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Case Report

Medial Patellar Instability Following Total Knee Arthroplasty

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ABSTRACT

Although lateral patellar instability has been discussed as a complication following total knee arthroplasty (TKA), there are no published reports of medial patellar instability. We present a case of a 72-year-old female patient with a remote history of medializing tibial tubercle osteotomy who underwent TKA complicated by a medial dislocation of the patella. Management consisted of lateral retinaculum imbrication, revision of the patellar component, and lateralizing tibial tubercle osteotomy in the setting of appropriate rotation of the tibial and femoral components. It is important to be aware of medial patellar instability as well as potential treatment options as this is a rare complication that can occur following TKA.

Introduction

Extensor mechanism complications following total knee arthroplasty (TKA) are a common cause for revision surgery [1-6]. Such complications may include patellar fracture, loosening or wear of the patellar component, and patellofemoral joint maltracking with instability or dislocation. Component design, placement, rotation and alignment, and soft tissue balancing are all factors influencing patellofemoral joint stability in the setting of TKA [1,3,4,7].

Patellar instability following TKA can be managed via a variety of techniques including revision of component position (mostly to optimize femoral and tibial rotation), lateral patellar retinaculum release, repair or reconstruction of the medial patellofemoral ligament, or a tibial tubercle osteotomy (TTO) [7-11]. While patellar instability in the setting of TKA has been well studied, all available literature discusses only lateral patellar instability (LPI). This is a case report of a patient who sustained a medial patellar dislocation following TKA. To our knowledge, this is the first report of medial patellar instability (MPI) in the TKA setting.

Case report

A 72-year-old female patient with a history of a right medializing TTO for LPI and multiple knee arthroscopies in the 1970s and 1980s presented for evaluation of right knee pain and instability. She ambulated with a cane secondary to her knee symptoms. Prior treatments included physical therapy and multiple hyaluronic acid injections. Physical examination in 2023 demonstrated an antalgic gait. There was a well-healed surgical incision over the anterior aspect of the right knee and a range of motion of 5°-110° of flexion. The knee was in neutral alignment and stable to varus and valgus stress as well as stable with an anterior and posterior drawer examination. The knee exhibited no extensor lag and the patella tracked midline. Initial radiographs of the bilateral knees are shown in Figure 1.

The patient underwent a right TKA through a standard medial parapatellar approach with the use of a tourniquet. The distal femur was cut in 5° of valgus based off of the anatomic axis of the femur. Appropriate femoral component rotation was determined based on bone landmarks using a combination of the posterior condylar axis, the transepicondylar axis, and Whiteside's line. The conformity of the anatomic tibial baseplate to the prepared tibial surface was used to assess the tibial component's rotation rather than the typical anatomic landmark of the tibial tubercle given the patient's prior TTO. The patella was resurfaced recreating the preresection thickness of 21 mm and the patellar component was medialized on the patella. The posterior cruciate ligament was retained and a medial congruent polyethylene insert was used. After implantation

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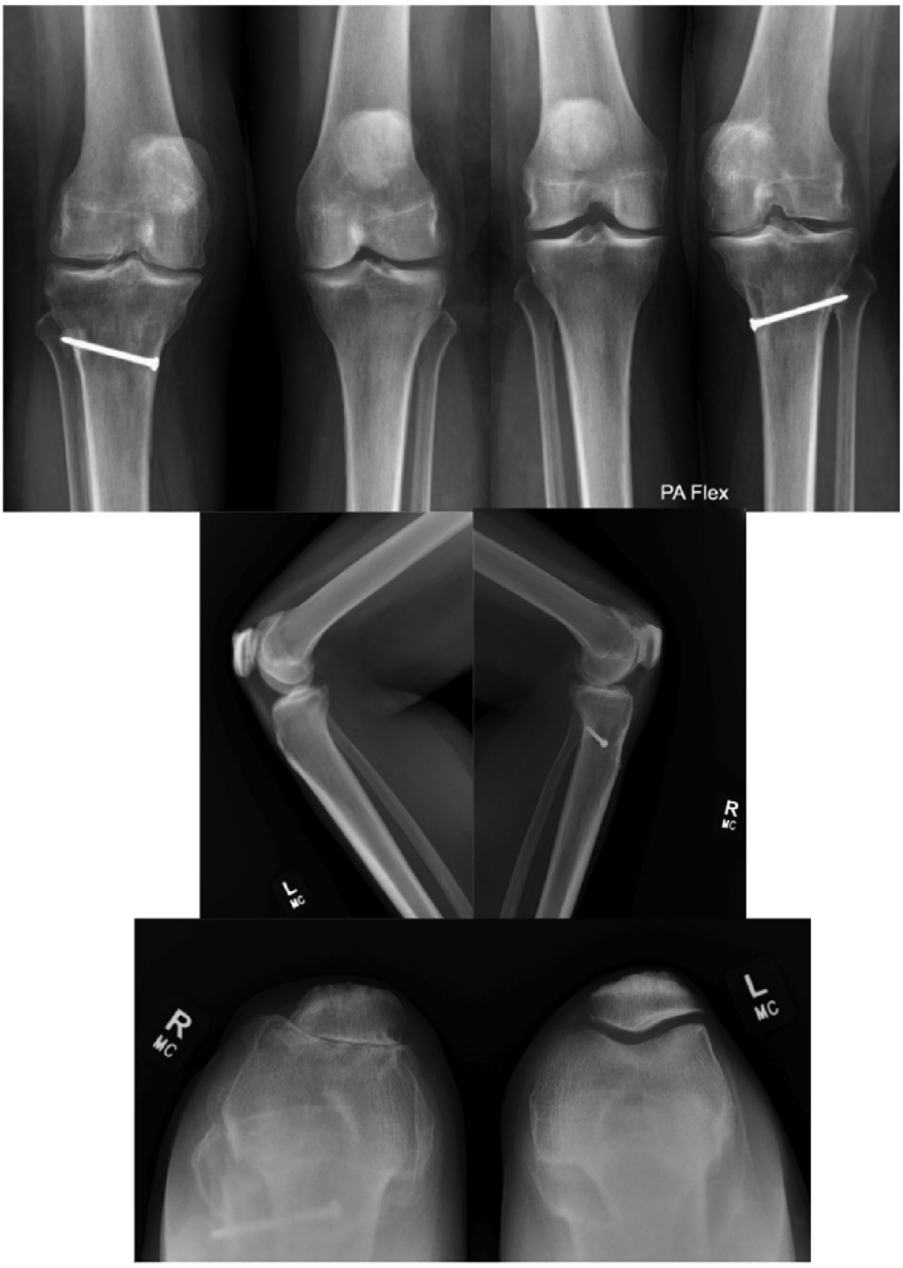

Figure 1. Anteroposterior, posteroanterior, flexion, lateral, and Merchant views of the bilateral knees demonstrating severe patellofemoral arthritis with trochlear dysplasia and patella baja. There is moderate medial and lateral compartment arthritis.

of all components, the patella tracked midline. There were no intraoperative complications, and the patient was discharged home on the same day without issues.

The patient presented at her 4-week postoperative visit with pain, weakness, and subjective instability of the knee. On examination, the patella was dislocated medially. The lateral retinaculum appeared stretched out with a possible palpable defect. She was able to perform a straight leg raise; however, on initiation of flexion, the patella dislocated medially. Attempts to relocate the patella and maintain its position during flexion and extension were unsuccessful as the patella continued to dislocate medially. Figure 2 shows radiographs obtained at that visit. After discussing treatment options with the patient, a decision was made to proceed with revision arthroplasty. A computed tomography (CT) scan was deferred preoperatively, because component alignment and rotation were planned to be assessed intraoperatively. Additionally, displacement of the tibial tubercle from the prior osteotomy would limit the accuracy of the CT guided assessment of tibial component rotation.

At the time of the revision procedure, the previous incision for the medial parapatellar approach was used. The rotation of the femoral and tibial components was analyzed. The tibial component was externally rotated to the tibial tubercle which had been previously medialized by her osteotomy procedure. Anatomically, the tibial baseplate had excellent coverage of the tibia. The lateral retinaculum was attenuated, but there was no gross defect. A 1-cm longitudinal strip of lateral retinaculum was excised and the resultant defect was imbricated to reproduce a lateral constraint for

Figure 2. AP, lateral, and merchant views of the right knee demonstrate total knee arthroplasty components in good position with medial dislocation of the patella.

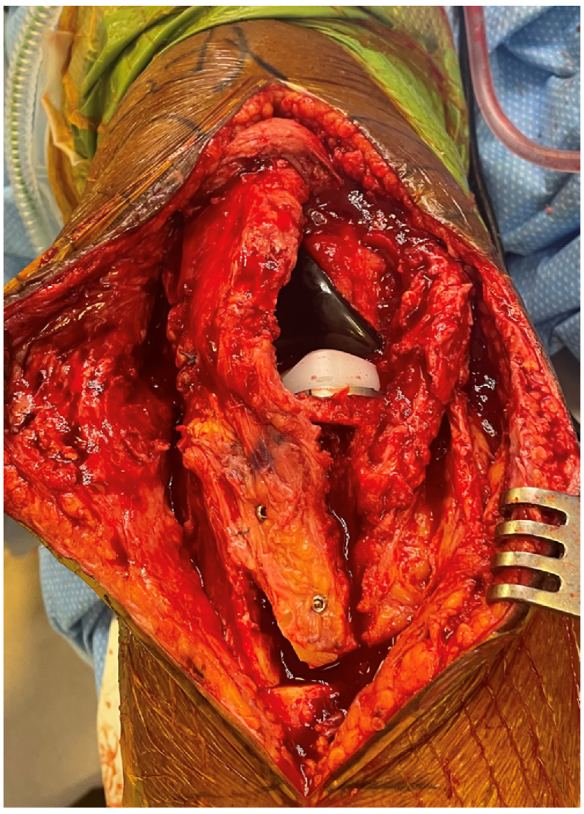

Figure 3. Intraoperative image after the tibial tubercle osteotomy was performed, lateralized, and fixed with 2 screws and washers. At the proximal, lateral aspect of the image, the imbricated lateral retinaculum can also be visualized.

the extensor mechanism. Assessment of the patellofemoral joint revealed that it was slightly overstuffed. At this early follow-up, the cementless patellar component was removed without difficulty. The patella was recut removing 2 mm of bone, and a new patellar component was cemented into place, positioned superiorly and centrally rather than medially.

Despite proximal realignment and reduction in patellar component thickness, medial subluxation of the patella persisted. It was speculated that the externally rotated tibial component resulted in significant relative internal rotation due to the already medialized tibial tubercle. This produced a medial vector on the extensor mechanism and subsequent medial instability. Given the appropriate rotation of the tibial baseplate and the morbidity associated with its removal, the decision was made to maintain the tibial component position and proceed with a lateralizing TTO. A tubercle fragment of 1 cm in width by 4 cm in length was created with an oscillating saw. The anterior tibial surface was decorticated with a burr to facilitate osseous union at the site of transfer. The fragment was lateralized 1 cm and fixed with 2 3.5-mm screws with washers (Fig. 3). The osteotomy site was then packed with cancellous autograft and demineralized bone matrix. The tibial rotation was now appropriately aligned with the middle third of the tibial tubercle and the patella tracked midline without tilt or subluxation.

The postoperative protocol entailed weight-bearing as tolerated with a hinged knee brace locked in extension for 3 weeks followed by a progressive range of motion protocol. Three months postoperatively, she was able to perform a straight leg raise. She had an 8° extensor lag, knee flexion to 80°, and a well-tracking patella throughout the entire arc of motion. She ambulated with a cane and was weaning off the hinged knee brace when outside of the house. Radiographs at this visit are shown in Figure 4. Potential management options for postoperative stiffness were discussed with the patient. We elected to defer manipulation under anesthesia (MUA) at this time due to the TTO and continue with physical therapy to improve her range of motion.

While her pain improved, her knee flexion unfortunately became more limited at subsequent follow-up visits. At 9 months, her knee range of motion was limited to 0°-70°. Consequently, decision was made to perform a MUA. At the time of manipulation, flexion of 110° was achieved. She started physical therapy and performed home range of motion exercises postmanipulation. At her most recent follow-up visit (4 months after MUA and 13 months postrevision surgery), her pain was significantly improved. She continued to ambulate with a cane for long distances but did not require it in her daily life. On examination, her range of motion was 5°-80° and the patella tracked midline. Figure 5 demonstrates most recent follow-up radiographs.

Written informed consent was obtained from the patient for publication of this case report and the patient consented to the use of all information and imaging contained in this case report.

Discussion

LPI is a well-studied complication following TKA. While the management algorithm can be complex given the multifactorial etiology of this complication and the morbidity associated with revision of components, there is literature that can be used to guide

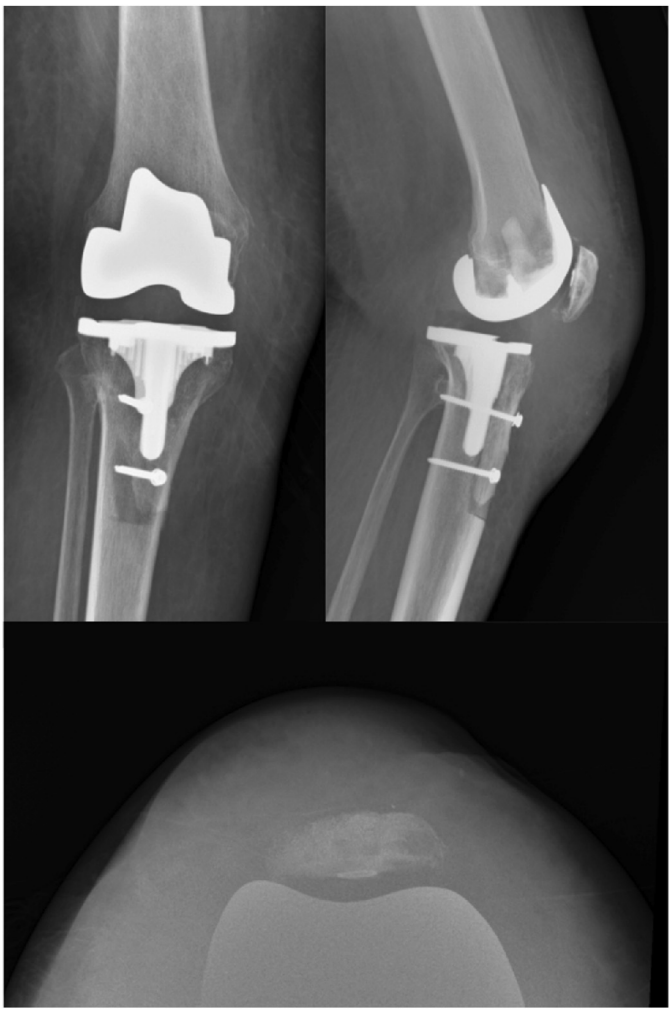

Figure 4. AP, lateral, and merchant views of the right knee demonstrating total knee arthroplasty components in good position, a well-fixed TTO without signs of failure of fixation, and patellar component well aligned centrally within the trochlear groove.

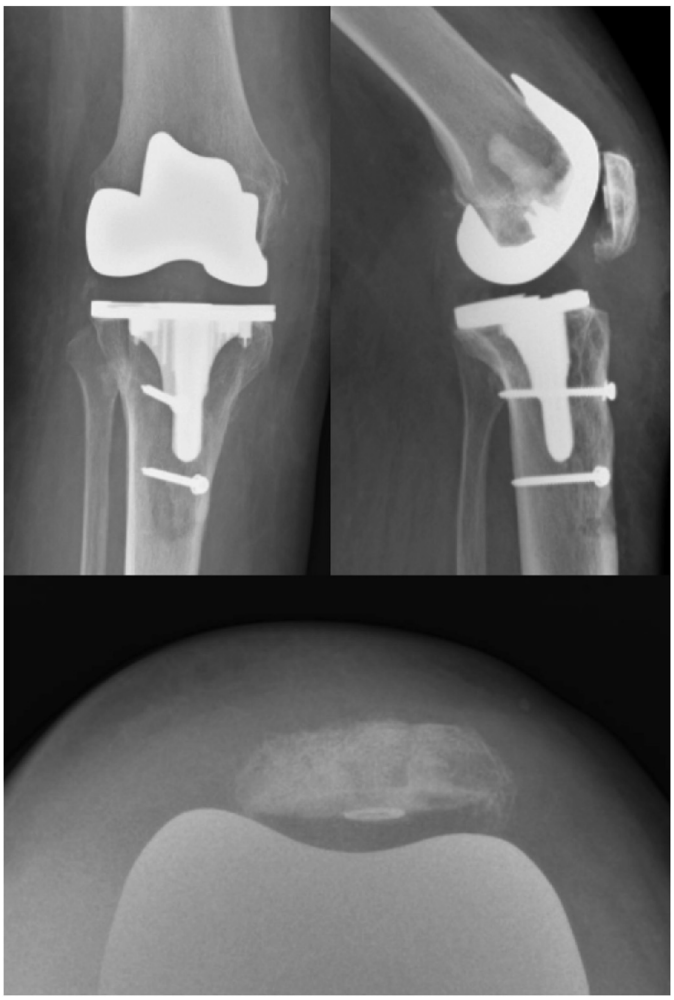

Figure 5. AP, lateral, and merchant views of the right knee demonstrating total knee arthroplasty components in good position. The prior TTO is well healed and the patellar component is aligned centrally within the trochlear groove.

decision-making. Conversely, MPI is a rare complication, and there is no literature that discusses this diagnosis or its management in the TKA setting.

Several risk factors have been associated with LPI following TKA. Patient-specific factors include preoperative valgus alignment more than 10°, a severely hypoplastic lateral condyle, and lateral subluxation of the patella [6,12-14]. Surgical technique also has a substantial impact on patellar stability. Malrotation of the femoral and/or tibial components is a frequent cause of instability, with moderate (3°-8°) or large (7°-17°) amounts of combined internal rotation being associated with lateral patellar subluxation and dislocation, respectively [15]. Additional technical errors include medialization of the femoral component, lateralization of the patellar component, an asymmetric patellar resection, and increasing the postresection thickness of the patella in patellar resurfacing knees [4,13,14,16]. Furthermore, design of the femoral (ie, depth, thickness, and symmetry of the anterior phalange/trochlear groove) and patellar components (ie, anatomic vs dome shapes) has been associated with patellofemoral related complications, although advances in prosthesis design have been made in an attempt to limit this risk [3,4,13].

The use of a tourniquet can also influence intraoperative assessment of patellar tracking and can cause lateral maltracking [17]. We did not release the tourniquet for intraoperative assessment during the index procedure. This theoretically may have provided a false sense of acceptable tracking as the tourniquet imparted a lateral pull on the extensor mechanism keeping the patella centralized within the trochlear groove and preventing medial subluxation.

Appropriate workup of post-TKA LPI commonly consists of a CT scan to assess the rotation of the femoral and tibial components [4,7,9,10,15]. If components are significantly malrotated or malpositioned, then most authors suggest this necessitates revision of one or both components [4,7,9]. While the rotation of the tibial component in relation to the tibial tubercle may not be accurate in the setting of a prior TTO, the tibial tubercle to trochlear groove distance can instead be used for assessment [18]. Nonetheless, we elected to forgo obtaining a CT scan in our case and instead assessed component rotation intraoperatively.

In the setting of acceptable component alignment, extensor mechanism realignment procedures, including proximal, distal, or combined procedures, can be performed. Proximal realignment consists of a lateral retinacular release with advancement of the vastus medialis and medial capsular plication or medial patellofemoral ligament reconstruction [3,4,6,7,9,10,12,19]. Distal realignment involves a medializing TTO. Authors recommend varying indications for this procedure such as chronic patellar dislocation, inadequate realignment with a proximally based procedure, or severity of patellar subluxation [4,6,8-10,20-22].

Limited flexion has been described in prior reports of TTO performed for LPI following TKA [10,22]. Similarly, this case was complicated by postoperative stiffness requiring manipulation. We suspect that the TTO lengthened and subsequently tensioned her extensor mechanism. This, in addition to her restricted preoperative motion, likely contributed to her limitations in knee flexion.

While there is no literature discussing MPI following TKA, it is rarely reported in native knees, occurring secondary to either traumatic or iatrogenic etiologies [23-27]. In 1988, Hughston et al. was the first to report MPI in patients who had undergone an arthroscopic lateral retinacular release for the management of LPI or patellofemoral knee pain [23]. Medial retinacular release or lateral retinacular repair vs reconstruction have been described as successful treatment options, albeit in small case series studies [24-26].

We attempted to extrapolate LPI management principles as well as techniques used for management of MPI in native knees to our case of MPI following TKA. Accordingly, we maintained our femoral and tibial components as their rotational alignment was within acceptable limits on intraoperative assessment. We realigned the extensor mechanism proximally by imbricating the lateral retinaculum and revising the patellar component. This was followed by a distal extensor mechanism realignment with a lateralizing TTO given the medial displacement of the tubercle in a setting of prior TTO, the extent of medial dislocation, and inadequate realignment with an isolated proximal procedure.

Summary

We present a case of MPI following TKA in a patient who had a remote history of medializing TTO. A preoperative CT scan can be used to assess component rotation; however, this can be deferred for intraoperative assessment in the setting of insufficient anatomic landmarks to measure rotation. Our treatment consisted of lateral retinaculum imbrication, revision of the patellar component, and a lateralizing TTO in the setting of appropriate rotation of the tibial and femoral components. To our knowledge, this is the first report describing MPI and its management in the TKA setting. In patients undergoing TKA in the setting of prior TTO, the tourniquet should be released during intraoperative assessment of patellar tracking. It is important to be aware of MPI as well as potential treatment options as this is a rare complication that can occur following TKA.

Conflicts of interest

Kevin B. Fricka receives speaker fees from Smith & Nephew and Zimmer; is a paid consultant for 2ndMD, Smith & Nephew, and Zimmer; holds stock or stock options in OrthoAlign and Pulse Platform; receives research support from Smith & Nephew and Zimmer and other financial or material support from OrthoCareRN; and is a board member in Operation Walk Virginia. All other authors declare no potential conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2024.101522.

Informed patient consent

The author(s) confirm that written informed consent has been obtained from the involved patient(s) or if appropriate from the parent, guardian, power of attorney of the involved patient(s); and, they have given approval for this information to be published in this case report (series).

CRediT authorship contribution statement

Joseph P. Barbera: Writing – review & editing, Writing – original draft, Data curation. **Nancy L. Parks:** Writing – review & editing, Writing – original draft. **Kevin B. Fricka:** Writing – review & editing, Validation, Supervision, Conceptualization.

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