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# Ipsilateral stress fracture of the proximal fibula after total knee arthroplasty in a patient with severe valgus knee deformity on a background of Rheumatoid arthritis

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## ABSTRACT

**INTRODUCTION:** Previous studies have reported a lower extremity stress fracture after total knee arthroplasty (TKA). However, a fibular fracture after TKA is quite rare. We report a case of proximal fibula fracture after TKA in a patient with rheumatoid arthritis (RA).

**PRESENTATION OF CASE:** A 45 year old woman with RA had severe knee and foot pain with an antalgic gait disturbance. There was a significant joint deformity in many of lower limb joints. Interval bilateral TKAs were performed two weeks apart. Right TKA was performed using a constraint-type prosthesis, through lateral parapatellar approach. Left TKA was performed using a posterior-stabilized (PS) prosthesis through the more commonly employed, medial parapatellar approach. Seven weeks after the right TKA, the patient was found to have an atraumatic proximal fibular fracture. The fracture went on to heal conservatively.

**DISCUSSION:** The fracture was considered to have occurred after the TKA. The callus appeared eleven weeks after the TKA. The factors that contributed to the fracture were thought to be overload of the fragile bone secondarily to disuse osteopaenia, RA or potentially the significant valgus malalignment correction. The surgical approach, the implant or implantation or the persisting joint deformity, were thought to be contributing factors to the aetiology of the stress fracture. The resultant change in clinical outcome/course is outlined in this case report.

**CONCLUSION:** A stress fracture of the proximal fibula has the potential in the aetiology of may cause other stress fractures, joint other instability, and/or malalignment of the total lower extremity.

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## 1. Introduction

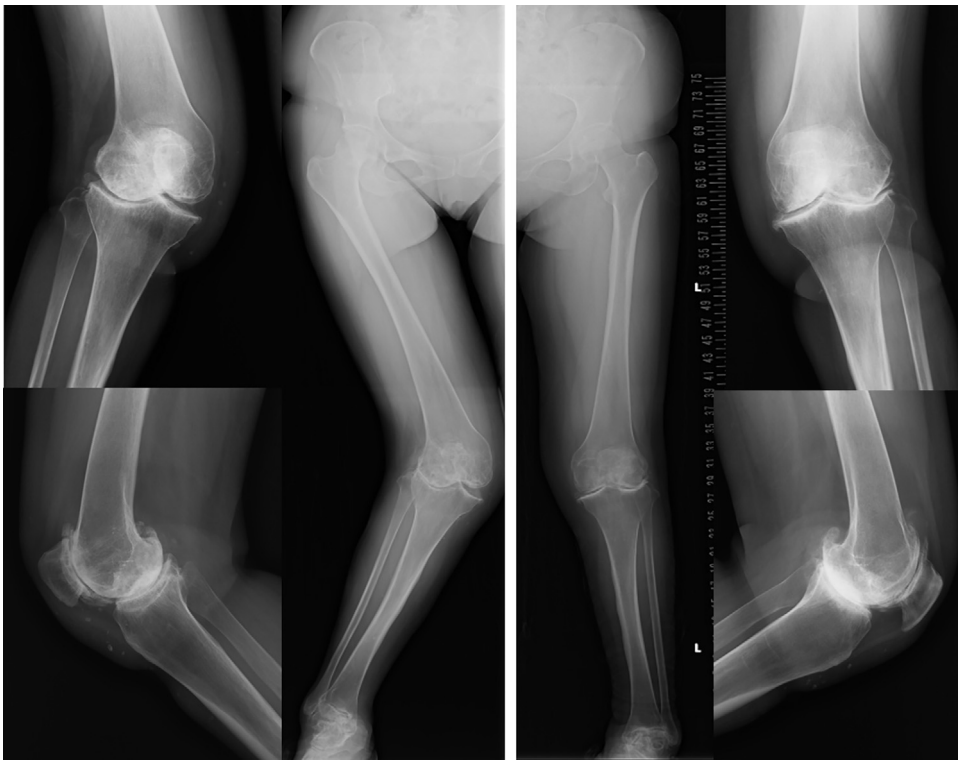
In recent years, the number of total knee arthroplasty (TKA) operations have been increasing internationally. This could be attributed to an ever increasing aging society. There have been significant advances in both technique and instrumentation, as reflected in the literature. Stress fracture of the lower extremity are a rare complication after TKA. In general, a stress fracture is divided into three types: fatigue fracture, insufficiency fracture and pathological fracture. The majority of TKA surgery is performed in an elderly population. Most stress fractures after TKA are considered insufficiency fractures. Many stress fractures after TKA in lower extremities have been reported [1–7]; however, a fibular fracture after TKA is extremely rare. To the best of our knowledge, only one case has been reported [8]. The fracture occurred fourteen years

after TKA. In this report, we describe a case of ipsilateral stress fracture of the proximal fibula at a relatively early stage post TKA. This work has been reported in line with the SCARE criteria [9].

## 2. Case report

A 45 year old woman with rheumatoid arthritis (RA) had strong difficulties with knee and foot pain with an antalgic gait disturbance. At 19 years of age (and the onset of RA), she had been treated with several steroidal, anti-rheumatic medications and biological agents at another University Hospital. However, these treatments were ineffective. Synovectomy of the knee was performed at the age of 24 years old. Recently, she has been treated with tofacitinib (Xeljanz<sup>®</sup>, XEL) and methotrexate (MTX) without steroids. She could not walk well due to persistent knee pain and limping (Video 1). The preoperative femorotibial angles while standing were measured at 130° on the right side and 168° on the left side (Fig. 1). The range of motion preoperatively was measured from –20 to 120° on both sides. Range of motion were measured by physiotherapist. Almost all the cartilage in the knee was

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**Fig. 1.** Preoperative radiographs of the knees. The radiographs show bilateral severe valgus knee deformity.



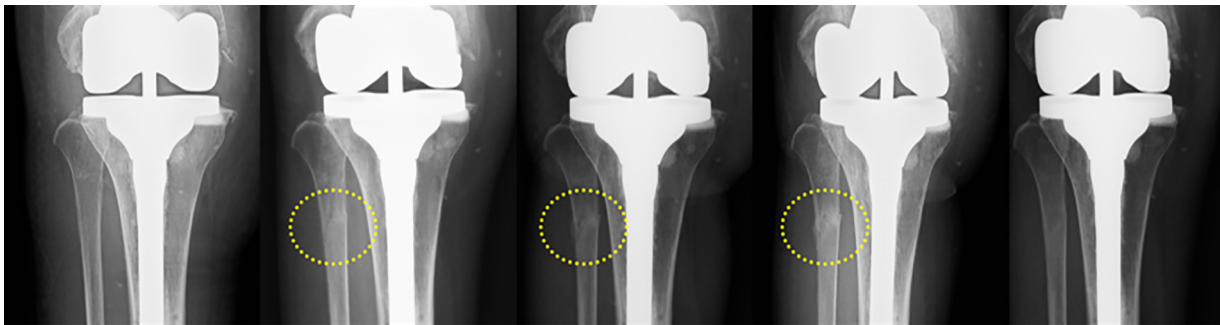
**Fig. 2.** Postoperative radiographs. The radiographs show the improved alignment of the lower limbs.

absent. Two weeks prior to surgery, the patient's treatment with XEL+MTX was withdrawn. The right TKA was performed with a lateral para-patellar approach (Keblish approach [10]) using a constraint-type prosthesis (Triathlon TS, Stryker, Mahwah, NJ). The left TKA was performed two weeks later with a medial para-patellar

approach using a posterior-stabilized type prosthesis (Triathlon PS, Stryker, Mahwah, NJ) (Fig. 2). Bilateral TKAs were performed using an image-free navigation system (Stryker, Mahwah, New Jersey). The postoperative femorotibial angles while standing were corrected to  $175^\circ$  on the right and  $174^\circ$  on the left. Three weeks



**Fig. 3.** Radiographs of the bilateral feet and ankles. Radiographs show severe deformity of the feet and ankles. We propose the patients to be treated with arthrodesis or total ankle arthroplasty in the near future.



**Fig. 4.** Radiographs obtained during the clinical course after TKA. a) Radiograph at three weeks after TKA shows no fracture. b) Radiograph at seven weeks after TKA show a fracture line without callus. c) Radiograph at eleven weeks after TKA show a fracture line with callus. d) Radiograph at fifteen weeks after TKA show a fracture line with more callus. e) Radiograph at one year after TKA show that the bony union has maintained alignment.

after the right TKA, there was no postoperative complications such as infection, delayed wound or peripheral nerve issues. Four weeks post-surgery, XEL+MTX was restarted. The preoperative range of motion improved from 0 to 130° on both sides. We also noted that the postoperative gait posture had improved (Video 2). Bilateral ankle deformities remained (Fig. 3). Seven weeks post-surgery, the patient was discharged from the Hospital free from knee pain. At the outpatient clinic, eleven weeks after the operation, a proximal fibular fracture with callus was diagnosed. Reviewing the radiographs taken at seven weeks, there was a non-displaced proximal fibular fracture without callus (Fig. 4). We missed the proximal fibular fracture at that time. Fortunately, fracture union was achieved by conservative measures without malalignment of the lower extremity. At the final follow-up, eighteen months after the right TKA, the patient was able to walk without knee pain. There has been no early loosening of the prosthesis.

### 3. Discussion

It is uncertain when the insufficiency fracture of the proximal fibula occurred. It has been previously reported that a severely malalignment valgus knee is commonly associated with a stress fracture of the proximal fibula [11,12]. In these cases, the fracture occurred before surgery. In our case report, there was no fracture in the radiographs three weeks after the TKA (Fig. 4). Intra-operative

iatrogenic fracture during TKA [13–15] has been reported in the literature previously. Phadnis et al. reported an avulsion fracture of the fibular head in correcting a severe valgus knee [13]. A proximal fibula fracture after the TKA is extremely rare. To the best of our knowledge, only one such case has been reported [8]. The radiographs seven weeks after the TKA showed a proximal fracture without callus, while the radiographs eleven weeks after the TKA showed the fracture with callus. We concluded that the proximal fibular fracture in our case must have occurred after the TKA according to the appearance/morphology of the callus at the time.

We questioned why the fibular fracture occurred. Even though the severity of the malalignment in the valgus knee was corrected (Fig. 5), the proximal fibular fracture occurred. Many stress fractures after TKA in the pelvis, femur, tibia, patella, calcaneus and metatarsal bones have been reported before [1–7]. In those reports, the mechanism to fracture were considered to be: (1) bone fragility caused by rheumatoid arthritis (2) disuse osteopaenia secondarily to symptom related restriction on the patients' activity, pre-operatively (3) postoperative overload due to high activity from the lack of severe knee pain (4) the realignment from significant malalignment (5) progress of the intraoperative micro fracture after TKA and (6) improper component orientation. Some of these factors applied to our case. The patient had juvenile rheumatoid arthritis with protracted periods of steroid use. The patient also had osteoporosis, which was being treated with Denosmab. Bone





**Fig. 5.** Pre-and post-operative photographs. The photographs show a dramatic change in the knees.

quality intra-operatively was found to be very poor. Chronic inflammatory disease, including rheumatoid arthritis, often accompanies osteoporosis and stress fracture [16,17].

We also focused on the gait posture after TKA, protecting the severe deformities of her ankles (Video 2). The reason why the fracture occurred in the proximal fibula might have been because the soleus muscle, biceps femoris and peroneus muscle originating at the proximal fibula had abnormal load due to this gait form. We propose the patients to be treated with arthrodesis or total ankle arthroplasty in the near future.

The other factor that may have caused the stress fracture of the proximal fibula was the prosthesis type used for TKA. Only one case of stress fracture of the fibula after TKA has been reported; Vaish et al. reported a proximal fibular fracture fourteen years after a TKA using a posterior-stabilized implant [8]. In this report, the valgus deformity of the knee had progressed after the proximal fibular fracture and the medial collateral ligament collapsed. The constraint-type prosthesis may prevent the instability of the knee. It was not a proximal fibular fracture after the TKA but instead, a stress fracture of the fibula that occurred in a severe valgus knee, which accompanied a stress fracture of the tibia. This exacerbated the valgus knee. The fibula bone plays an important role as a strut in the knee. If there is malalignment of the lower extremity, the collapse of the medial collateral ligament might have occurred after the proximal fibula stress fracture. It is essential to correct proper alignment in cases of TKA for severe valgus knee deformity. In this case report, the right knee was operated using a lateral approach, releasing the iliotibial band and cutting the origin of the lateral collateral ligament and popliteus tendon. This procedure helps to correct the severe valgus knee deformity [18,19] but it involves the risk of overloading the medial collateral ligament in the future. Many stress fractures of the tibia occur in the proximal tibia, which is located a little far from the keel of the tibial implant. Long stem implants help reduce the stress concentration and prevent these stress fractures of the tibia. Although there was a report about an adverse event after TKA [20], the constraint-type prosthesis and long stem implant that secure the stability of the knee are considered good choices in TKA for the severely deformed valgus knee.

#### 4. Conclusion

We report on an ipsilateral stress fracture of the fibula at a relatively early stage after TKA for severe valgus knee deformity correction. Severe valgus knee accompanied by fibular stress fracture may cause a tibial stress fracture, a collapse of medial collateral ligaments and the progression of the valgus deformity. It is essen-

tial to correct proper alignment in cases of TKA for severe valgus knee deformity. Further careful follow-up is needed to study fibular stress fractures after TKA.

#### Conflict of interest

All authors declare no conflict of interest relevant to this case report.

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This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

#### Ethical approval

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

A copy of the written consent is available for review by the Editor in Chief of this journal on request.

The final draft for the submission was considered by the Ethical Review Committee, meets the requirements of Ethical Guidelines for Medical and Health Research Involving Human Subjects (2014) and was approved.

Approval Number: JMC242-1725

Ethical Review Committee Kumamoto Kinoh Hospital

#### Consent

We have obtained a written and signed consent from the patient to publish the case report.

#### Author contribution

All authors contributed to the article. Study design was created by HT and TT. All data were collected by MM and HT. HT, SK, and NN participated in the clinical treatment. The manuscript was written by HT. All authors read and approved the final version of this manuscript.

#### Guarantor

Hirokazu Takai MD, corresponding author.

#### Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.ijscr.2018.02.042>.

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