthesis is not loose, it may still be preserved even if a sinus forms [7, 17, 18].

The duration of therapy is up for debate, with a minimum of 8 to 10 months. Although the average duration of treatment is 15 months, there is a clear trend towards shorter treatment durations. Two-stage revision is advised in the situation of a subsequent bacterial infection or prosthesis loosening. Cement spacer implantation treated with antibiotics may contribute to the preservation of the soft tissue envelope [17].

Table 1. Literature review of periprosthetic TB infection without previous history of TB

Author and Year	Time from TKA to Infection	Medication & Duration In (Months)	Treatment/Surgery	Follow-up
Zeiger et al. 1984	4 Years	NS	Resection Arthroplasty	NR
Wolfgang 1985	1 Year	H, R (24)	Reinsertion12 Months	1 year
Bryan et al. 1990	8 years	H, R, E (24)	Arthrodesis	3 years
Lusk et al. 1995	15 years	H, E, Z (6)	Resection Arthroplasty	6 months
Al-Shaikh et al. 1995	8 months	H, R, Z (12), E (9)	Arthrodesis	1 year
Tokumoto et al. 1995	1.7 Years	H, E (18)	Debridement	8 Years
Lusk et al. 1995	15 Years	H, E, P (6)	Resection Arthroplasty	6 Months
Spinner et al.1996	6 Years	H, E, P (9)	Debridement	2.5 Years

Marmor et al. 2004	4 Months	H, E, P (8)	Debridement	18 Months
Marmor et al. 2004	2 Months	H, R, P (6)	Revision Arthroplasty	5 Years
Marmor et al. 2004	3 Months	H, R, P (6)	Revision Arthroplasty	7 Years
Wang et al. 2007	3 years	H, R, Z, E	Debridement	Died
Khater et al. 2007	3 Months	H, E (18), R, P (NS)	Resection Arthroplasty	1.5 years
de Haan 2008	3 months	H, R, Z, E (9)	Debridement	36 months
Marschall 2008	6 months	H, A, E (1), MOX (0.5), R (0.5)	None	Died during therapy
Lee et al. 2009	2 months	H, R, Z, E (6)	Debridement	13 months
Neogi et al. 2009	14 years	H, R (18), Z (7), E (4)	None	36 months
Uppal 2010	1 month	H, R, Z, E (18)	Debridement	NR
Klein 2012	11 months	H, R, Z, E (19), MOX, AMK (19)	Staged revision	36 months
Tekin Koruk et al. 2013	15 days	H, R (12), Z, E (2)	None	18 months
Harwin et al. 2013	7 months	H, R (21), Z, E (12)	Staged revision	24 months
Egües Dubuc et al. 2014	NR	H, R, Z	None	NR
von Keudell et al. 2016	5 months	H, R, Z, E (12), H, R	Staged revision	924 months
Elzein 2017	14 months	H, R (24), Z (2), H, R (10)	Staged revision	NR
Kandnari et al. 2017	3 years	H, R, Z, E (10)	None	NR
Veloci et al. 2018	postoperatively	H, R (18), Z (2)	None	19 months
Chang CH et al. 2018	4 months	H, R, Z, E (8), H, R (4)	Staged revision	917 months
Chang et al. 2018	8 months	H, R, Z E (14)	Staged revision	27 months
Al Soub et al. 2019	6 months	E, Z (13), Mox (13)	Staged revision	20 months
Uhel et al. 2019	3 years	H, R (16) Z, E (2)	None	NR
Barry et al. 2019	4 years	H, R, Z, E (2), H, R (10)	None	12 months
Du Hang 2020	1 month	H, R, Z, E (12)	none	24.75 months
This case	1 year	H, R, Z E, (2), HR (10)	Debridement	15 Months

NS: Not supplied, H: Isoniazid, R: Rifampicin, E: Ethambutol, Z: Pyrazinamide, STM: Streptomycin, NR: Not Recorded, Mox: Moxifloxacin, AMK: amikacin,

CONCLUSION

In the absence of a prior tuberculosis history, Prosthetic Joint Infection (PJI) is uncommon and hence, the diagnosis is usually difficult. Synovial specimens, culture as well as histology, and CBNAAT /PCR are the most beneficial diagnostic tools. If diagnosis is made early and treatment is started, it may preserve prosthesis and avoid revision surgery. Generaly immunocompromised patients should be at a higher risk of post-operative tubercular infection. ATT should be started as early as possible for better outcomes of the patient. In order to treat PJI caused by TB, a medical and, if necessary, surgical method must be used.

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