



Case Report

Anterior cruciate ligament avulsion fracture following medial unicompartmental knee arthroplasty: A case report

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ARTICLE INFO

Keywords:

Anterior cruciate ligament
Avulsion fracture
Unicompartmental knee arthroplasty

ABSTRACT

Introduction: Anterior cruciate ligament (ACL) avulsion fracture after unicompartmental knee arthroplasty (UKA) has not been reported until recently. We describe a case of ACL avulsion fracture that developed after medial UKA.

Case presentation: A 57-year-old woman underwent UKA for right medial compartment osteoarthritis. She developed knee pain and swelling at 2 weeks after UKA, and radiographs showed an ACL avulsion fracture at 3 weeks after UKA. After conservative treatment failed, the fracture was fixed using screws. After 5 months from internal fixation, bone union was confirmed, and the screws were removed. At 16 months after removing screws, there was no further complication.

Discussion: The patient did not exhibit a fracture on the radiograph taken immediately after UKA. We carefully re-examined the radiographs and observed a 5-mm horizontal cement shadow on the lateral side of the tibial component. It is thought that excessive lateral resection of the proximal tibia during UKA may have resulted in a micro fracture and this outcome. In the present case, the posterior slope angle of the tibial component measured postoperatively was 11.5 degrees. The angle of more than 7 degrees along with excessive horizontal resection of the proximal tibia probably increased load on the ACL.

Conclusion: If patients exhibit a horizontal cement shadow near the tibial component and a higher posterior slope angle of the tibial component on the radiograph after UKA, surgeons should be aware of possible ACL avulsion fracture and perform additional radiological examinations in patients with continuous knee pain and swelling.

1. Introduction

Unicompartmental knee arthroplasty (UKA) has been established as a successful surgical treatment for medial compartment osteoarthritis. Although there have been multiple reports of complications after UKA, proximal tibia fracture has been rarely reported [1–3], and anterior cruciate ligament (ACL) avulsion fracture has not been reported until recently. We describe a case of ACL avulsion fracture that developed after medial UKA.

The study was approved by the Institutional Review Board of the institution (no. 2019-02-008). 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. This case report has been reported in line with the SCARE criteria [4].

2. Presentation of case

A 57-year-old female patient underwent right-sided unicompartmental knee replacement for medial compartmental osteoarthritis using Miller-Galante II (Zimmer, Warsaw, USA). Full weight-bearing and range of motion exercise were started at three days after the operation. She had no relevant medical and family histories. She also had no allergies. On the radiograph taken immediately postoperatively, there were no signs of fracture. However, the patient developed persistent knee pain and swelling at 2 weeks postoperatively and came to the hospital at 3 weeks postoperatively. Radiograph was taken and indicated the presence of tibia plateau fracture. The patient was diagnosed with a type 2 ACL avulsion fracture according to the Meyers and McKeever Classification, with confirmed displacement of the anterior portion of the bone fragment [5]. As the patient was in her late 50s and was not expected to perform a high level of physical activities, especially

Abbreviations: ACL, anterior cruciate ligament; UKA, unicompartmental knee arthroplasty; CT, computed tomography.

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<https://doi.org/10.1016/j.amsu.2021.102328>

Received 1 February 2021; Received in revised form 10 April 2021; Accepted 13 April 2021

Available online 19 April 2021

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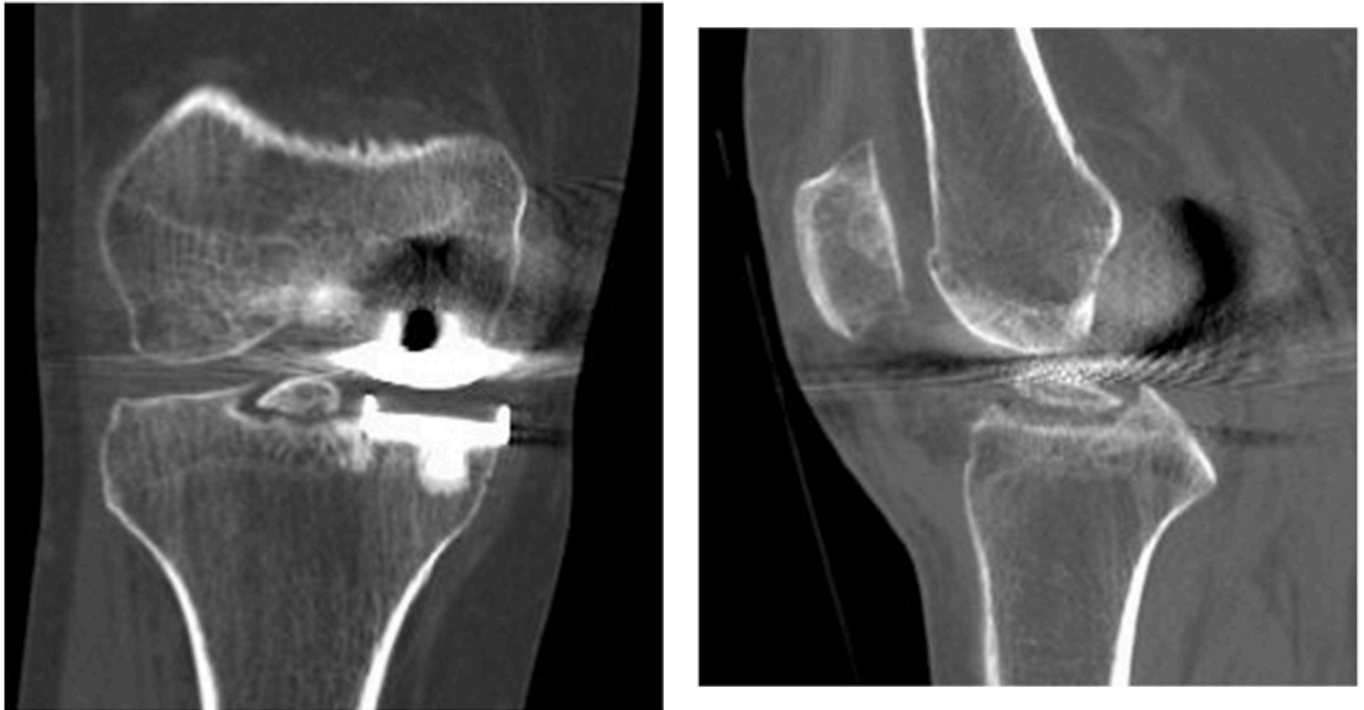


Fig. 1. Computed tomography scans in the coronal view (A) and sagittal view (B) at 4 months after unicompartmental knee arthroplasty showing complete displacement of the tibial eminence fracture fragment.

after unicompartmental knee replacement, we decided to perform conservative treatment using a long-leg cast.

At 4 months after UKA, the patient continued to experience pain and swelling in the knee joint. Computed tomography (CT) was performed and indicated that displacement of the bone fragment had worsened to a type 3A ACL avulsion fracture (Fig. 1A and B), and radiographs showed medial subluxation of the tibia (Fig. 2) as well as increased valgus alignment of the lower limb from 3 degrees (immediately postoperatively) to 7 degrees (Fig. 3A and B). Consequently, additional surgery using arthroscopy was decided to perform. After confirming that there was no damage to the structure of the ACL, arthroscopic debridement was performed near the bone fragment, and internal fixation was performed using cannulated screws (Fig. 4A and B). The operation was performed by the author, who is a faculty member of district general hospital and has over 10 years of experience. Radiography performed postoperatively suggested improvements in subluxation of the tibia and valgus alignment of the lower limb to 4 degrees. After 5 months from internal fixation, pain and swelling of the knee joint improved, bone union was confirmed, and the screws were removed

(Figs. 5 and 6). At 16 months after removing screws, the patient complained no symptom and the radiograph showed no further complication (Fig. 7).

3. Discussion

There are very few reports on tibia plateau fracture after unicompartmental knee replacement. On the basis of the studies published until now, insertion of surgical pins into the area near the medial cortical bone [1], insertion of more than 3 pins [2], or destruction of the posterior tibial cortex during the formation of keels for the tibial insert [3] may lead to the development of tibia plateau fracture. Moreover, there has not been any report on ACL avulsion fracture occurring after UKA. The patient herein did not exhibit a tibia plateau fracture on the radiograph taken immediately after UKA, and ACL avulsion fracture was confirmed 3 weeks postoperatively. The findings of this case report suggest that patients with persistent pain and swelling in the knee after UKA should undergo early assessments with radiography or CT. We carefully re-examined the radiographs obtained after the primary

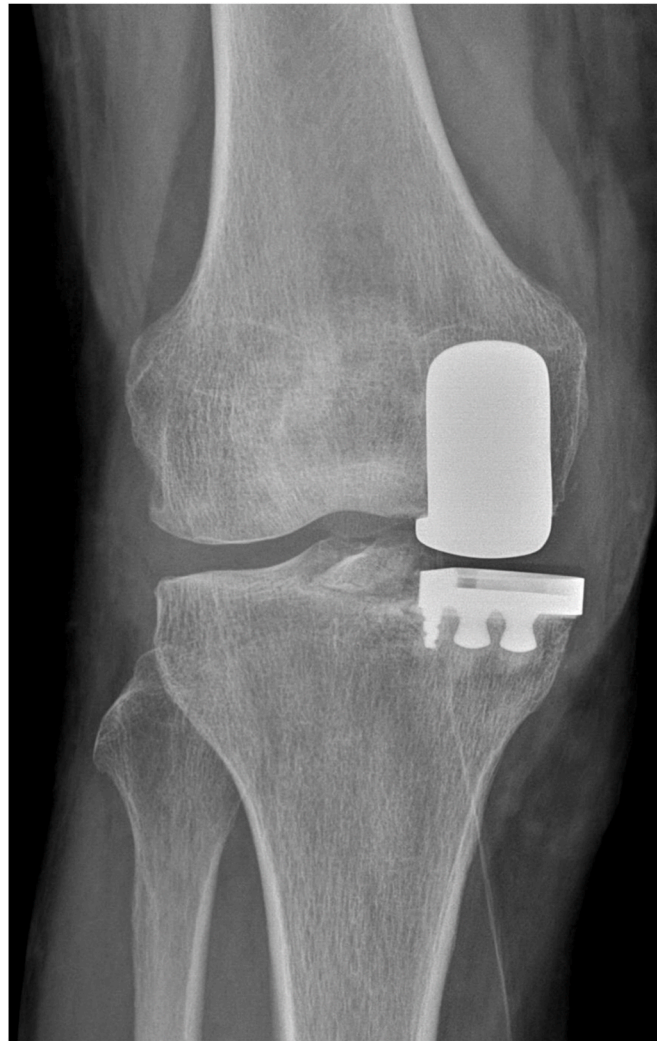


Fig. 2. Simple anteroposterior radiograph showing medial subluxation of the proximal tibia.

operation and observed a 5-mm horizontal cement shadow on the lateral side of the tibial component (Fig. 8A). The shadow shared the same location on the bone fragment that was confirmed by CT. It is thought that excessive lateral resection of the proximal tibia during UKA may have resulted in a micro fracture and this outcome.

When performing UKA with reduced function of the ACL, Suero et al. [6] reported—in their study using cadavers—that lowering the posterior slope angle of the tibial component by 8 degrees can reduce the anterior movement of the tibia by 5 mm. Furthermore, Hernigou and Deschamps [7]—in their study with living human participants—demonstrated that more than 7 degrees of a posterior slope angle of the tibial component can increase the failure rate of replacement surgery. In the present case, the posterior slope angle of the tibial component measured post-operatively was 11.5 degrees. Although this is not largely different from the posterior slope angle of the preoperative tibial joint surface (10.5 degrees), the angle of more than 7 degrees along with excessive horizontal resection of the proximal tibia probably increased load on the attachment site of the ACL (Fig. 8B).

The knee joint is known to exhibit several accompanying kinematic changes with ACL injuries. Li et al. [8] reported that 15 or 30 degrees of flexion of the knee joint increases the incidence of medial subluxation of the tibia or valgus deformity of the knee joint. In their study of cadavers, Matsumoto et al. [9] reported that medial rotation of the tibia caused by ACL injuries accompanied by posterior slope of the tibial joint surface can cause the development of valgus deformity of the knee joint. Herein, the patient exhibited medial subluxation of the tibia and worsened valgus alignment of the lower limb from 3 to 7 degrees after ACL avulsion fracture. Another previous study by Hernigou and Deschamps [10] suggested that more than 10 degrees of varus alignment or valgus alignment of the knee joint after UKA increased wear of the polyethylene insert. Additionally, Perkins and Gunckle [11] reported that patients with varus alignment of more than 3 degrees or valgus alignment of more than 7 degrees have a greater risk of revisional surgery. We initially considered and attempted conservative treatment based on minor displacement of the ACL avulsion fracture fragment and the patient's age. However, after the patient started to exhibit poor prognostic

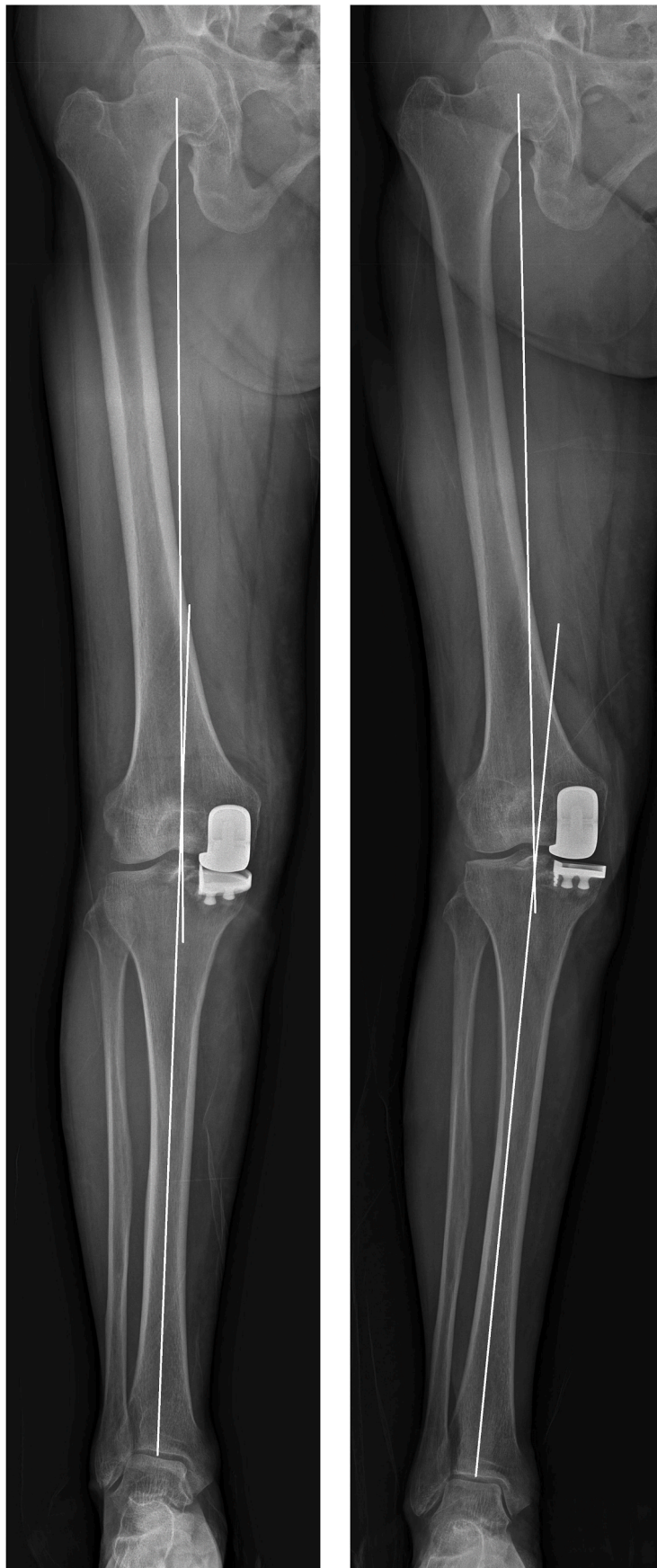


Fig. 3. Lower extremity anteroposterior radiographs showing increased valgus angle of the knee joint after complete displacement of the fracture fragment from 3° (A) to 7° (B).

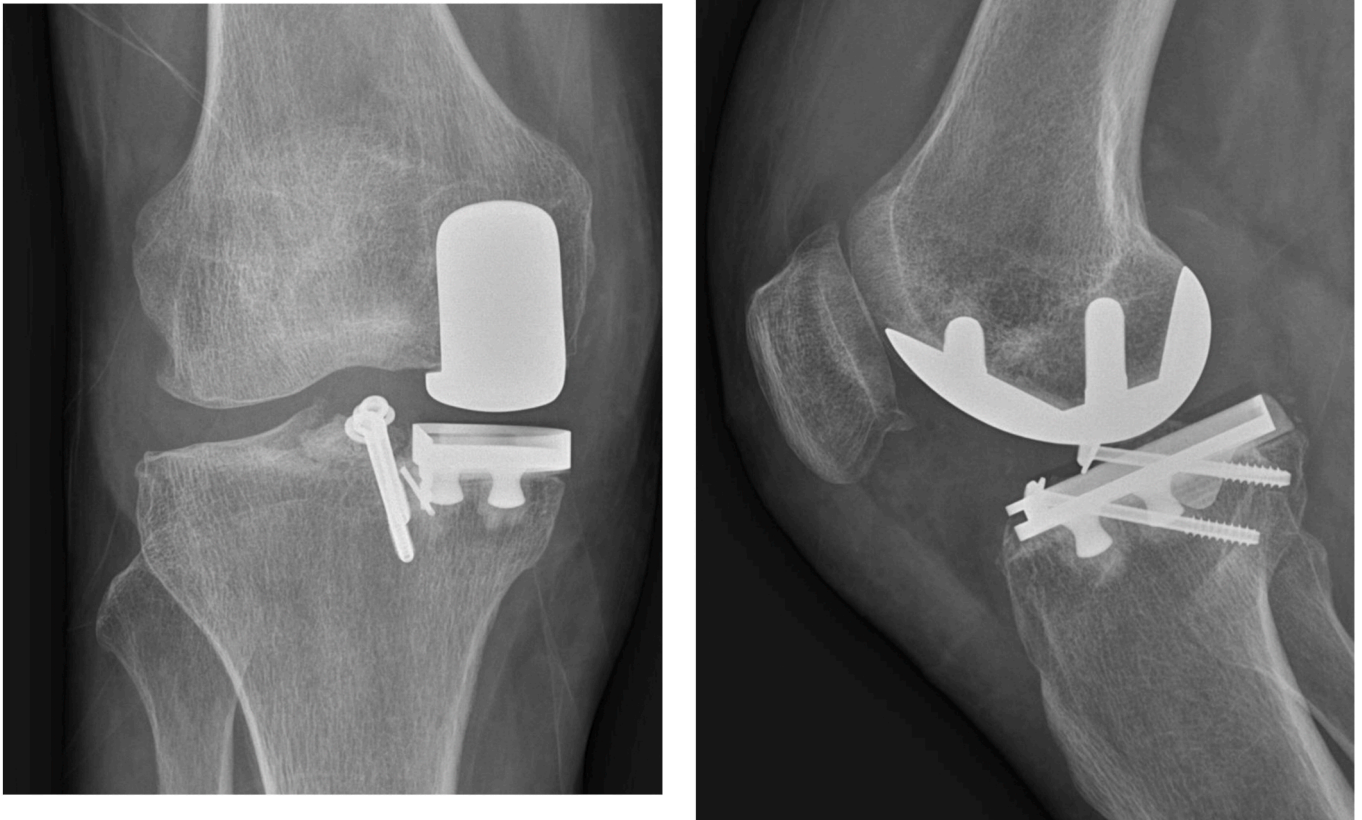


Fig. 4. Simple anteroposterior (A) and lateral (B) radiographs showing reduction and fixation of the fragment using two cannulated screws.



Fig. 5. Simple anteroposterior radiograph showing bone union of the tibial eminence and reduced medial subluxation of the tibia.



Fig. 6. Lower extremity anteroposterior radiograph showing a reduced valgus angle (4 degrees) of the knee joint after fixation of the fracture fragment.



Fig. 7. Simple anteroposterior radiograph showing maintained bone union of the tibial eminence.

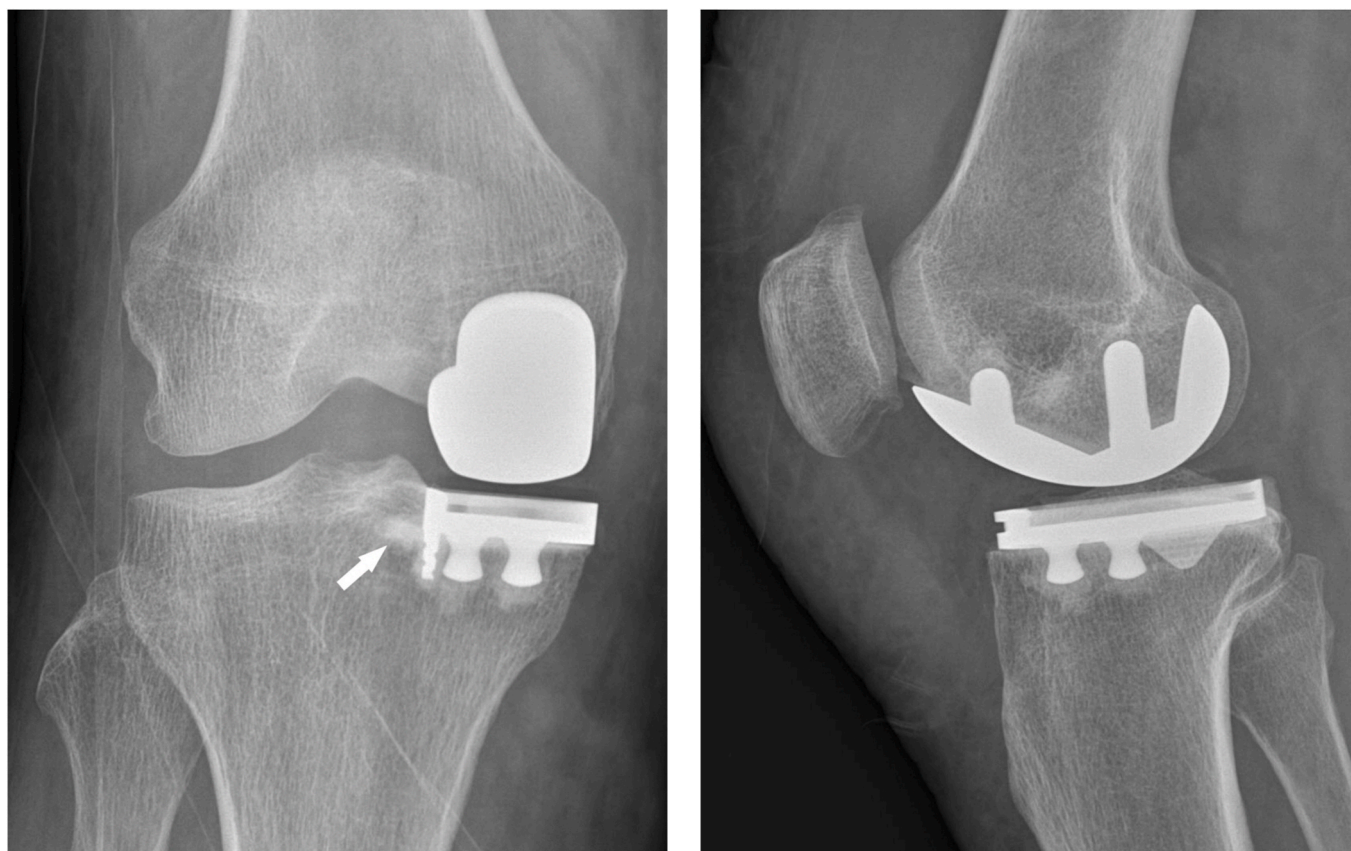


Fig. 8. (A) Simple anteroposterior radiograph taken immediately after UKA showing a horizontal cement shadow near the tibial component (white arrow). (B) Simple lateral radiograph taken immediately after UKA showing a high posterior slope (11.5°) of the tibial component.

factors of UKA, including subluxation of the tibia and worsened valgus deformity of 8 degrees, we considered additional surgical treatment.

4. Conclusion

As shown in the present case, if patients exhibit a horizontal cement shadow near the tibial component on the radiograph after UKA, surgeons should be aware of possible ACL avulsion fracture and perform additional radiological examinations in patients with continuous knee pain and swelling. Furthermore, patients who develop a fracture should be considered for early surgical interventions.

Patient perspective

The procedure of surgery was explained to the patient with all advantage and possible complications. She agreed to the procedure and provided informed consent.

Informed consent

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.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Ethical approval

The study was approved by the Institutional Review Board of my institution (no. 2019-02-008).

Sources of funding

None.

Author contribution

Sang Jin Lee performed the operation, collected the data and wrote the manuscript.

Research registry

This paper is case report. The author does not need to register this work.

Guarantor

Sang Jin Lee.

Declaration of competing interest

Author has nothing to disclose.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2021.102328>.

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