

Case Report

Ipsilateral Periprosthetic Fractures above and below the Knee Associated with Navigation Tracker Pin and Bone Fragility

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We report a case of ipsilateral periprosthetic fractures above and below the knee that occurred at different times due to navigation tracker pin and bone fragility. A 66-year-old Japanese woman with rheumatoid arthritis (RA) underwent a total knee arthroplasty. Four months post-surgery, a periprosthetic fracture above the knee at the navigation pin hole was detected. She underwent osteosynthesis and could walk independently, but she developed an ipsilateral tibial component fracture. Conservative treatment with a splint was followed by bone union. Patients with RA treated with oral steroids tend to develop ipsilateral periprosthetic fractures around the knee due to bone fragility.

Key words: periprosthetic fracture, total knee arthroplasty, navigation system, bone fragility

With the advent of a super-aging society, the performance of total knee arthroplasty (TKA) and the incidence of peri-TKA fractures are increasing worldwide [1]. Peri-TKA fractures are more difficult to treat because of the worsening of bone fragility due to aging, treatment with drugs that cause osteoporosis, and repeated surgery. We report the case of a patient in whom ipsilateral peri-TKA fractures developed above and below the knee at different times due to navigation tracker pin and bone fragility.

Case Report

The patient was a 66-year-old Japanese woman who had had diabetes mellitus for 20 years and rheumatoid arthritis (RA) for 10 years, the latter of which had been treated with bucillamine (50 mg/day) for 10 years and steroids (prednisolone, 5 mg/day) for 8 years. She

underwent a TKA for her left rheumatoid knee at the age of 64 years, at which time she was diagnosed with osteoporosis and was administered an oral bisphosphonate. Two years later, she underwent another TKA, for her right rheumatoid knee (Fig. 1A, B). Both surgeries were performed under navigation with tracker pins in the distal femur and proximal tibia. Range-of-motion training was started the day after the second surgery, and full weight bearing was allowed according to the patient's pain. Three weeks after the right TKA operation, the patient was able to walk with a T-cane and was discharged from the hospital.

At the outpatient visit 2 months after the TKA, the patient reported no pain as she was using the T-cane. However, 4 months after the TKA, she experienced right knee pain and came to a clinic in a wheelchair. No fractures or implant loosening was detected, and she was followed up at her home. A week later, she fell to the ground while walking and incurred a distal femoral

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fracture at the navigation tracker pin position (Fig. 2A). She underwent osteosynthesis with a locking plate (Zimmer NCB periprosthetic femur plate system, Warsaw, IN, USA) (Fig. 2B) and achieved bone union (Fig. 2C) and a one T-cane gait 3 months after the osteosynthesis surgery; afterward, she was able to walk without aid.

A bone mineral density examination using dual-energy X-ray absorptiometry (DEXA) revealed a T-score of -2.5 and osteoporosis in the proximal part of her femur. The level of the bone metabolism marker serum tartrate-resistant acid phosphatase 5b (TRACP-5b) was high at 443 mU/dL, and the total amino-terminal propeptide of type 1 procollagen (PINP) value was normal at 58.9 ng/dL. After the fracture healed, the oral bisphosphonate was changed to raloxifene hydrochloride (60 mg/day).

Approximately 1 year and 6 months after the osteosynthesis surgery, the patient fell again, and a fracture was detected around the right TKA tibial component. She was admitted to another hospital and was transferred to our institute 3 weeks after the injury. The displacement of the fracture was minimal, and callus formation had already started (Fig. 3A). Therefore, conservative treatment was continued with a splint, and daily teriparatide (Forteo® subcutaneous injection kit, 20 µg/day) was started 1 month after the injury. The prednisolone dosage was decreased and finally stopped after 1 month. The patient achieved bone union 4 months after the injury (Fig. 3B). Teriparatide was continued for 2 years. Supplementation of calcium, phosphorus, and vitamin D was not prescribed. Two years after the tibial fracture, the range of motion of the right knee was 0° in extension and 125° in flexion and the

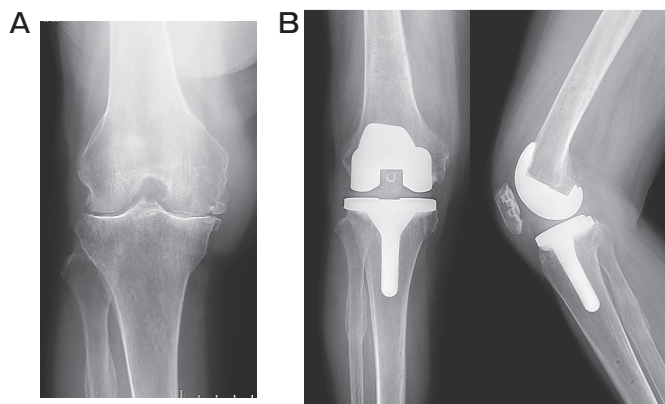


Fig. 1 Radiographs before and after the patient's total knee arthroplasty (TKA). A, Preoperative radiograph of the knee; B, Radiograph 3 months after the TKA.

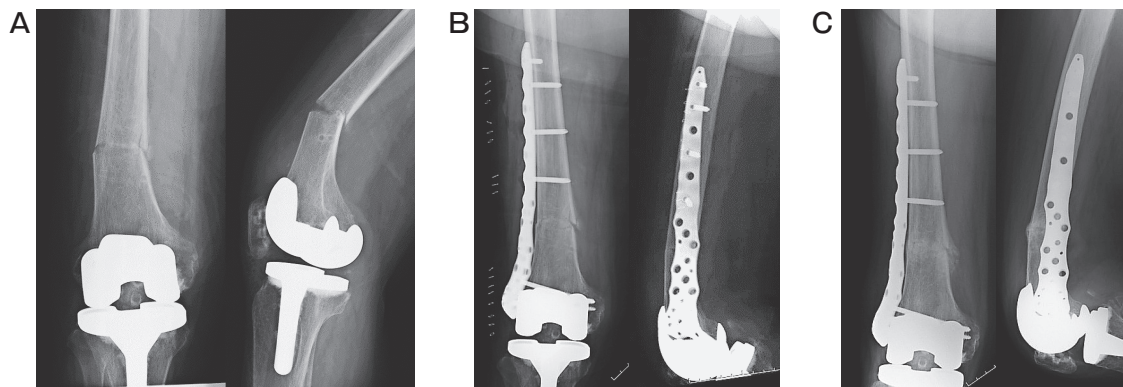


Fig. 2 Radiographs of the periprosthetic femoral fracture around the TKA. A, Initial radiograph of the peri-TKA femoral fracture. The fracture line was consistent with the tracker pin hole; B, Postoperative radiograph. A periprosthetic locking plate was used; C, Radiograph 3 months after the surgery. Bone union was achieved.

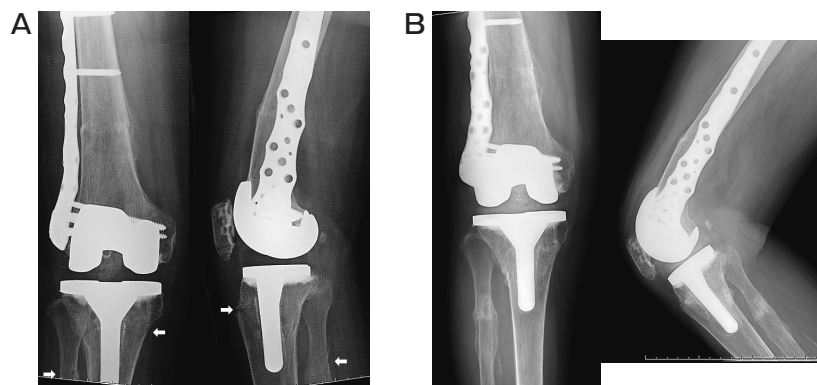


Fig. 3 Radiographs of the periprosthetic tibial fracture around the patient's TKA at a hospital visit 1 year and 6 months after the femoral fracture. **A**, Radiograph 3 weeks after the patient's fall/injury. Displacement was minimal and callus formation was observed around the fracture site; **B**, Radiograph 4 months after the injury. Bone union was achieved.

patient could walk independently. Her Knee Society System (KSS) clinical score for the right knee was 100 points and the functional score was 80 points; her pre-TKA KSS clinical and functional scores were 64 and 30 for the left side and 67 and 35 for the right side, respectively.

Discussion

Periprosthetic fractures have been reported to occur in the femoral component of TKA patients in 0.3-2.5% of primary TKA cases and 1.6-32% of revision TKA cases; fractures occur in 0.4% of tibial components [2]. Osteoporosis, RA, the administration of oral steroids, and multiple surgeries have been reported as risk factors for periprosthetic fractures [3]. Other reports state that age > 70 years, female sex, and axial malalignment and improper installation of the TKA components are risk factors [4,5]. The present patient was elderly, female, and had a history of osteoporosis and RA; no problems had been detected in the TKA components.

Reports of ipsilateral periprosthetic fractures around the knee are rare [6,7]. Jeong et al. reported an ipsilateral peri-TKA fracture due to low-energy trauma in a steroid user with RA, which is similar to the present case. They named this condition a 'floating total knee,' and their patient achieved good results after treatment with a stem-equipped artificial joint revision. Our patient's case would not be diagnosed as a floating total knee. However, a periarticular fracture on the ipsilateral side is possible, and thus steroid users and patients with comorbidities such as RA should be monitored carefully after surgery.

Fractures around a navigation tracker pin have been reported in systematic reviews [8,9]. The incidence ranges from 0.065% to 0.2%, and the causes of pin site fractures are thought to be multifactorial. As patient factors, female sex, osteoporosis, aging, higher body mass index (BMI), and comorbidities may play similar contributory roles for a periprosthetic fracture following tracker pin fixation. Surgical risk factors include bicortical pin fixation, the direction and position of the pin, multiple drilling, and the pin diameter. In our patient's case, the tracker pin hole was bicortical, from the anteromedial to the posterolateral direction. In addition, her RA and her steroid treatment may have delayed the repair of the drill hole, leading to a fracture.

The limitation of this case report is that we did not obtain the patient's menopausal status, female hormone levels, and vitamin D level. However, a low female hormone level is common in the elderly, and an elderly woman is thus at greater risk for a peri-TKA fracture. The peri-TKA fracture in our patient with RA and steroid usage may have been due to bone fragility. Clinicians should pay careful attention to symptoms around the knee following a TKA.

In summary, we treated ipsilateral peri-TKA fractures in an elderly female patient with rheumatoid arthritis. Oral steroids may have affected the onset of the fractures, and caution is therefore required in patients with rheumatoid arthritis who undergo a TKA.

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