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Robot-Assisted Total Knee Arthroplasty After Treated Osteoarticular Tuberculosis With a Medial Tibial Bone Defect: A Case Report and Surgical Insights

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Abstract

Osteoarticular tuberculosis of the knee is uncommon but may lead to progressive articular destruction, cavitary bone loss, and disabling postinfectious arthritis. Total knee arthroplasty (TKA) has been described as a reconstructive option in selected patients after treated or inactive tuberculosis, although timing, infection control, bone-defect management, and the need for postoperative antituberculous therapy remain clinically relevant concerns.[1-6] We present the case of a 55-year-old woman with previously treated osteoarticular tuberculosis of the left knee, residual medial tibial bone loss, and severe functional limitation who underwent imageless robot-assisted cemented TKA using the CORI system. The medial tibial cavitary defect was managed with autologous bone graft mixed with antibiotic-loaded cement. At the most recent clinic follow-up in May 2026, she was doing well, ambulated without an assistive device, had VAS pain of 0 mm, and demonstrated improvement in range of motion from 5-100 degrees preoperatively to 0-124 degrees postoperatively. Postoperative WOMAC subscale scores were pain 6, stiffness 4, and function 26; WHODAS was 46. No clinical evidence of tuberculosis reactivation or prosthetic compromise was identified. This case illustrates the feasibility of robot-assisted TKA as a technical adjunct in a carefully selected post-tuberculous knee with contained tibial bone loss, while emphasizing the need for cautious interpretation because this is a single case with limited standardized preoperative PROM data.

Keywords: robotic assistance, TKA, CORI, tuberculosis, bone defect, surgical technique .

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Introduction

Osteoarticular tuberculosis accounts for a small proportion of extrapulmonary tuberculosis, and the knee is among the more frequent peripheral joints involved after the spine and hip.[1,2] The disease is often chronic and insidious, which can delay diagnosis and allow progressive cartilage destruction, subchondral bone involvement, deformity, stiffness, and cavitary defects.[1,2] Even after successful antimicrobial treatment, residual mechanical sequelae may persist and ultimately require reconstructive surgery.

TKA in the setting of previous tuberculous arthritis remains uncommon and technically demanding. Published case reports and series suggest that arthroplasty can improve pain and function in selected patients, but recurrence risk, infection workup, timing of surgery, bone loss, and postoperative, antimicrobial strategy must be carefully considered.[3-8] Some authors recommend arthroplasty after clinical and biological quiescence, whereas others have reported one-stage TKA even in active tuberculosis when combined with thorough debridement and antituberculous therapy.[4,6,7] Robotic assistance may offer advantages in complex arthroplasty by supporting controlled bone resection, intraoperative planning, and gap assessment, although its specific value in post-tuberculous knees remains insufficiently studied.

The purpose of this report is to describe a robot-assisted TKA in a patient with previously treated osteoarticular tuberculosis, a contained medial tibial bone defect, and severe preoperative disability, with emphasis on

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operative strategy, postoperative outcome, and limitations relevant to future reporting.

Case Presentation

A 55-year-old woman from Mexico presented with chronic left knee pain and progressive functional limitation. She had a history of osteoarticular tuberculosis of the left knee diagnosed in 2014 and treated with a complete antituberculous regimen consisting of isoniazid, rifampin, pyrazinamide, and ethambutol. She also had controlled dermatomyositis. She was evaluated by the Infectious Diseases department, which documented clinical cure and absence of active infection before arthroplasty.

Preoperatively, the patient described severe pain and substantially worse function than at her latest postoperative visit. On examination, the knee was stable and showed no local inflammatory signs. Range of motion was limited by an approximately 5-degree flexion contracture and flexion to 100 degrees. A previous medial biopsy scar was present. Standardized preoperative PROM values were not comprehensively recorded, but the clinical history documented marked pain, walking limitation, and progressive disability.

Preoperative imaging demonstrated advanced degenerative changes and a cavitary defect involving the medial tibial plateau/metaphyseal region. Preoperative templating showed AMA 5.1 degrees, mLDFA 85.8 degrees, mMPTA 88.8 degrees, aLDFA 80.7 degrees, aMPFA 74.6 degrees, JLCA 3.5 degrees, and an approximate MAD of 2 mm, with a nearly neutral mechanical axis. The defect was interpreted as a contained medial tibial cavitary defect with preserved peripheral cortical support; based on the available description, it was most consistent with an AORI type 1 to 2A defect. Exact volumetric dimensions were not available and are therefore acknowledged as a limitation.

Surgical Technique

A left cemented TKA was performed using an imageless robot-assisted workflow with the CORI robotic-assisted system (Smith & Nephew, Memphis, TN, USA). The robotic workflow began with intraoperative acquisition of femoral and tibial anatomical landmarks, followed by registration of the knee and assessment of the patient-specific anatomy. Planning focused on controlled femoral and tibial resections, restoration of alignment, implant positioning, and soft-tissue balance while preserving remaining tibial bone stock.

The robotic system was used to guide femoral and tibial bone cuts according to the intraoperative plan. Gap assessment in flexion and extension was used to optimize ligament balance and avoid unnecessary bone resection in the presence of medial tibial bone loss. The final reconstruction used a cemented Anthem system (Smith & Nephew), with a size 5 femoral component, size 3 tibial component, and 9-mm polyethylene insert. The contained medial tibial cavitary defect was treated with autologous bone graft mixed with antibiotic-loaded cement. Due to poor patellar bone quality, patellar resurfacing was not performed; circumferential patellar denervation was performed instead. Intraoperative samples were obtained to evaluate for infection or reactivation.

Postoperative Course

The early postoperative course was initially favorable. During follow-up, the patient developed superficial wound dehiscence without initial evidence of deep infection. She was subsequently diagnosed with a soft-tissue infection caused by Clostridium perfringens. This was managed by Infectious Diseases with directed antibiotic therapy, initially with levofloxacin and later with linezolid, as well as wound care. The wound healed progressively, and later controls documented complete closure without fistula, drainage, or signs of active infection.

The postoperative infectious complication was interpreted as a bacterial soft-tissue process rather than tuberculous reactivation. At the latest follow-up, there was no clinical evidence of tuberculosis

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recurrence or deep periprosthetic infection. The patient remained under close clinical surveillance because of her history of tuberculosis and postoperative wound complication.

Follow-up and Results

The patient was evaluated in clinic during the week prior to this revision in May 2026 and was doing well compared with her preoperative status. She reported major improvement in pain and global function. She ambulated without an assistive device, with only a mild and barely perceptible left-sided limp. She reported no knee pain at rest, with VAS pain of 0 mm.

On physical examination, the anterior left knee scar was slightly hypertrophic and adherent, with mild residual edema but no drainage, fistula, or inflammatory changes. Range of motion improved from 5-100 degrees preoperatively to 0-124 degrees postoperatively. The clinical note documented adequate gait phases and no relevant difficulty with gait variation. Strength testing showed psoas 3+/4+, quadriceps 5/3+, hamstrings 5/5, and tibialis anterior 5/5.

Measure	Preoperative status	Latest postoperative follow-up
Pain	Severe chronic pain reported clinically; no formal preoperative VAS recorded	VAS 0 mm
Range of motion	5-100 degrees	0-124 degrees
WOMAC	Not formally recorded preoperatively; patient reported substantially worse pain and function	Pain 6, stiffness 4, function 26
WHODAS	Not formally recorded preoperatively	46
Ambulation	Functionally limited by pain and stiffness	Independent gait without assistive device; mild left limp

Patient-Reported Outcome Measures

Postoperative radiographs demonstrated satisfactory component position and alignment, without evident prosthetic loosening, progressive radiolucent lines, tibial depression, or collapse of the cement-graft construct. No radiographic finding suggested failure of the medial tibial reconstruction at the time of latest follow-up.

Discussion

TKA after previous osteoarticular tuberculosis is uncommon and requires careful assessment of infection status, bone stock, deformity, and soft-tissue condition. The literature supports the possibility of good functional improvement after TKA in selected patients with healed or inactive tuberculous arthritis, but recurrence and reinfection remain important concerns.[3-8] In the present case, the patient had treated tuberculosis with clinical confirmation of inactivity before surgery, a contained medial tibial defect, and disabling postinfectious degenerative arthritis.

The timing of arthroplasty after tuberculous arthritis is not universally standardized. A cautious approach generally includes completion of antituberculous treatment, absence of sinus or local inflammatory signs, multidisciplinary evaluation, and assessment of inflammatory markers when available.[3-8] However, the literature is not absolute: some reports describe TKA in active or recently treated disease

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when aggressive debridement and antituberculous therapy are used.[4,6,7] Therefore, rather than presenting infection quiescence as a universal rule, this case supports careful individualized decision-making.

The medial tibial cavitary defect was managed with autologous bone graft combined with antibiotic-loaded cement. In primary TKA, contained metaphyseal defects may be treated with cement, bone graft, metal augmentation, or stems depending on size, containment, cortical support, and expected load transfer.[9-11] In this patient, preserved cortical containment allowed reconstruction without stems or additional metal augmentation. This decision was also influenced by the goal of preserving bone stock and avoiding unnecessary implant constraint.

Robotic assistance was relevant in this case because previous infection had altered the proximal tibial bone stock and made conservative resection important. The imageless robotic workflow allowed intraoperative registration, planning, gap assessment, and guided bone cuts. This helped prioritize controlled tibial resection and component positioning while avoiding excessive medial bone removal. Nevertheless, this report cannot prove that robotics improved the outcome. Robotic systems may increase cost, operative time, and technical complexity, and their added value in post-tuberculous TKA requires further study.

The role of postoperative antituberculous therapy after arthroplasty in previously treated inactive disease remains controversial. Some reports include postoperative antituberculous therapy, particularly when disease is active or incidentally diagnosed, whereas other cases of clinically cured disease may be managed without restarting therapy.[4-8,12] For this reason, the decision should be individualized in coordination with Infectious Diseases rather than presented as a fixed recommendation.

The postoperative soft-tissue infection in this patient was caused by Clostridium perfringens and resolved with directed antibiotic therapy and wound care. Importantly, this complication was not interpreted as tuberculous reactivation, and the patient ultimately demonstrated wound healing, independent ambulation, pain relief, and improved range of motion.

Limitations

This report has several limitations. First, it describes a single patient and therefore cannot establish safety, efficacy, or superiority of robot-assisted TKA in post-tuberculous knees. Second, follow-up remains limited, and longer surveillance is required to evaluate implant durability, graft-cement stability, late loosening, and possible infectious recurrence. Third, standardized preoperative PROMs were not fully collected. Although the patient was clinically much worse before surgery and improved substantially after surgery, only postoperative WOMAC and WHODAS values were available for objective reporting. Future cases should include complete preoperative and postoperative PROMs, ideally including WOMAC, KOOS JR, and Forgotten Joint Score-12 (FJS-12), to better quantify pain, function, joint awareness, and patient satisfaction. Finally, exact defect dimensions were not available, limiting reproducibility of the bone-defect classification and reconstruction strategy.

Conclusion

Robot-assisted TKA may be a feasible reconstructive option in carefully selected patients with previously treated osteoarticular tuberculosis and residual contained tibial bone loss. In this patient, the procedure was associated with marked pain relief, improved range of motion, independent ambulation, and no clinical evidence of tuberculosis reactivation at latest follow-up. Because this is a single case with limited standardized preoperative PROM data and short follow-up, conclusions should be limited to technical feasibility rather than general claims of safety or effectiveness. Larger studies with longer follow-up and complete PROM collection are needed.

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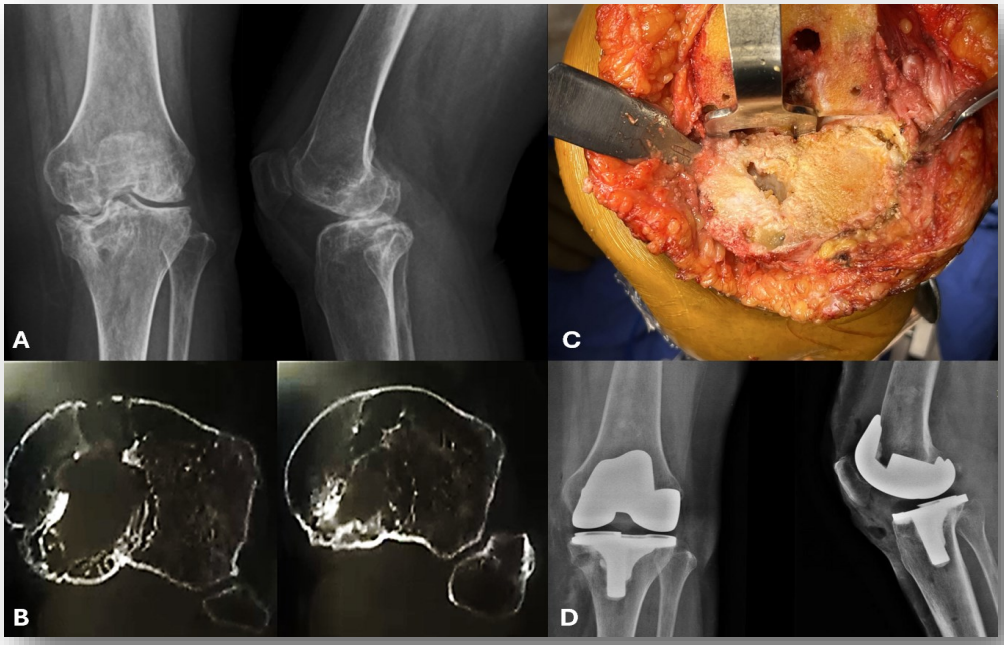


Figure 1. Preoperative, Intraoperative, and Postoperative Evaluation of a Tuberculous Medial Tibial Defect. (1A) Preoperative radiographs of the left knee showing a pronounced bone defect in the medial tibial plateau and hypoplasia of the medial femoral condyle. (1B) Preoperative CT scan demonstrates a post-tuberculous proximal tibial defect with cortical irregularity and metaphyseal bone loss. (1C) Intraoperative image revealing a cavitary defect in the medial tibial plateau consistent with sequelae of bone tuberculosis. (1D) Postoperative radiographs showing cemented components in appropriate mechanical alignment with satisfactory reconstruction of the medial tibial plateau.

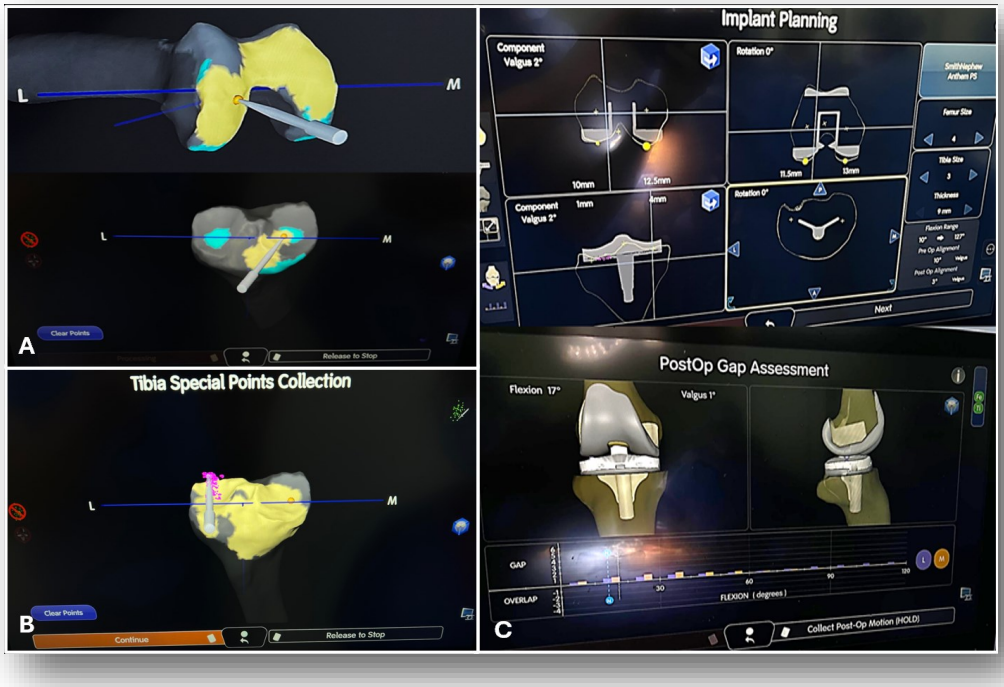


Figure 2. Robotic-Assisted Registration, Defect Mapping, and Prosthetic Planning in Total Knee Arthroplasty. Femoral and tibial anatomical registration using the CORI® robotic-assisted system provides three-dimensional reconstruction and surface mapping to accurately identify reference points, quantify medial tibial bone loss, and plan precise resection planes (A). The platform also enables detailed marking of the tibial cavitary defect through "Special Points," integrating the defect into a customized surgical plan that favors conservative and anatomically guided bone resections (B). Robotic-assisted prosthetic planning and final intraoperative evaluation were then performed, allowing adjustment of component size and orientation according to ligament balance and bone preservation, with dynamic gap assessment confirming symmetric and stable alignment after implantation (C).

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Ethical Considerations

Informed consent was obtained from the patient for publication of the clinical information and associated imaging. Identifying information was removed to protect patient confidentiality. According to institutional policy, isolated case reports do not require formal ethics committee approval.

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