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CASE REPORT

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Total knee arthroplasty with a long-stemmed component for fractures adjacent to the knee in rheumatoid arthritis: a report of four cases

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Abstract Four rheumatoid arthritis patients with fractures adjacent to the knee were treated by total knee arthroplasty with a long-stemmed component. All four fractures healed; joint reconstruction and limb realignment were achieved simultaneously. Total knee arthroplasty with a long-stemmed component was useful in stabilizing the fracture and rapidly restoring function in the joint and the limb.

Key words Arthroplasty · Fracture · Knee · Long stem · Rheumatoid arthritis (RA)

Introduction

The knee is among the most commonly affected joints in rheumatoid arthritis (RA).[1] When progressive joint destruction leads to unremitting pain and articular deformity, total knee arthroplasty (TKA) is performed to relieve pain, increase functional capability, and improve lifestyle. Success of TKA in RA has been well documented; over 95% of prostheses still function well after 10 years.[2,3]

A stemmed component of the prosthesis is used to manage defects of the distal femur and proximal tibia in primary TKA and in revision procedures.[4–6] A supracondylar fracture adjacent to a loose or failing total knee implant can be treated by revising the implant as part of fracture stabilization; a long-stemmed component replaces the damaged bone and stabilizes the fracture.[7]

This report describes three supracondylar fractures of the femur and one tibial stress fracture in rheumatoid arthritis patients successfully treated by long-stemmed TKA. Knee-joint arthroplasty with a stemmed component has the advantage of restoring bone integrity and treating the arthritic joint in one procedure. It also allows immediate mobilization of the patient without need for a cumbersome cast or splint. A long stem should be used to extend beyond the fracture site, providing stable fixation of the fracture.

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Case 1 (Fig. 1)

A 59-year-old woman with RA of 19 years' duration, who had a press-fit TKA (Yamamoto MK4) implanted in her right knee 7 years prior to injury, had a fall in which she sustained a supracondylar femoral fracture just above the prosthesis. The femoral component showed no loosening. An attempt at closed reduction under fluoroscopic guidance was unsuccessful. The knee prosthesis did not have sufficient intercondylar space to accommodate insertion of a supracondylar intramedullary rod, and the distal fragment was too small and osteoporotic to obtain fracture stability by internal fixation. The patient was treated with a TKA revision (Nexgen CRA). The femoral component had a long stem, which was implanted with cement for fixation of the femoral fracture. Range-of-motion exercise was initiated on the second postoperative day. Gait training with weight-bearing was allowed at 14 days after surgery. One year later, the fracture had healed and the patient walked with a crutch just as before the fall. The range of motion at the knee was 0°–100°.

Case 2 (Fig. 2)

A 78-year-old woman with RA of 21 years' duration had a cemented revision TKA (Bioceram KC type) with stemmed femoral and tibial components implanted in her left knee 13 years prior to injury. She had a fall in which she sustained a supracondylar femoral fracture above the stem. A compression hip screw (CHS) had been implanted to treat a femoral neck fracture at the age of 77 years. The femoral component of the knee prosthesis showed no loosening. After the

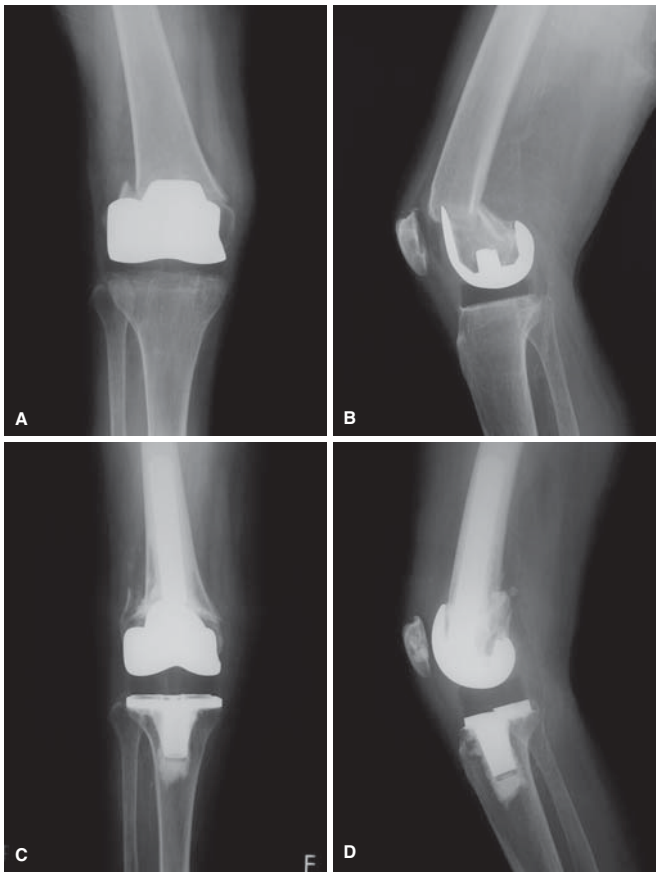

Fig. 1A–D. Case 1. Anteroposterior and lateral radiographs (**A** and **B**, respectively) showed a fracture above a stable right knee arthroplasty. One year after revision, anteroposterior and lateral radiographs (**C** and **D**) showed union and good alignment of components

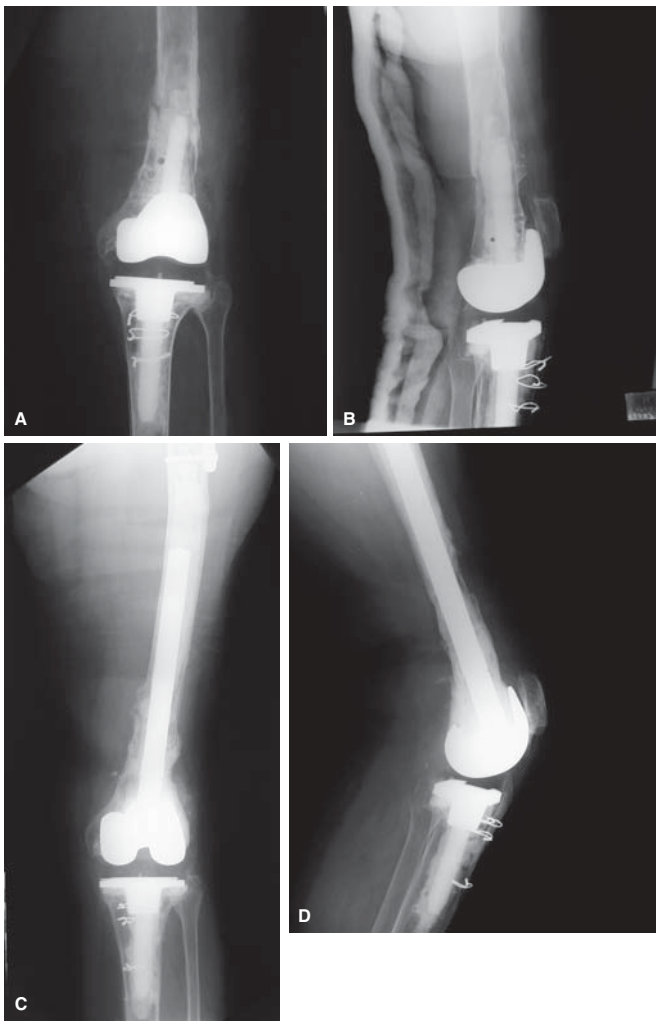

Fig. 2A–D. Case 2. Anteroposterior and lateral radiographs (**A** and **B**, respectively) showed nonunion above a stable stemmed component after osteosynthesis on the left knee. One and a half years after revision, anteroposterior and lateral radiographs (**C** and **D**) showed union and good alignment of the component

present fall, open reduction and internal fixation with pin-and-cast fixation was attempted initially, but failed. After 4 months a second operation was performed using an external fixator with bone grafting; 15 weeks later, the fracture showed abnormal instability. A revision procedure was performed in which the stemmed femoral component was replaced with a longer stemmed component (IB-2-constrained condylar knee). The stable tibial component was retained. The length of the stem was adjusted during operation using a high-speed carbide burr, with care not to disturb the CHS above. Range-of-motion exercise was carried out postoperatively with the assistance of a continuous passive motion (CPM) machine. Standing exercise was begun 2 weeks after operation. One and a half years later, the fracture was soundly united and the patient was ambulatory with a knee-motion range of 0°–90°.

Case 3 (Fig. 3)

A 77-year-old woman with a 30-year history of RA had a fall in which she sustained a supracondylar right femoral fracture. After 5 months of conservative treatment by cast immobilization, the supracondylar femoral fracture showed abnormal instability. Joint deformity from RA was evident and range of motion at the knee was severely limited. The joint space was very narrow, and the patellofemoral joint was partially ankylosed. Primary TKA (Nexgen CRA) with a long-stemmed component was performed to stabilize the fracture and restore joint function. Without cast immobilization, early range-of-motion exercise and full-weight-bearing walking was achieved. Six weeks after the operation she could walk with a cane. Six months later the fracture had healed, with a range for knee motion of 0°–105°.

Case 4 (Fig. 4)

A 75-year-old woman with a 15-year history of RA presented with spontaneous pain and swelling of the left knee.

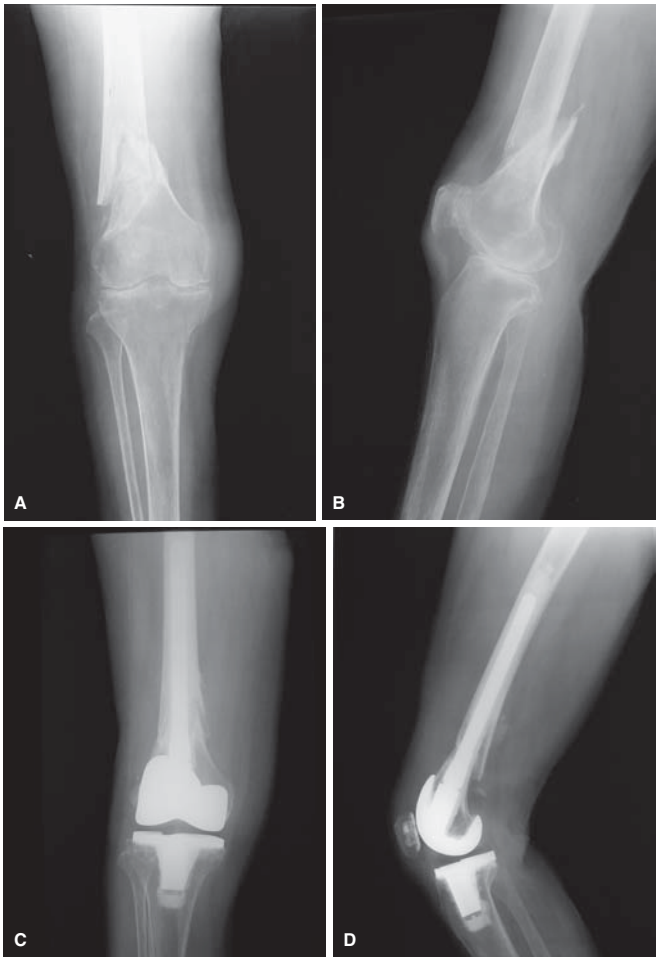

Fig. 3A–D. Case 3. Anteroposterior and lateral radiographs (**A** and **B**, respectively) showed a displaced supracondylar fracture of the right femur. Six months postoperatively, anteroposterior and lateral radiographs (**C** and **D**) showed stable components and good alignment of the right knee

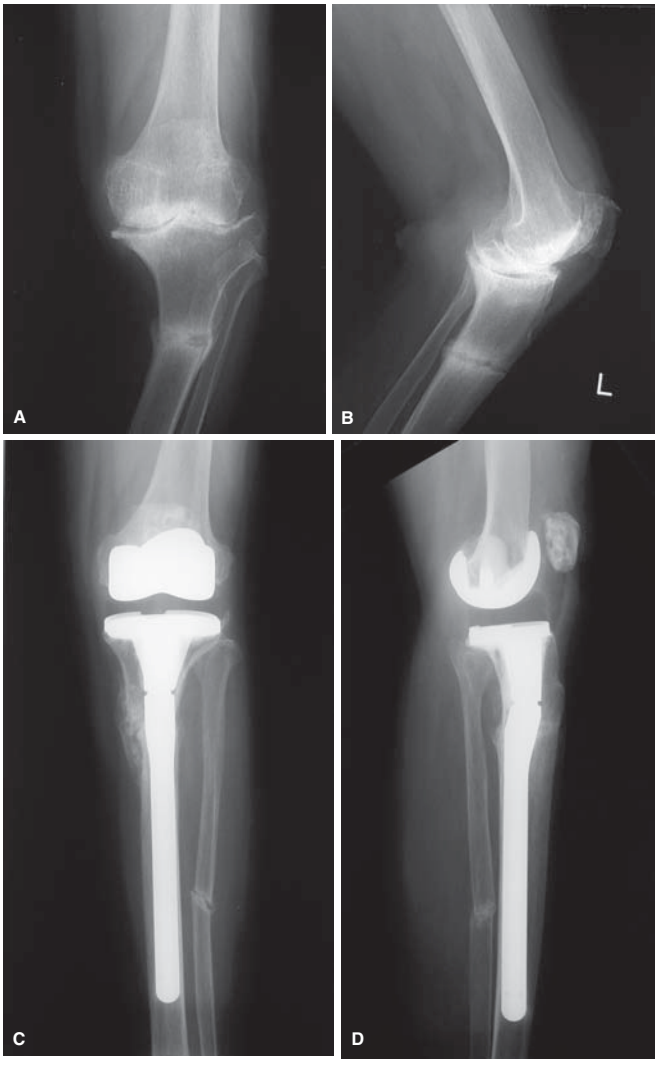

Fig. 4A–D. Case 4. Anteroposterior and lateral radiographs (**A** and **B**, respectively) showed a stress fracture of the uppermost third of the left tibia. Five months postoperatively, anteroposterior and lateral radiographs (**C** and **D**) showed union and good alignment of components

Examination revealed a hot, swollen knee with 30° varus deformity and a range of flexion from 0° to 130°. An area of tenderness was present over the upper medial part of the left tibia. Radiographs showed a stress fracture of the uppermost third of the left tibia coinciding with the tender area. Advanced knee destruction was also evident. Total knee arthroplasty was performed for reconstruction of the joint and fixation of the fracture. A modular knee arthroplasty (NexGen CRA) with an offset stemmed tibial component was implanted following open reduction of the fracture with bone grafting. Femoral and tibial components were fixed with cement, but cement application to the stem extension was omitted so as not to disturb fracture healing, considering that the fracture had sufficient stability after reduction and stem fixation. Standing exercise with full weight-bearing was initiated 4 weeks after surgery. Five months following surgery, the patient was asymptomatic, and the fracture was soundly united with a range of motion at the knee of 0°–130°.

Discussion

In RA, the knee is among the joints most commonly affected. Fractures adjacent to the knee can pose difficult treatment problems in RA patients, who must be mobilized rapidly to avoid medical complications of prolonged bed rest and inactivity. Walking with protected weight-bearing is often impossible because of multiple-joint involvement. In most instances early definitive treatment is preferable to a less invasive conservative procedure. In this report, primary TKA or TKA revision using a long-stemmed component was shown to be useful for treating fractures adjacent to knees with prostheses or deformities compromising function in RA patients.

When treatment is chosen for a supracondylar fracture of the femur after total knee arthroplasty, consideration

must be given to multiple factors, including status of the prosthetic fixation, degree of comminution of the fracture, proximity of the fracture to the prosthetic component, longitudinal alignment of the limb, and degree of displacement of the fracture.[7] Usually a revision operation is indicated for a supracondylar fracture adjacent to a loose or failing total-knee implant. A long-stemmed femoral component can stabilize the fracture and restore joint function simultaneously. After such revision surgery the patient avoids a bed-bound state, so range-of-motion exercise of the knee and walking exercise with full weight bearing can be started early, without prolonged bed rest. In cases with an intact or stable prosthesis, open or closed reduction and internal fixation is indicated with the use of a plate, screw, or supracondylar intramedullary rod.[8] However, open reduction requires periosteal stripping, which disturbs the fracture hematoma. When rigid internal fixation cannot be obtained with a supracondylar intramedullary rod, revision of the prosthesis offers the great advantage of permitting early exercise. In case 1 closed reduction was not obtained, and the type of knee prosthesis did not allow rigid internal fixation with a supracondylar intramedullary rod. Revision therefore was performed with a long-stemmed femoral prosthesis using cement. Cast immobilization was unnecessary, range-of-motion exercise was started on the second postoperative day, full-weight-bearing standing exercise was permitted at 10–14 days after surgery, and walking without avoidance of weight-bearing was allowed to the extent of effective muscular control of the leg.

The revision procedure is more invasive than standard fracture operations, and the operative technique is more difficult. However, the revision arthroplasty with a long-stemmed component is desirable for promoting more rapid functional recovery in RA patients with multiple-joint involvement. This is particularly true for patients in whom attempts at stabilizing the fracture have failed and for those who cannot become ambulatory without an additional procedure. In case 2 the fracture had not united even after a procedure using bone grafting, and the patient had been unable to walk for 7 months. After removal of the cemented stemmed component, a longer stemmed component of the IB-2-constrained condylar knee was implanted. The length of the stem was adjusted during the operation using a high-speed carbide burr, since the IB-2-constrained condylar knee is not a modular system and the range of sizes available is not extensive.

In case 3 a supracondylar fracture occurred adjacent to a knee with advanced rheumatoid change. Conservative treatment with cast immobilization failed, and primary TKA was performed with a long-stemmed femoral component to stabilize the fracture and restore joint function. The modular total knee system used was convenient in offering choice of a stem with width and length best suited to stabilize the fracture and the femoral component. Mobilization and rehabilitation were rapidly achieved.[9–11]

Case 4 represented a proximal tibial stress fracture in an RA patient who had developed varus deformity at the knee, as described by Young and Kinsella.[12] This typically occurs in elderly women with joint deformity and osteoporosis. Correction of alignment both at the knee and at the fracture site is necessary to restore the mechanical axis of the limb to normal and facilitate fracture healing. Knee-joint arthroplasty with a stemmed tibial component has the advantage of restoring anatomy at the fracture site and treating the arthritic joint in one procedure.[13] It also allows immediate mobilization of the patient without cumbersome casting or splinting. Use of a long tibial stem extending beyond the fracture site is important for stable fixation of the fracture. A modular knee arthroplasty (NexGen CRA) with a stemmed tibial component is useful in this situation for combining fracture treatment with joint reconstruction. The offset stem is very suitable for fracture fixation and for compatibility with the shape of the medullary canal. In this case, cement was placed only on the cut surfaces in the metaphyseal region of the tibia to avoid disruption of fracture healing and prevent problems associated with removal of cemented stems at the time of a subsequent revision.[5] Usually, however, in cases with severe bone deficiency at a revision site with fracture, stability cannot be achieved without cementing the stem.[6]

Without doubt, reoperation using a long-stemmed component with cement fixation is highly invasive and poses many difficulties in cases with infection or periprosthetic fracture. However, this strategy is indicated for patients who require immediate mobilization without restriction to avoid medical complications of bed rest and inactivity.

In conclusion, the aim of treatment of knees compromised by RA in proximity to fractures is restoration of knee mobility combined with acceleration and maximization of functional recovery. Total knee arthroplasty with a long-stemmed component was very useful for stabilizing the fracture while restoring joint function in RA patients whose fractures showed unstable internal fixation, nonunion after failed osteosynthesis, or delayed union with joint destruction, as well as in proximal tibial stress fracture associated with RA.

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