Management of knee rheumatoid arthritis and tibia nonunion with one-stage total knee arthroplasty and intramedullary nailing: A report of two cases

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Introduction

Rheumatoid arthritis (RA) is an autoimmune disease characterized by synovial joint destruction.\(^1\)\(^-\)\(^2\) Knee involvement is common in patients with RA.\(^3\)\(^-\)\(^4\) Total knee arthroplasty (TKA) is a widely used surgical treatment method for patients with knee RA.\(^5\) However, osteopenia is a challenging problem in RA and impacts the success rate of TKA procedures. Furthermore, progressive joint destruction leads to flexion contracture of the knee joint, which can cause technical difficulties when performing TKA in RA.\(^6\)\(^-\)\(^7\) The RA patients have a higher risk of infection.\(^8\)\(^-\)\(^9\) Patients with RA who undergo TKA are at increased risk of prosthetic joint infection.\(^10\)\(^-\)\(^11\) Tibial stress fractures are overuse injuries, which are often associated with RA in elderly people with osteoarthritis, osteoporosis, or post-traumatic deformity.\(^12\)\(^-\)\(^13\) Osteopenia, corticosteroid use, poor nutrition and abnormalities of calcium metabolism decrease the strength of bone and are also significant risk factors for prevention of fracture healing in patients with RA.\(^14\) When normal alignment of the lower leg is lost due to an unhealed fracture or other condition, deviations from this anatomic norm may become technical obstacles in performing TKA.\(^15\)\(^-\)\(^16\)

There is no current information in the literature regarding the operative treatment for tibial nonunion and severe knee arthritis in patients with RA. This article presents two cases of TKA and tibial corrective osteotomy with intramedullary nail for nonunited traumatic and stress fracture of the tibia in patients with RA. The patients provided informed consent, and the authors have no conflicts of interest.

Case one

A 58-year-old woman was diagnosed with RA 10 years ago and took Deltacortril\(^\text{®}\) 5 mg/week. Gradually, increasing pain in the left knee and tibia deformity made walking difficult. The patient had a left tibia fracture after a fall 9 months ago, which was not treated, leading to nonunion.

On examination, severe knee pain and remarkable varus deformity were observed. Her knee demonstrated –20° extension with flexion to 45°. She had grade 2 varus instability of the knee. The patient was wheelchair-dependent. The knee score and function scores, according to the Knee Society clinical rating system, were 0 and –20 points, respectively.\(^17\)

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Radiographs showed a limb length discrepancy of 2 cm. There was significant arthritis (Fig. 1). Hypertrophic nonunion was detected on the metaphyseal-diaphyseal junction of the distal tibia (Fig. 2).

The patient underwent surgery for tibial intramedullary nailing and TKA. After the debridement of fibrous tissues and the osteotomy of the nonunion, the alignment of the lower leg was corrected. An intramedullary nail (11.5 mm × 30 cm TRIGEN® IMN System, Smith and Nephew) was inserted distal to the tibial insertion of the anterior cruciate ligament and lateral to the anterior horn of the medial meniscus, on the proximal anterior part of tibial plateau. This site was slightly distal to the routine insertion point. The nail was secured with proximal and distal screws. After nailing, the femoral component (medium, 70 mm), tibial component (medium, 72 mm) and insert (P-S insert, medium, 10 mm) were placed and TKA (Performance® Cemented Knee System, Biomet) was completed.

Postoperatively the patient received low molecular-weight heparin as prophylaxis for deep vein thrombosis and three doses of a second-generation cephalosporin as infection prophylaxis. ROM exercises were initiated on the next postoperative day. Weight-bearing was started on the first postoperative day. The patient used walker for one month, then a crutch until the bone union was complete. Bony union was achieved in 3 months. During this time she continued physical therapy.

Eight years after surgery, the patient was assessed clinically and radiologically (Fig. 3). She had full ROM of her knee of 0°–120° without pain. The knee score and function scores, according to the Knee Society clinical rating system, were 68 and 60 points, respectively.

Case two

A 54-year-old woman was diagnosed with RA 30 years ago and took methotrexate 6 mg/week and prednisolone 35 mg/week. Gradually, persistent pain in left knee and tibia deformity made walking difficult. Her medical history showed no major trauma before.

On examination, severe knee pain and remarkable flexion and varus deformity on the tibia diaphysis were observed. Her knee demonstrated –15° extension with flexion to 30°. The patient was
wheelchair-dependent. The knee and function scores, according to the Knee Society clinical rating system, were 0 and −20 points, respectively.

Radiographs showed a limb-length discrepancy of 3 cm. There was significant arthritis (Fig. 4). Stress fracture and nonunion were detected on the diaphysis of the tibia.

The patient underwent surgery for tibia intramedullary nailing (8.5 mm × 26 cm, TRIGEN® IMN System, Smith and Nephew) and TKA as the first case. After the intramedullary nail, the femoral component (size 4), tibial component (size 3), and insert (P-S insert, 9 mm) were placed and TKA (GENESIS II® Knee System, Smith and Nephew) was completed.

Postoperatively ROM exercises, weight bearing, prophylaxis for deep vein thrombosis and infection protocols were the same as the first case. Bony union was achieved in 3.5 months.

Eight years after knee replacement, the patient was assessed clinically and radiologically (Fig. 5). She had full ROM of her knee of 0°–110° without pain. The knee score and function scores, according to the Knee Society clinical rating system, were 58 and 60 points, respectively.

Discussion

TKA is an effective treatment method with successful results in patients with RA. However, the functional results remain far lower than those for patients with osteoarthritis because of technical difficulties and poor bone quality and infection. Furthermore, because of a reduced mineralization rate in the bones and prolonged systemic corticosteroid usage, nonunion is a notable problem when treating fractures in patients with RA.
Two nonunited tibial fractures (one traumatic fracture and one stress fracture), severe knee RA with TKA, and intramedullary nailing were treated.

Several treatment options exist for severe arthritis of the knee and for nonunion at the tibia. The first option is a two-stage procedure. In the first stage, nonunion of the distal tibial shaft is corrected using an interlocking nail or a plate. In the second stage, after union of the tibial fracture, TKA is performed with simultaneous removal of the nail or the plate. Osteotomy with or without second-stage TKA after bone union has provided successful results. However, two-stage surgery requires two separate operations and prolonged treatment duration, persistent arthritic symptoms, and likewise, uncorrected mechanical axis untreated in the first stage, which may lead to implant failure. The second option is a single stage TKA with a long stem extension of the tibial component to bypass the fracture site or TKA with an interlocking nail or a plate. We also preferred performing one-stage tibial corrective osteotomy and TKA to decrease the treatment duration and avoid the problems related to the two-stage procedure. Furthermore, in our cases, the knee flexion was so limited that we could not flex the knee to insert the nail or the guide of the nail to the proximal tibial plateau before performing a tibial cut. For this reason, two-stage treatment was not an option for our cases. Furthermore, the cutting bone fragments were used as an autograft at the nonunion area.

Two fixation options were available to stabilize the nonunion of the tibia: using a plate or an intramedullary nail. The dissection at the nonunion area would be extensive if the plate was used. The intramedullary nail was a load-sharing device and the risk of refracture was lower than the plate and allowed early weight bearing. Because of these, we preferred using intramedullary nails instead of plates for fixation in the osteoporotic bones of our RA patients. The insertion point of intramedullary nail was more distal than routine application and through distal portion of the patellar tendon. Particular attention was paid to leave enough space in proximal fragment for manipulation and proximal locking of the nail. Additionally, the chosen tibial stem did not occlude the medullary canal too much against difficulties in proximal locking of the nail.

Mittal treated arthritic knees and tibiofemoral stress fractures with one-stage long-stem TKA and suggested that a successful outcome can be obtained with pain relief and fracture healing. However, TKA with a long stem would not have been possible in case one because the fracture had occurred in the distal metaphyseal-diaphyseal junction and it was impossible to bypass the fracture site with a long-stem modular implant. Furthermore, we believed TKA with long-stem tibial extension cannot maintain rigid rotational stability when compared with TKA and an intramedullary nail.

Cameron treated two cases of tibial stress fracture with severe medial compartment arthritis of the knee. He reported that after correction of the deformity, TKA was not required. However, in our cases, we had to treat both knee arthritis and deformity. The knee flexion contracture was so severe that we could not perform tibial intramedullary nail insertion unless tibial cuts were made. Furthermore, we believed that the severe varus deformity of the knee caused significant stress on the tibia, shifting the mechanical axis and making it difficult for the fracture to heal. Flexion contracture is a common deformity that causes problem during TKA in RA and requires surgical correction with bony resection, ligamentous releases, and use of increasing constraint prosthesis. We performed excessive release of the posterior capsule and medial or lateral collateral ligament and used constrained prostheses to effectively achieve improvement of the ROM and the functional recovery. Although it was reported that surgical correction of flexion contracture in the knee can cause nerve palsy, we did not experience any neurological complication.

We treated two cases of severe knee RA and nonunited tibia fracture; one of our cases based on a traumatic origin and the other a stress fracture. We performed TKA and intramedullary nailing. Our patient obtained satisfactory knee motion without pain, and fracture union. Performing tibial cuts of TKA before intramedullary nailing provided us better knee flexion.

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