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Original Research

Tibial Post Refracture in Posterior-Stabilized Total Knee Arthroplasty Following Isolated Tibial Insert Exchange

Ji-Hoon Baek, MD [a], Su Chan Lee, MD [a], Suengryol Ryu, MD [b], Chang Hyun Nam, MD [a, *]

[a] Joint & Arthritis Research, Department of Orthopaedic Surgery, Himchan Hospital, Seoul, South Korea
[b] Department of Orthopaedic Surgery, Himnaera Hospital, Busan, Republic of Korea

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ABSTRACT

Background: We report 4 cases with a tibial post refracture following isolated tibial insert exchange in posterior-stabilized total knee arthroplasty at a single center.
Methods: In our institution, 27 cases (26 patients) underwent reoperation due to tibial post fracture in posterior-stabilized total knee arthroplasty between July 2008 and November 2020. Of these 27 cases, 4 (4 patients) tibial post refractures occurred at a mean follow-up period of 9.1 years.
Results: All 4 cases of tibial post refracture occurred in a group of 21 cases with isolated tibial insert exchange. There was no tibial post refracture in patients with a tibial revision surgery. The incidence of this complication following isolated tibial insert exchange was 19.0%. The mean elapsed time from tibial insert exchange to the diagnosis of a post refracture was 2.5 years (range: 1.1–6.6 years).
Conclusions: Isolated exchange of a tibial insert with excessive thickness as a treatment for tibial post fracture is associated with a high probability of tibial post refracture. The treatment method should be selected after a thorough analysis according to the cause of fracture.
Level of evidence: IV.

Introduction

The posterior-stabilized (PS) total knee prosthesis is commonly used for total knee arthroplasty (TKA). This prosthesis features a femoral cam and tibial post mechanism that can limit posterior displacement and enhance femoral rollback. However, there are concerns about the risk of fracture of the tibial insert post due to potential weakness of the post in PS TKA [1,2]. This protruding part of the tibial insert can be a focal point for continuous and repeated loading. Several cases of tibial insert post fracture in a variety of PS total knee prostheses have been reported [1,3–6].

Although the exact incidence of tibial post fracture following TKA is difficult to estimate due to several design aspects of the chosen prosthesis, it has been reported to be <1% to 1.2% in a systematic review article by Lachiewicz [2]. However, the literature examining tibial post refractures following isolated tibial insert exchange in PS TKA is scarce. Thus, the objective of this TKA case series was to report 4 cases of tibial post refracture following isolated tibial insert exchange in PS TKAs at a single center.

Material and methods

The design and protocol of this retrospective study were approved by the institutional review board of our hospital, which waived the requirement for informed consent. From July 2008 to November 2020, 27 knees (26 patients) underwent reoperation due to tibial post fracture in PS TKAs at a single center. The mean time from index TKA to the diagnosis of the post fracture was 5.8 years (range: 0.5–13.0 years). Of these knees, 21 (21 patients) were replaced with a thicker conventional tibial insert with retention of femoral and tibial components, and 6 (5 patients) were treated by revision surgery of the tibial component. Of these 27 knees, 4 (4 patients) experienced tibial post refracture at a mean follow-up period of 9.1 years (range: 1.0–13.3 years).

Demographic data (including sex, age, and initial diagnosis) for all 4 patients with a tibial post refracture were obtained by reviewing their medical records. All surgical procedures were

* Corresponding author. Joint & Arthritis Research, Department of Orthopaedic Surgery, Himchan Hospital, 120, Sinmok-ro, Yangcheon-gu, Seoul, Republic of Korea. Tel.: +82 2 3219 9229.
E-mail address: himchanhospital@gmail.com

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performed using the standard medial parapatellar approach with sacrifice of anterior and posterior cruciate ligaments in all patients. All implants were inserted with cement. Patients were mobilized postoperatively with immediate weight-bearing as tolerated, and active exercise was initiated under supervision of a physiotherapist. Patients underwent clinical and radiographic follow-up at postoperative 2 weeks and 6 weeks; 3, 6, 9, and 12 months; and then yearly thereafter. Any patients who did not return for their scheduled follow-up evaluations were contacted by telephone. Two nurses and 1 private doctor contacted and visited these nonresponders. Patients with a history of revision operation following a TKA were encouraged to revisit our hospital. Assessment of tibial post fractures was carried out using hospital records and/or by patient interview. Patients who were unable to attend follow-up evaluations were interviewed by telephone.

Results

The 4 cases of tibial post refracture occurred within 21 cases with isolated tibial insert exchange. There were no trauma history or other precipitating incidents. There were no cases of tibial post refracture within 6 cases with a tibial revision surgery. The mean time from tibial insert exchange to the diagnosis of post refractures was 2.5 years (range: 1.1–6.6 years). Patient demographic and radiographic information on these 4 patients with tibial post refractures are presented in Table 1. In 2 cases (patients 1 and 2), the rebroken tibial insert was replaced with a thicker compatible total stabilizer (TS) tibial insert with retention of femoral and tibial components (Figs. 1–3). Two cases (patients 3 and 4) were treated by tibial revision surgery with a TS tibial insert (Figs. 4 and 5).

Discussion

Surgical treatment is necessary in the management of a tibial post fracture following TKA. The most frequent treatment for tibial post fractures is resurgery with isolated tibial insert exchange, usually increasing the thickness of the insert by 2 mm to 6 mm [2]. Lachiewicz [2] has reported that isolated tibial insert exchange can be successful for at least 2 to 5 years if components have proper alignment or rotation. Lim et al. [7] have recommended a complete revision surgery if the components are loose or malpositioned. Other studies involving various knee problems such as wear and instability have cautioned that isolated tibial insert exchange is associated with a high probability of a revision surgery [8,9]. In our study, broken tibial inserts of 21 cases were replaced with a thicker tibial insert with retention of femoral and tibial components, and 6 cases were treated by tibial revision surgery. All 4 cases with tibial post refractures occurred in patients receiving isolated tibial insert exchange. The incidence of a tibial post refracture following isolated tibial insert exchange was 19.0% at a mean follow-up period of 9.1 years, suggesting that this complication was not rare. Therefore, isolated tibial insert exchange following tibial post fractures should be considered after determining whether components and knee status could cause a tibial post refracture.

The primary cause of the tibial post fracture is impingement of the anterior tibial post. Several studies have shown wear and deformation of the anterior side on the tibial post in various designs of PS prostheses [10–12]. In addition, several etiologies of tibial post fractures have been proposed, including anterior impingement due to improper femoral and tibial component positions [10,13], inaccurate ligament balancing [6], gradual ligament stretching [14], high-flexion range of motion [5], alteration of knee joint line [15], and inadequate tibial post design [11]. In our study, all 4 cases were treated by implanting a significantly thicker tibial insert after the first tibial post fracture. This might mean that there was a primary

Table 1
Demographics of patients with a tibial post refracture.

Patient no.	Sex	Age at primary TKA (y)	Initial diagnosis	Side	Coronal alignment (post TKA)	Flexion angle of the femoral component	Posterior tibial slope	Type of prosthesis	Time between primary TKA and post fracture (mo)	Time between insert exchange and post refracture (mo)	Final treatment
1	F	63	OA	L	1.9° varus	4.8° flexion	2.0°	Scorpio NRG	9	13	TS insert exchange
2	F	59	OA	L	0.7° valgus	5.0° flexion	2.4°	Scorpio Superflex	76	79	TS insert exchange
3	F	67	OA	R	3.1° varus	7.0° flexion	8.0°	Scorpio Superflex	18	13	Tibial revision
4	F	63	OA	L	1.8° varus	4.0° flexion	1.8°	Scorpio Superflex	6	13	Tibial revision

F, female; L, left; NRG, nonrestrictive geometry; OA, osteoarthritis; R, right.

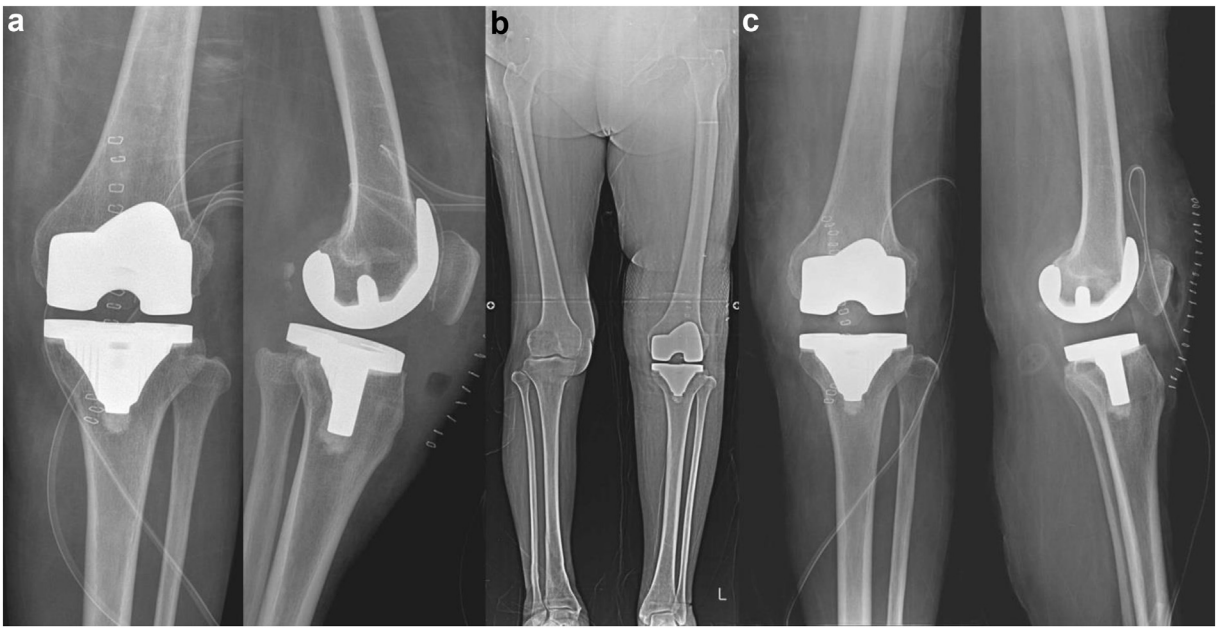

Figure 1. (a) Patient 1. A 63-year-old female underwent left total knee arthroplasty (TKA) with a 10-mm tibial insert. A lateral radiograph shows a femoral component flexion angle of 4.8° and a posterior tibial slope of 2.0°. (b) A postoperative standing anteroposterior (AP) radiograph shows a left hip-knee-ankle (HKA) angle of 1.9°. (c) She underwent isolated tibial insert exchange with an 18-mm tibial insert following tibial post fractures.

imbalance in the knee that could lead to failure at the time of the first surgery. In 2 of our patients (patients 1 and 2), postoperative alignment and positions of components were within normal limits. The failure mechanism of tibial post refracture was likely due to isolated tibial insert exchange with excessive thickness from 10 to 18 mm. The use of a thicker tibial insert is associated with elevation of

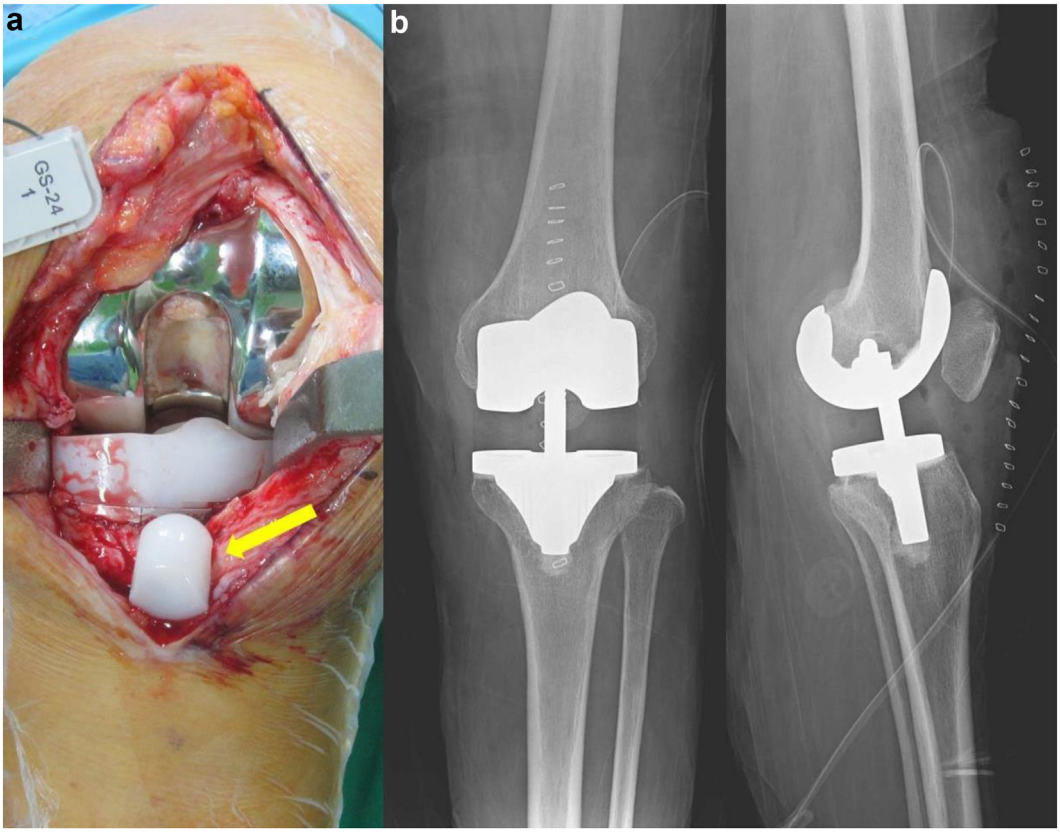

Figure 2. (a) Intraoperative photographic findings of patient 1. A broken tibial post (yellow arrow) was found in the intercondylar notch. (b) Postoperative radiographs showing exchange for a total stabilizer (TS) tibial insert with an increased thickness (21 mm) after a tibial post refracture.

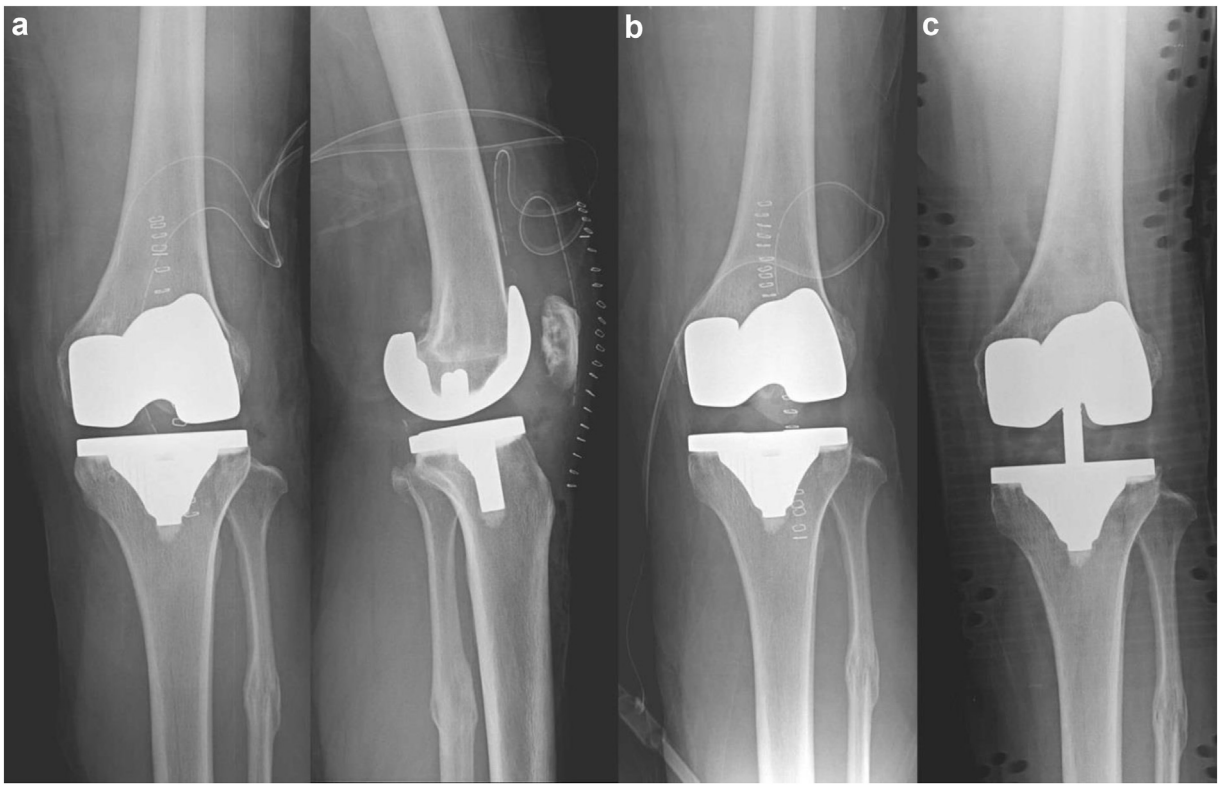

Figure 3. (a) Patient 2. A 59-year-old female underwent left TKA with a 10-mm tibial insert. A lateral radiograph shows a femoral component flexion angle of 5.0° and a posterior tibial slope of 2.4°. (b) She underwent isolated tibial insert exchange with an 18-mm tibial insert following a tibial post fracture. (c) A postoperative radiograph shows exchange for a TS tibial insert with an increased thickness (21 mm) after a tibial post refracture.

the knee joint line. Join line alteration of 8 mm or more can predispose a knee to anterior impingement and failure of the tibial post [15]. Therefore, components were properly positioned, and refractured tibial inserts were replaced with durable TS tibial inserts with retention of femoral and tibial components. In our patient 3, the postoperative femoral component was placed in a flexed

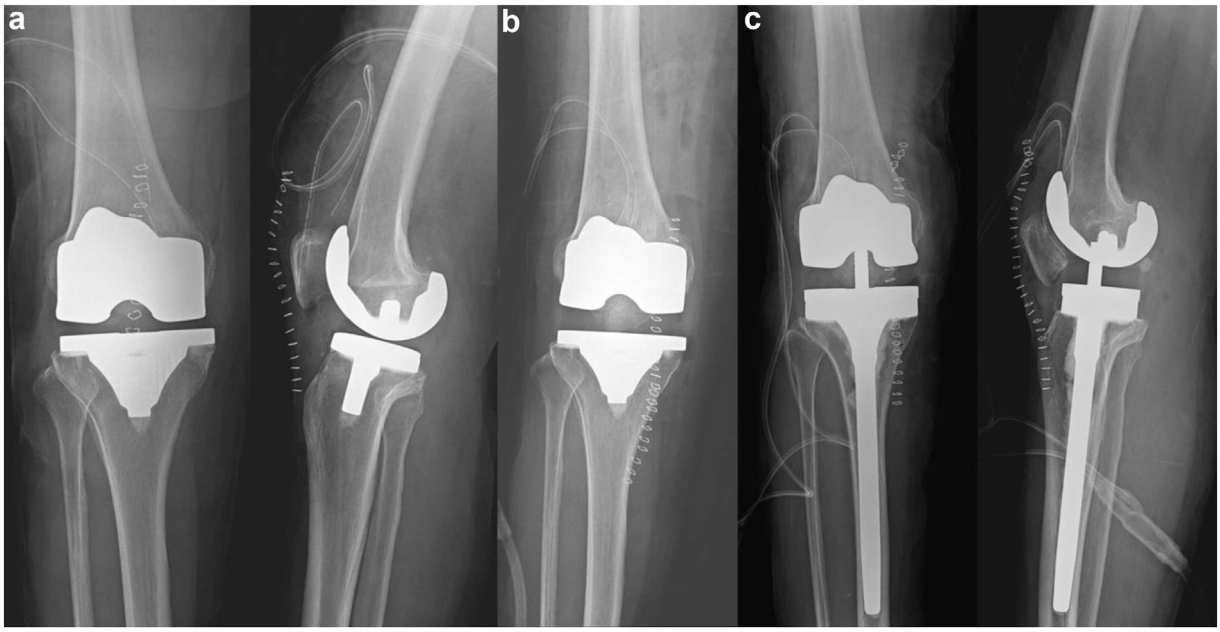

Figure 4. (a) Patient 3. A 67-year-old female underwent right TKA with a 10-mm tibial insert. A lateral radiograph shows a femoral component flexion angle of 7.0° and a posterior tibial slope of 8.0°. (b) She underwent isolated tibial insert exchange with an 18-mm tibial insert following a tibial post fracture. (c) Postoperative radiographs show tibial revision surgery with TS tibial insert after a tibial post refracture.

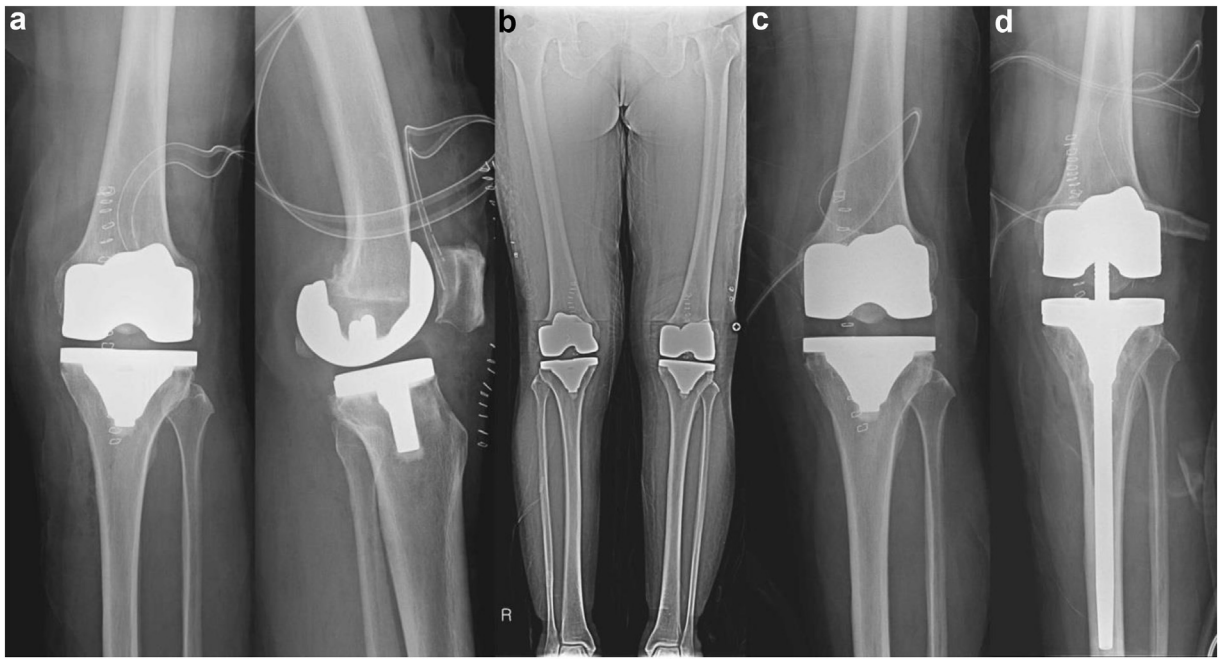

Figure 5. (a) Patient 4. A 63-year-old female underwent left TKA with a 10-mm tibial insert. A lateral radiograph shows a femoral component flexion angle of 4.0° and a posterior tibial slope of 1.8°. (b) A postoperative standing AP radiograph shows an HKA angle of 1.8°. (c) She underwent isolated tibial insert exchange with a 15-mm tibial insert following a tibial post fracture. (d) Postoperative radiograph shows tibial revision surgery with a TS tibial insert after a tibial post refracture.

position, and the tibial component had an excessive posterior slope. The failure mechanism of the tibial post refracture was likely anterior impingement of the femoral component on the anterior base of the tibial post. Therefore, patient 3 was treated by tibial revision surgery. For patient 4, we were unable to determine the possible cause of the tibial post refracture. However, patient 4 was treated by tibial revision surgery because the extension and flexion gap were too big for a simple TS tibial insert replacement during a surgery.

There is no established treatment for fracture of the tibial insert post. The definitive treatment is revision surgery of components of the prosthesis according to the cause of the tibial post fracture. Because it is not easy to know the exact cause of tibial post fractures and the component exchange in revision TKA procedures is an enormous challenge, isolated tibial insert exchange is the most frequent treatment for a tibial post fracture. Advantages of isolated exchange of tibial inserts include preservation of the bone stock, a shorter operation time, less blood loss, faster rehabilitation, and lower cost [16]. Nevertheless, tibial post refracture after isolated tibial insert exchange in PS TKA is an adverse effect that should not be overlooked, and isolated exchange of the tibial insert with excessive thickness should be addressed.

This study had several limitations. First, because there were only few cases with tibial post refractures at a single center, generalization about these outcomes was limited. Second, the incidence of a tibial post refracture might be underdiagnosed or underreported due to the retrospective study design. However, a strength of this study was that it was the first one to examine tibial post refractures following isolated tibial insert exchange in PS TKA at a mean follow-up period of 9.1 years.

Conclusion

In conclusion, recommendations for managing tibial post fractures are limited. However, isolated exchange of the tibial insert with excessive thickness as a treatment of tibial post fractures is associated with a high probability of tibial post refractures. Surgeons should select the treatment method after a thorough analysis according to the cause of the tibial post fracture.

Conflicts of interest

The authors declare there are no conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2022.101075.

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