

## Case Report

## Salvage surgery with a tumor prosthesis for femoral condylar nonunion at the very advanced age of 90 years

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## ABSTRACT

We report an unusual case of multifragmentary condylar femoral nonunion with severe synovitis and bone loss in a 90-year-old woman. Initially, conservative treatment of the condylar femoral fracture was indicated because the fracture was severely comminuted and the patient was very advanced in age. The fracture failed to heal. Salvage surgery with a total knee tumor endoprosthesis replacement was performed. Four years postoperatively, the patient was walking without knee pain using a walker. We believe that the present results justify the use of a megaprosthesis in the treatment of benign conditions even in very elderly patients.

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## 1. Introduction

Fractures of the distal femur in the elderly are usually caused by low-energy, ground level falls onto a flexed knee. Pre-existing osteoarthritis and juxta-articular osteopenia in this age group result in high levels of comminution and articular damage at the time of injury, which challenges both management and treatment outcomes.<sup>1</sup> Some fractures may not be candidates for internal fixation because of severe comminution, and many orthopedic surgeons may select conservative treatment for such cases, particularly in patients at a very advanced age.<sup>2,3</sup> However, these intraarticular fractures have a greater tendency to result in nonunion. The purpose of this case report was to document the use of a distal femoral tumor endoprosthesis (megaprosthesis) originally developed for use in musculoskeletal tumor surgery as a treatment option in severely osteoporotic patients who have persistent nonunion after multifragmentary femoral condylar fracture.

## 2. Case report

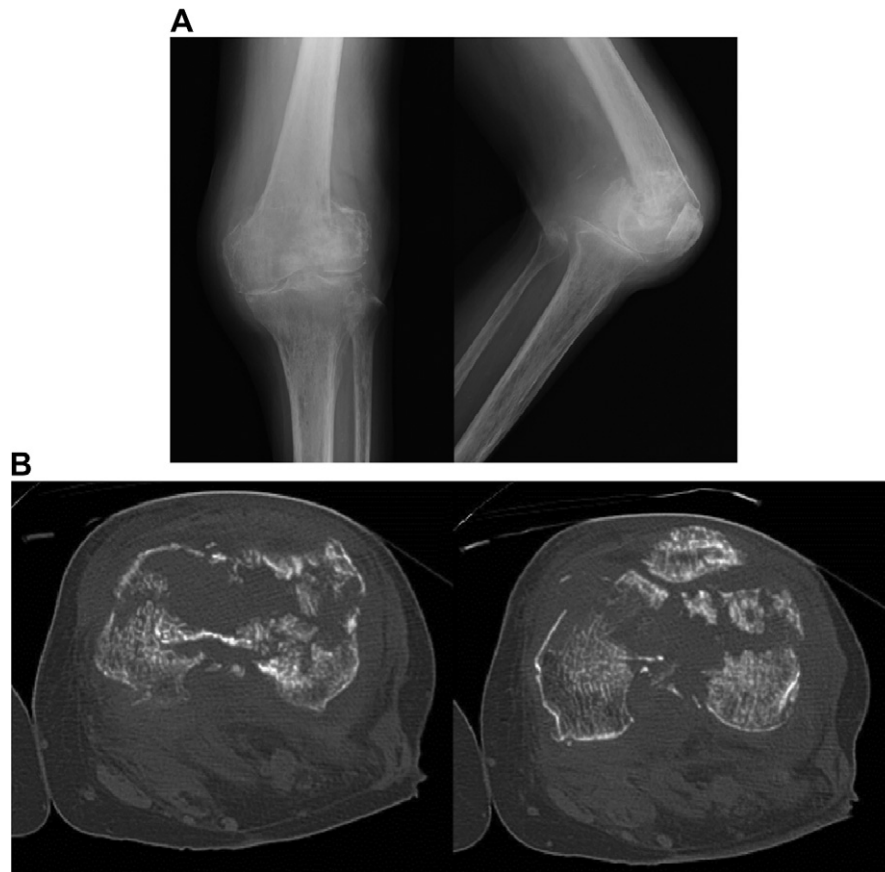
In August 2006, a 90-year-old woman fell at home, and she was transferred to a nearby general hospital and diagnosed with a left

femoral condylar fracture. Radiography and computed tomography (CT) scans revealed that the fracture was severely multifragmented with severe osteoporosis (Fig. 1). The operative reduction and fixation was not given because of the surgeon's concern of severe comminution and osteoporosis, so conservative treatment with long-leg casting was performed. However, she continued to endure painful nonunion, and she was bedridden for 5 months after the injury. In January 2007, she was referred to our hospital seeking surgical treatment. At examination, she had severe instability of the left knee and her knee joint was severely swollen due to synovitis. She had contracture of the knee and an active range of motion (ROM) from 0° to 10° of flexion. Blood analysis showed no signs of infections. Radiographs revealed femoral condylar nonunion with considerable bony defects (Fig. 2). To treat her persistent left femoral condylar nonunion, salvage surgery with a total knee tumor endoprosthesis replacement was planned.

The salvage surgery was performed under general or spinal anesthesia and under tourniquet control using a midline longitudinal incision and a medial parapatellar approach. We excised the morbidly outgrowing synovial membrane, the appropriate length of femur containing multifragmentary fractured femoral condyle with its attached collateral ligaments and the tibial articular surface. We used a HMRS Modular Resection System (Stryker, Kalamazoo, MI, USA) as a prosthesis for reconstruction of the knee joint and massive bone defect. This prosthesis was a non-customized implant with long-stemmed femoral and tibial components linked intraoperatively using a transverse metal rod

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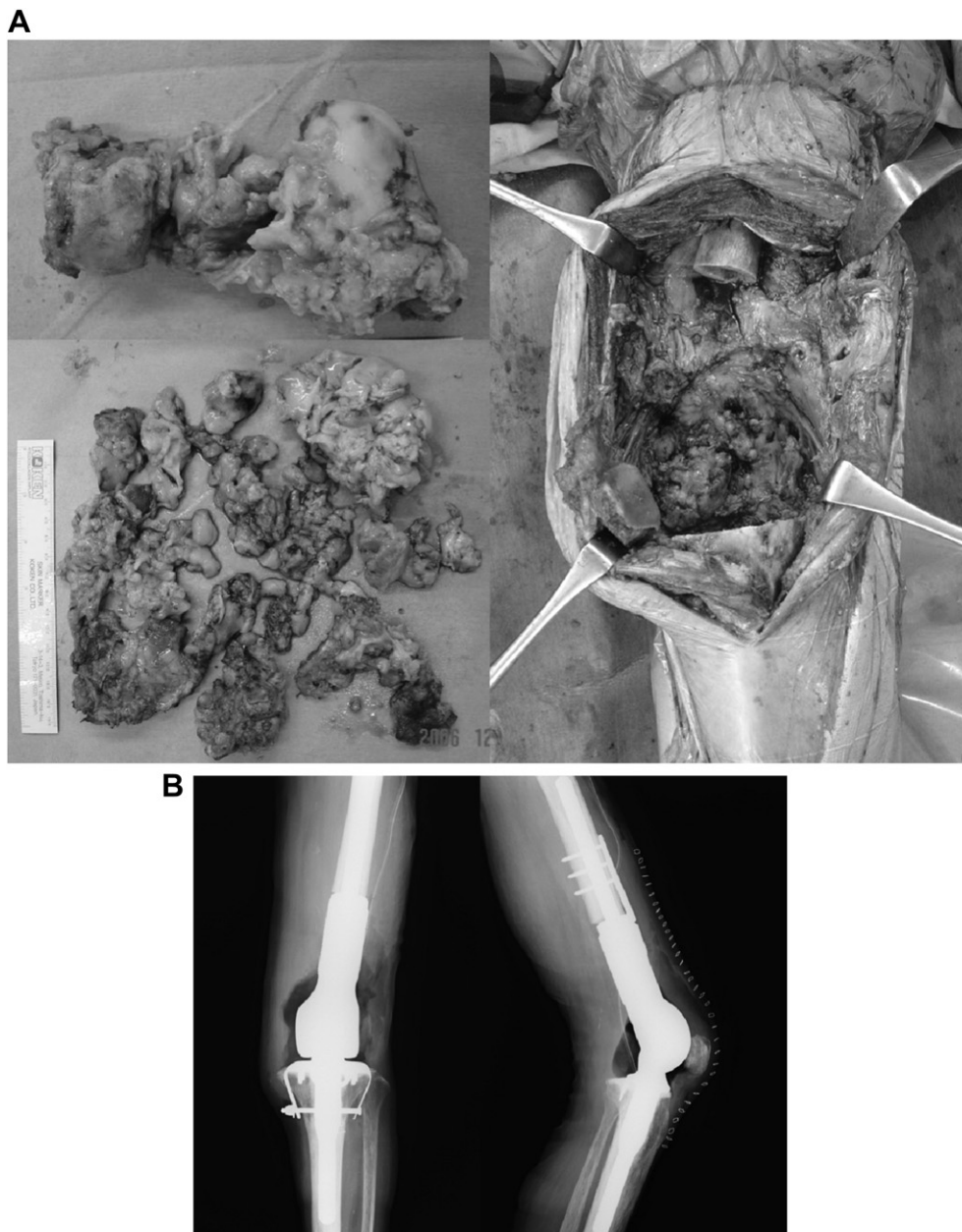
E-mail address: [nabechov@sf7.so-net.ne.jp](mailto:nabechov@sf7.so-net.ne.jp) (K. Watanabe).



**Fig. 1.** (A) Anteroposterior and lateral radiographs showing a displaced comminuted supracondylar and intercondylar fracture; (B) coronal computed tomography scan images revealing extensive comminution of the bilateral condyle and avulsed fragments of the collateral and cruciate ligaments.



**Fig. 2.** (A) Radiographs at 4 months after injury showing abortive conservative treatment: femoral supracondylar and intercondylar nonunion with considerable bony defects; (B) the knee joint was severely deformed posteriorly and swollen due to synovitis.



**Fig. 3.** (A) Multifragmentary necrotic bone and synovial proliferation were excised and reconstruction using a megaprosthesis was then performed; (B) femoral component was fixed without cement, and the tibial component was fixed with cement.

and polyethylene bushings. The distal femoral canal was reamed and prepared for the intramedullary stem of the implant. The tibia was prepared in the usual fashion, and resurfacing of the patella was performed. Trial components were initially assembled uncemented to ensure adequate anatomic restoration of the joint line and soft-tissue tensioning, and the patellar tracking was checked. After medullary lavage and drying of the medullary canals, the femoral component was inserted with a cementless technique and fixed with three screws, and a cemented long-stem modular tibial tray with a modular polyethylene liner was used. Wound closure was done over closed suction drains that were removed after 48 hours. The quantity of operative hemorrhage was 200 mL, and the total operating time was 3 hours (Fig. 3).

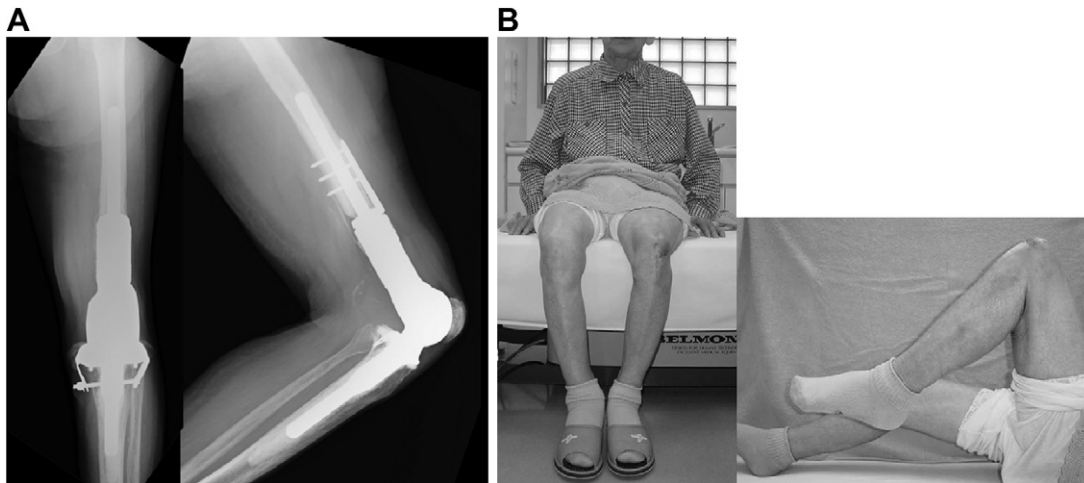
Postoperatively, no splints or orthoses were used and the patient immediately began ROM exercises using continuous

passive motion equipment and began weight bearing as tolerated. At the latest follow-up, 4 years postoperatively, her knee ROM was maintained from 0° to 110°. The patient had marked improvement in motion pain and currently walks without knee pain using a walker. Radiographs showed no radiolucent lines around the femoral and tibial components (Fig. 4).

The patient gave informed consent prior to being included in the study.

### 3. Discussion

Our patient was 90 years of age, an age at which orthopedic surgery is challenging. To our knowledge, this is the oldest case of reconstruction with tumor prosthesis for a nontumoral disorder.



**Fig. 4.** (A) Radiographs at the latest follow-up, 4 years postoperatively, that showed no radiolucent lines around the femoral and tibial components; (B) knee range of motion was maintained from 0° to 110°.

Four years have passed since the patient underwent surgery, and she has experienced a favorable outcome.

The aim of treatment of supracondylar and intercondylar femoral fractures is restoration of knee mobility and the earliest possible return to pre-injury function. Nonsurgical management is associated with a high incidence of complications,<sup>4,5</sup> and internal fixation has therefore been advocated<sup>6–8</sup>; however, this may be difficult if the bone is extremely porotic or if the bone stock is inadequate. Considerable problems have been encountered in using conventional internal fixation techniques in patients older than 60 years of age.<sup>2,3</sup> Extensive metaphyseal or diaphyseal comminution may necessitate the use of a modular prosthesis. Moreover, in the case of aggravated nonunion, it is impossible to fix fracture fragments with internal fixation techniques because of poor bone stock.

Nonunion of supracondylar distal femoral fractures occur mostly in patients with poor bone quality or unfavorable fracture patterns. Internal fixation and prosthetic replacement are the usual methods of treating nonunions.<sup>9–11</sup> In elderly patients with poor bone stock, osteosynthesis is not a feasible option. Total knee arthroplasty is a recognized therapeutic option but its efficacy and durability have not been established in supracondylar fractures where bone loss needs to be augmented with an allograft.<sup>12</sup>

In the field of musculoskeletal oncology, good long-term results have been achieved with hinge endoprostheses following tumor resection around the knee joint. The 5-year survival rate of such reconstructions has been reported to be approximately 80–90%.<sup>13,14</sup> As the success of megaprotheses becomes more predictable, the indications for using them are expanding. Some authors have reported good results for distal femoral replacement in elderly patients with acute distal femoral fractures or nonunions.<sup>1,15,16</sup> However, other authors have reported high rates of postoperative infection associated with reconstructive procedures involving a tumor prosthesis. Freedman et al<sup>1</sup> reported that two of five cases reconstructed with a hinge prosthesis experienced postoperative infectious complications. Springer et al<sup>17</sup> reported five postoperative deep infections after the use of a modular kinematic rotating hinge for nonneoplastic limb salvage, and they noted that potential causes of infection included a very invasive approach, long operating time, and poor soft tissue condition due to multiple surgeries. Haidukewych et al<sup>18</sup> also reported a relatively high rate of complications, and recommended that this salvage procedure should be reserved primarily for elderly and sedentary patients. According to these recommendations, the selection of our patient

was appropriate for this reconstructive procedure. We also recommend this treatment modality in selected osteopenic elderly patients with difficult distal femoral reconstructive problems.

There are other alternatives such as condylar constrained knee or rotating hinge prostheses with a cemented femoral long stem to manage situations like this case. However, a condylar constrained knee prosthesis needs either MCL or LCL to obtain excellent functional outcome, and nontumoral rotating hinge prostheses could not fill femoral bone defects with 10–25 mm spacers in this case.

A hinged knee replacement should be used for most supracondylar or intercondylar fractures because the collateral and cruciate ligaments are removed with the distal femur. In the present case, we judged that the patient was a suitable candidate for using a modular megaprosthesis to salvage the persistent painful nonunion. This reconstruction could only be expected to provide excellent pain relief, good knee ROM immediately after surgery, and early weight bearing. Megaprotheses cost more than other knee prostheses and fracture fixation implants such as plates and nails. However, the use of a megaprosthesis is a one-stage solution for this complex problem; it can be considered as a cost-effective measure despite its higher cost. The long-term durability of such a modular megaprosthesis is also a concern; longer clinical follow-up will help determine the true efficacy of reconstructive procedures for such a condition.

In conclusion, we believe that the present results justify the use of a megaprosthesis in the treatment of multifragmentary intercondylar femoral fracture in elderly patients who have severe osteoporosis, nonunion, and inadequate bone stock.

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