Case report

Instability of the proximal tibiofibular joint associated with total knee arthroplasty

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ABSTRACT

To our knowledge, proximal tibiofibular joint instability has never been reported in a patient with a total knee arthroplasty (TKA). We present the case of a patient with anterolateral proximal tibiofibular joint instability associated with a complex primary TKA. In 2010, a male patient of 47 years was referred for TKA after posttraumatic osteoarthritis. The patient's history includes a fracture of the left lateral tibial plateau in 2008 and removal of osteosynthesis material in 2009. TKA with a lateral metal augment and intramedullary stem was performed in 2010. After TKA, instability of the left proximal tibiofibular joint (PTFJ) was diagnosed. The patient underwent PTFJ arthrodesis and, at 5 years’ follow-up, had no residual pain, with full range of motion. In this case, arthrodesis was the only possible surgical option because reconstruction surgeries require the establishment of bone tunnels in the tibia and fibula for the passage of a graft. Low bone quality and the use of an intramedullary stem with a metal augment in the tibia made any reconstruction technique unfeasible because the proximal tibia was obliterated. Although several PTFJ reconstruction techniques are available, they are difficult to apply to patients with a complex TKA.

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Introduction

Proximal tibiofibular joint instability (PTFI) is increasingly reported in the literature. Clinically, PTFI can be seen in patients with no history of knee trauma (eg, idiopathic subluxation of the joint) and in patients experiencing high-energy traumatic dislocations that may be associated with long bone fractures. Injury to the proximal tibiofibular joint (PTFJ) is most commonly observed among athletes whose sports require violent twisting motions of the flexed knee, such as soccer, rugby, football, baseball, and basketball [1-6].

PTFJ pathologies can be classified into 6 types: subluxation, anterolateral, posteromedial, superior, posterolateral, and inferior dislocations [3,7,8]. Of these, anterolateral PTFI is the most common, ranging from 69% to 85% of cases [9,10]. The last 2 dislocations are both unusual and associated with floating knee injuries. Their diagnoses are mainly based on the presence of neurovascular injuries. Treatment options for PTFI are variable and include closed/open reduction with reconstruction, fibular head resection, and arthrodesis [7,8]. To our knowledge, none of these treatment options have been reported in patients with PTFI after total knee arthroplasty (TKA). We present the case of a patient with anterolateral PTFI associated with a complex primary TKA. The patient gave written informed consent for the publication of this case report.

Case history

The patient’s case history is summarized in Table 1. A 47-year-old white male computer technician underwent an open reduction and internal fixation in 2008 after a Schatzker type 2 [11] lateral tibial plateau fracture after a fall from a height of 10 feet (3 m). In 2009, malunion with significant depression of the lateral tibial plateau was diagnosed, leaving the patient with pain and functional impairment marked by an inability to bear weight. It was decided at...
this time to remove the osteosynthesis material. The plate removal was staged from the TKA procedure because preoperative templating showed that the planned intramedullary stem would end at the same level as the most distal screw hole in the plate and therefore induce a stress riser for a potential fracture in the diaphysis of the tibia.

The patient developed posttraumatic osteoarthritis, and in April 2010, underwent TKA. Before TKA, the patient had been unable to bear weight on the affected knee and had been using crutches for 2 years. Before surgery, the patient’s mechanical axis was 15° of valgus, range of motion (ROM) was 0° -130°, and erythrocyte sedimentation rate, C-reactive protein level, and white blood cell count were normal. Preoperative and postoperative radiographs are shown in Figures 1 and 2.

After TKA, the patient reported lateral knee pain when bearing weight on the affected knee. Dynamic fluoroscopy of the PTFJ was done at 15 months and PTJI was diagnosed (Fig. 3). When looking back at previous radiographs, lateralization of the fibular head was present from the initial trauma and was missed by the surgeon initially taking care of this patient. At 15 months after TKA, the patient underwent PTFJ arthrodesis.

Arthrodesis was performed by a separate lateral skin incision, allowing access to the PTFJ. Protecting the fibular nerve, fibular head cartilage was exposed and removed using a curette. Two short-threaded 4.0 cancellous screws were placed across the PTFJ to stabilize the proximal fibula (Fig. 4). Postoperatively, immediate weight bearing was allowed and early motion was encouraged.

The patient reported complete pain relief at 6 months after arthrodesis. At the latest follow-up (43 months after arthrodesis and 58 months after TKA), the patient has no residual pain in the knee or in the ankle, with full ROM.

Discussion

The PTFJ is a stable joint located in the posterolateral corner of the knee which serves as the attachment site for many structures that function as primary and secondary stabilizers of the joint [12,13]. The primary stabilizers are mostly the lateral collateral ligament, the biceps femoris tendon, and the capsular and ligament attachments. The arcuate ligament, the popliteo-fibular ligament, and the popliteus muscle and tendon are secondary stabilizers. The joint is reinforced anteriorly by the biceps femoris tendon insertion into the fibular head, posteriorly by the popliteus tendon,

Table 1
Timeline of the patient’s case history.

| Date       | Event                                                                 |
|------------|------------------------------------------------------------------------|
| 2008       | Patient undergoes an open reduction internal fixation after a fall from a height of 10 feet (3 m). |
| 2009       | Patient is diagnosed with malunion with significant depression of the lateral tibial plateau. Osteosynthesis material is removed, leaving the patient with pain and functional impairment marked by an inability to bear weight. |
| 2009-2010  | Patient develops posttraumatic osteoarthritis, is unable to bear weight on the affected knee, and is required to use crutches for 2 years. |
| April 2010 | Patient undergoes TKA. After TKA, patient reports lateral knee pain when bearing weight on the affected knee. |
| July 2011  | Dynamic fluoroscopy of the proximal tibiofibular joint is done, and PTJI is diagnosed. Patient undergoes arthrodesis on the affected knee. |
| January 2012 | Patient reports complete pain relief after arthrodesis. |
| February 2015 | Patient has no residual pain in the knee or in the ankle, with full range of motion, at the latest follow-up. |

Figure 1. Radiograph of the patient’s knee before TKA revealing posttraumatic osteoarthritis.

Figure 2. Radiograph of the patient’s knee after TKA.
the tibia and fibula. The capsule is strengthened by 2 prominent accessory ligaments, which provide additional stability. The posterior aspect of the capsule consists of a single weak band running from the fibular head to the posterior aspect of the popliteus tendon. The anterior proximal tibiofibular ligament consists of 2 or 3 flat fibrous bands, which pass obliquely upward from the front of the head of the fibula to the front of the lateral condyle of the tibia. The posterior proximal tibiofibular ligament is a thick single broad band, which passes obliquely upward from the back of the head of the fibula to the back of the lateral plateau of the tibia. It is covered by the tendon of the popliteus. These ligaments are not entirely separable from the fibrous capsule.

The PTFJ is a hyaline cartilage articulation, lined with a synovial membrane, that communicates with the knee joint in 10% to 12% of people [14,15]. Barnett and Napier [16] observed that the fibula rotates externally on its long axis during dorsiflexion of the ankle. Ogden [17] evaluated anteroposterior motion of the proximal fibula with positional changes of the knee. With knee flexion, the fibula moved anteriorly, whereas in extension of the knee, the proximal fibula translated posteriorly. According to Ogden, in most patients, with the knee flexed, the fibular head could be moved approximately 1 cm in both anterior and posterior directions. With the knee extended, the excursion of the fibular head was minimal. There is also a slight upward movement of the fibula because of forced transverse expansion of the malleolar mortise during maximal dorsiflexion of the ankle [18].

The anatomy of the PTFJ is undoubtedly directly related to its functional stability, as it can withstand stresses applied in either a longitudinal or axial fashion. Approximately one-sixth of the static load applied at the ankle is transmitted along the fibula to the PTFJ, and the proximal fibula is involved in tensile forces [19,20]. Thus, the primary functions of the PTFJ are (1) dissipation of torsional stresses applied at the ankle, (2) dissipation of lateral tibial bending moments, and (3) tensile, rather than compressive, weight bearing [17].

There are anatomic variants to the PTFJ which can be classified into 3 types. Type I includes PTFJs with a nearly horizontal articular surface (<30° of inclination) and a surface area >20 mm². Type II includes PTFJs with a large, elliptical surface, concave on the fibula, and frequently having a joint communication to the knee. Type III includes PTFJs with a small articular surface (<15 mm²) and a steep
inclination (>30°) [16]. These anatomic variations must be considered when treating patients with PTJI.

PTJI is a rare condition that results in ill-defined lateral knee pain and instability of the lateral knee associated with marked functional impairment [7,21]. It is often incorrectly diagnosed as other, better described and recognized injuries to the lateral knee.

There are several treatment options for PTJI, most intended to correct PTJI while preserving motion in the PTJ. In the case of acute PTJF dislocation, closed reduction is usually performed, with or without immobilization, with the knee in extension or slight flexion for 2-3 weeks [3]. It is controversial whether weight bearing should be performed after the procedure [22].

Surgical stabilization is required in up to 57% of late or recurrent cases because of persistent pain and chronic instability [3,21]. Open reduction may be required for patients who experience chronic dislocation, failed closed reduction, unstable reduction, or neurovascular injuries with associated fractures. Surgical options for the treatment of chronic PTJI include fibular head resection, arthrodesis of the PTJF with or without fibular osteotomy, open reduction internal fixation with or without the removal of hardware, and ligament reconstruction using the iliotibial band or the biceps femoris tendon [3,23-26]. The decision to remove hardware after arthrodesis remains controversial. Van den Bekerom et al. [27] performed PTJF arthrodesis with early screw removal at 3 to 6 months and obtained good results in athletes. Although multiple surgical procedures are available, there is currently no clear evidence to support the use of one over the other. We did not perform a concurrent fibular osteotomy at the time of PTJF arthrodesis even if early studies showed a risk of potential late development of ankle pain due to the loss of normal fibular rotation [17]. If late ankle pain had been reported by our patient, a late fibular osteotomy would theoretically restore normal kinematics to the distal fibula and relieve pain.

Surgical treatment options for PTJI are not without complications. The most common complications experienced by patients with PTJI after surgery include peroneal nerve palsy (3%-5%), PTJF arthritis, infection, chronic instability, ankle arthritis and chronic pain, and deep venous thrombosis [3,9,21].

We present the case of a patient experiencing PTJI after TKA. There is currently no technique or published report available to guide the treatment approach for this kind of patient. Therefore, we based our decision to perform an arthrodesis on the space obliterated by the tibial component of the knee prosthesis and the low bone quality.

Summary

PTJI after TKA is rare. There are currently no surgical techniques available for PTJF reconstruction for patients who have had TKA, as the components of the knee prosthesis introduce technical difficulties to such procedures. In the case presented here, PTJI after TKA was successfully treated with arthrodesis of the PTJF and, at 43 months’ follow-up, the patient had no residual pain in the knee or in the ankle, with full ROM.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.artd.2015.12.001.

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