



Case Report

Knee Rheumatoid Arthritis With Lateral Tibial Plateau and Tibial Stress Fractures Managed With One-Stage Knee Joint Replacement

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ABSTRACT

Rheumatoid arthritis (RA) is a chronic systemic disease that causes progressive joint damage, bony defects, and ligament imbalance. These sequelae of RA present major difficulties to surgeons during hip or knee arthroplasty. The presence of coexistent periarticular fractures adds to these difficulties and represents a surgical dilemma. No guidance exists within the literature for the medical and surgical management of complicated cases of RA with coexistent fractures. So far, the evidence has focused on fixation techniques, arthroplasty, and conservative management for periarticular fractures of osteoarthritic joints without significant degeneration of anatomical structures. We report a case of advanced knee RA with associated ipsilateral tibial plateau fracture and a tibial shaft stress fracture that was treated successfully with a single-stage joint replacement procedure. The case study presents a well-planned, single-stage arthroplasty with a lateral parapatellar approach as a management option that allows for early weight-bearing and restoration of function and provides a detailed guide for surgeons when managing similar cases.

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Introduction

Rheumatoid arthritis (RA) is a chronic systemic inflammatory disease that primarily affects the small joints of the body. Although it can affect many systems in the body, its main symptoms are related to synovitis and cartilage destruction of joints [1]. The pathogenesis of this disease is connected to 2 main processes that go hand in hand: the formation of antibodies and then inflammation. Antibodies are thought to appear in the blood 3 to 5 years before RA becomes symptomatic, attacking many citrullinated peptides and proteins. The ongoing pathophysiological process is sustained by elevated antibodies (RF and Anti-CCP) and inflammatory markers, for example, C-reactive protein in the bloodstream [1,2]. The effect of this inflammatory process of RA is joint damage. However, the evolution of medical treatment, for example, anti-tumor necrosis factor and disease-modified antirheumatic drugs has reduced the need for joint replacement [3–5]. Joint

replacement is the standard recommendation for managing pain caused by joint damage and deformity unresponsive to conservative treatment [6]. Patients with RA who undergo arthroplasty have a higher rate of postoperative complications and intraoperative challenges including bone defects, ligament imbalance, and synovitis [7].

Stress fractures are fatigue injuries sustained because of repeated cyclic loads on the bone [8]. The incidence of stress fractures is also higher in joints deformed because of osteoarthritis and RA. A two-staged procedure to manage this type of fracture may increase the rate of postoperative infection, poor functional outcomes, and pain scores [8,9]. 25% to 45% of patients who sustain a fracture of the tibial plateau develop post-traumatic arthritis [10]. Post-traumatic arthritis has also been linked to worse outcomes after total knee arthroplasty. However, the acute management of tibial plateau fractures with arthroplasty can limit complications of two-stage surgeries, especially among the elderly [11]. Currently, there are no clear guidelines within the literature for the management of RA patients with a lateral tibial plateau fracture and an ipsilateral lateral tibial cortex stress fracture.

We report the case of a 65-year-old female patient with left knee RA, nonunited lateral tibial plateau fracture, and ipsilateral stress

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fracture on the lateral tibial cortex. We obtained signed informed consent from the patient before commencing data collection and received approval for publishing our findings.

Case history

A 65-year-old female patient diagnosed with RA at the age of 20 complained of the inability to weight-bear after trauma to her left knee when she slipped and fell in the bathroom 1 month before presenting in the clinic. Before this, the patient sustained a 3-month-old injury when she bumped into her apartment door and fractured her left lateral tibial plateau. The fracture was managed conservatively as the patient refused surgery. Before sustaining these injuries, the patient had a good baseline activity level, knee score of 48, and knee function score of 75 measured using the knee society rating system [12]. The patient also had a 10-year history of right hip pain secondary to RA that progressed with the shortening of her right lower limb and was managed with methotrexate.

On examination, the patient had evidence of RA, which affected all small joints of the hands and feet as well as the right hip and both knees. Local examination showed 4-cm limb length discrepancy with the right lower limb shorter. The proximal part of the left leg was tender to pressure (Fig. 1). We observed a ten-degree left knee flexion deformity to compensate for the shorter length of the right lower limb. The range of motion of the left knee was 10 degrees during extension to 120 degrees during knee flexion. The patient could perform the straight leg-raising test with adequate left lower limb quadriceps power; she had a full range of motion in the right knee and limited abduction range of the right hip with a normal flexion range. The valgus stress test revealed laxity of the medial structures. Plain radiographs showed severe end-stage RA of the right hip and shortening of the proximal femur due to severe erosion of the head and neck of the right femur. A radiograph of the left knee showed advanced RA, a nonunited left lateral tibial plateau-split fracture with marginal sclerosis, an ipsilateral stress fracture on the lateral cortex of the upper one-third of the tibia, and another united fracture of the left fibula (Fig. 2). The patient was prepped for surgery to replace the left knee with constrained knee prosthesis in anticipation of ligamentous laxity. Metal augments were available to fill any bony defects.

The patient received spinal-epidural anesthesia in the lumbar spine. We used a lateral parapatellar approach to facilitate access to both the fracture and knee joint surface; this helps release tight lateral structures in the valgus knee [13]. We performed a mid-line incision and arthrotomy lateral to the quadriceps tendon, patella, and the patellar ligament, respectively, preserving the subpatellar pyramid-shaped fat pad flap to help closure of the wound. The joint was exposed, revealing severe degeneration and split fracture of

the left lateral tibia plateau (Fig. 3). We removed the diseased synovium, carrying out a knee arthroplasty procedure with the femoral cuts first. After that, we made the cuts in the NexGen® Legacy® (Zimmer Biomet, Warsaw, IN) Constrained Condylar Knee box. We performed debridement of the tibial surface. The fracture edges were refreshed using curettage and drilling. We fixed the fracture with a 3.5-mm T-shaped plate and screws after applying the tibial prosthesis trial, so the screws would not hinder the insertion of the actual prosthesis (Fig. 4). Then cementation was performed, and the final prosthesis was inserted (Fig. 5).

On day 1 after surgery, the patient commenced weight-bearing using a walker, quadriceps strengthening, and passive range of motion exercises. Rehabilitation progressed to full weight-bearing on a walker and then use of a cane for walking. After discharge on day 7, self-management continued with home exercises, gait training, and strengthening exercises for 6 months after surgery. The patient was able to achieve 90 degrees of knee flexion after surgery, which continued to improve. One-year postoperative outcome assessed using the knee society rating system [12] showed a left knee score of 75 and a function score 85. Similarly, radiograph results at 1-year follow-up showed union of the fracture and retained knee prosthesis with no loosening (Fig. 5).

Discussion

Our case report shows the benefit of the planned management of a 65-year-old female patient with RA with coexistent lateral tibial plateau fracture and an ipsilateral lateral tibial cortex stress fracture. Total knee arthroplasty is the best treatment for managing patients with advanced knee osteoarthritis and other inflammatory arthritic conditions [2,14]. Removal of the synovium during the total knee arthroplasty of RA helps decrease postoperative pain and decrease the risk of flares. Arthroplasty in patients with RA may have higher complication rates such as earlier readmission within the postoperative 90-day period because of infection and revisions [15]. The presence of multisystem inflammation in RA increases the risk of postoperative complications of infections, revisions, and thromboembolisms. It requires multisystem monitoring, evaluation, and drug modifications for successful management [5,7,16]. Patients with RA undergoing joint replacement also have an increased risk of postoperative flares of generalized pain, increased joint pain, stiffness, or functional impairment. Increased postoperative pain and function are strongly related to preoperative disease activity [3].

There is a growing interest among surgeons to perform knee replacements earlier than previously considered within clinical practice, especially for distal femoral fractures. The aim is to reduce postsurgical complications such as nonunion or malunion and limit



Figure 1. Clinical photograph of the patient with valgus alignment of the left lower limb and shortening of the right lower limb due to previous right hip pathology with rheumatoid hands.

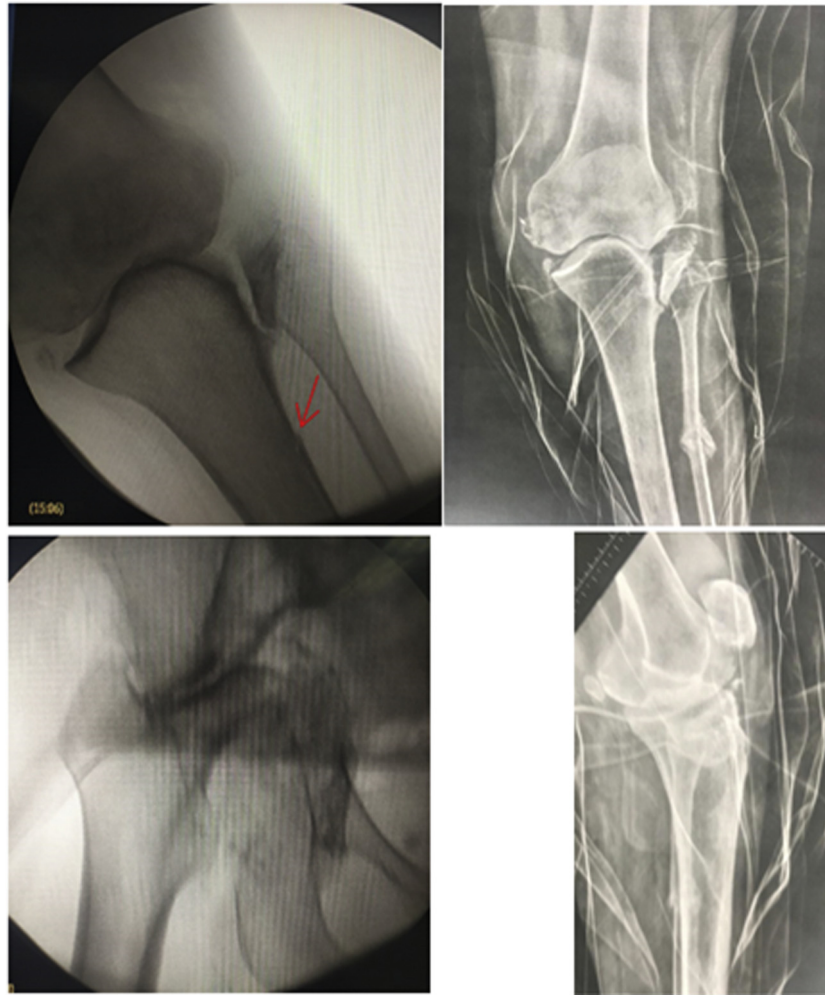


Figure 2. Radiographs showing severe arthritis of the left knee, and the left knee with a coexistent split fracture of the left tibia plateau with an ipsilateral stress fracture of the lateral tibia cortex (red arrow). It also shows severe arthritis and degeneration in the right hip.

issues with weight-bearing. Acute management is especially important when managing elderly patients with osteoporosis, who commonly experience fixation failure or other morbidities [17,18]. Fixation failure of tibial plateau fractures reaches 80% in the elderly older than 60 years and 100% with severe osteoporosis [17]. Wolfgang first reported acute treatment of knee fractures in 1982

[19]. Ever since, studies have reported good postoperative functional outcomes and return to the preinjury state after acutely managing tibial plateau fractures with knee arthroplasty [20,21]. Most of these studies recommend cemented stemmed constrained prosthesis to provide stability and bypass the fracture; however, the effect of cement on fracture healing has not yet been

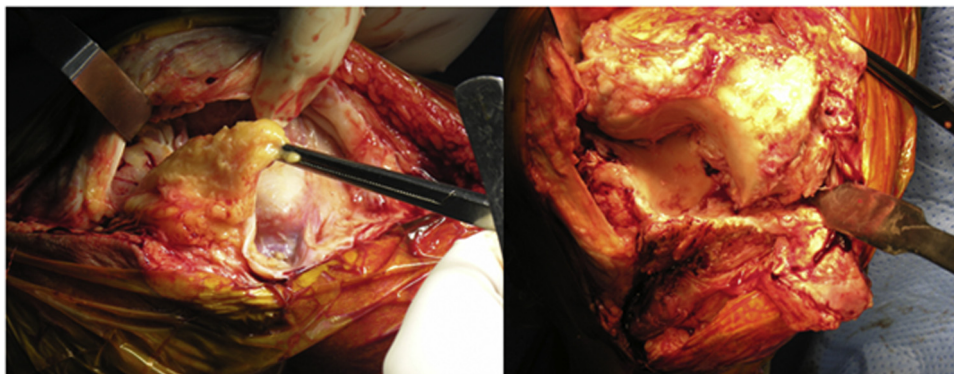


Figure 3. Intraoperative photograph showing the pyramid-shaped fat pad of the lateral parapatellar approach and severe degeneration of the knee joint with a fractured lateral tibia plateau.

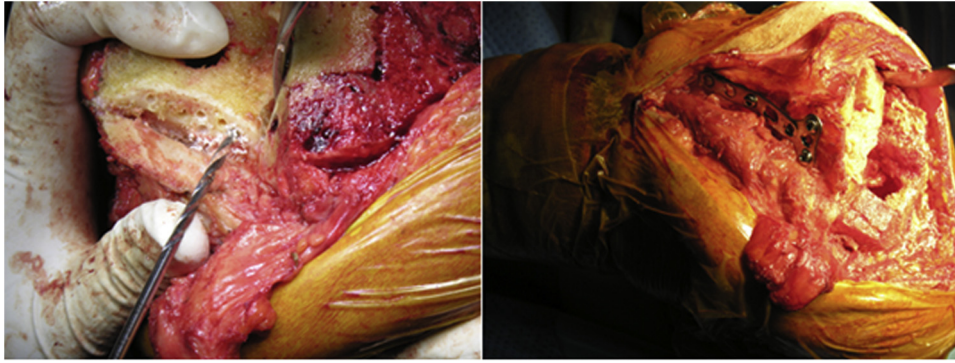


Figure 4. Intraoperative photograph showing refreshing and drilling of the sclerosed bone and the fracture site and final fixation of the fracture with a plate and screws.

established [11,20,21]. Bony defects in the proximal tibia can be managed using different types of augments, either wedges or blocks, depending on surgeon experience. However, total replacement of the proximal tibia in severely comminuted tibial plateau fractures may lead to complications because of poor soft-tissue coverage, disruption of the tibial tuberosity, and extensor mechanism [11]. Acute treatment of tibial plateau fractures with knee arthroplasty requires careful planning, as the fracture line may compromise the collateral ligaments, which would then require a constrained implant [11].

In this case report, we have shown that knee joint replacement of tibia plateau fractures with RA can be performed in the acute phase among older adults with better outcomes that allow for early

weight-bearing within the first month. This is in contrast to fixation techniques that require 2 significant operations—fixation and arthroplasty—for patients with comorbidities. Acute knee replacement also avoids complications of the initial fixation such as stiffness, hardware removal, important considerations when planning the surgical incision in the presence of scar tissue [11,16,22]. Wasserstein et al showed that 7.3% of patients who underwent open reduction and fixation of tibial plateau fractures after the formation of scar tissue required a knee replacement at 10 years [23].

Stress fractures commonly occur in young people because of repeated stress on the bone, leading to its failure. In older people, stress fractures have been linked to osteoporosis, Paget disease, metabolic diseases, or joint malalignment due to RA or osteoarthritis [8,9]. Knee malalignment due to knee arthritis shifts the mechanical axis of the lower limb. It changes the distribution of the load on the proximal tibial cortex that leads to fracture. Stress fractures in arthritic knees are clinically diagnosed by increased pain and tenderness on the proximal tibia and even sudden inability to weight-bear. Radiologically, stress fractures appear as a cortical discontinuity on the medial or lateral cortex in varus or valgus knees, respectively. Stress fractures in altered joint mechanics are mainly managed by restoring normal lower limb mechanics, which decreases the load on the fracture to facilitate healing. However, conservative treatment of these fractures yields unsatisfactory results of nonunion and pseudoarthrosis [9]. To achieve better outcome, stress fractures can be managed using either one-stage arthroplasty with a long stem or a two-stage fixation with plates that requires consideration for wedge osteotomies, realignment in nonunited fractures, and pseudoarthrosis. The initial surgery is then followed by arthroplasty to manage arthritic joints [8,9]. Most surgeons preferred a single-stage arthroplasty of stress fractures in arthritic knees as two-staged procedure causes painful fracture fixation with the residual pain of arthritis, risk of nonunion or malunion, future requirement for hardware removal, and managing the old scar [8,9].

Our findings show that it is possible to manage a complicated case of RA of the knee with one-stage arthroplasty using a lateral parapatellar approach. Managing these patients requires comprehensive preoperative planning to select the appropriate surgical approach, clinical investigations, and implant that would restore function, activity, and improve quality of life.

Summary

Total knee replacement is the main treatment of end-stage arthritis caused by RA or osteoarthritis. Managing complicated cases of RA of the knee with associated fractures is feasible. It, however, requires comprehensive preoperative planning of the

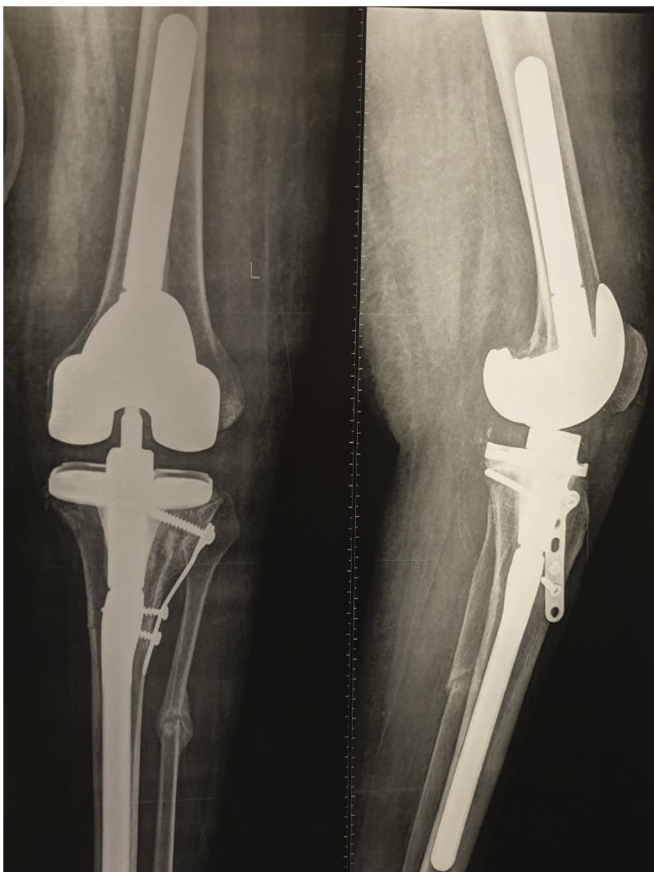


Figure 5. Final postoperative radiograph showing constrained knee arthroplasty of the left knee with fixation of the lateral tibia plateau.

surgical approach, clinical investigations, and choice of implants to achieve outcomes of improved quality of life and function. The lateral parapatellar approach provides good exposure of the joint and the associated fractures in valgus knees with associated lateral plateau fractures.

Conflict of interests

The authors declare there are no conflicts of interest.

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