Chronic Knee Dislocation After Total Knee Arthroplasty

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abstract

Knee dislocation after total knee arthroplasty (TKA), although rare, is a dangerous injury that can lead to neurovascular compromise and permanent disability. Chronic dislocation after TKA is even less common and is defined as dislocation that is present for 4 weeks or more. There are few reports of its management. Chronic dislocation may be complicated further by concomitant extensor mechanism disruption, ligamentous instability, and/or capsular contracture. This article describes 3 cases of chronically dislocated TKAs and the challenges encountered in treating this difficult problem. A higher level of constraint was required to maintain knee stability, and an extensor mechanism allograft was needed in 2 of the 3 reported patients. The preferred technique at the authors' institution is a complete allograft composite, tensioned in full extension. In the setting of a chronically dislocated TKA, the authors now recommend revision surgery with an enhanced measure of constraint (constrained condylar device or hinged knee prosthesis), reconstruction of the extensor mechanism when necessary, and restoration of the joint while compensating for concomitant bony defects. Even when surgeons follow these principles, it is important to inform the patient that long-term outcomes will likely be inferior to those of revision surgery for other causes. [Orthopedics. 2015; 38(12):e1155-e1159.]
Total knee arthroplasty (TKA) is the gold standard treatment for patients who have pain and functional impairment as a result of degenerative joint disease. Despite excellent long-term results, a small percentage of patients require revision surgery for a variety of reasons. In the setting of aseptic failure, patients may present with component loosening, polyethylene wear, patellofemoral maltracking, and/or ligamentous instability. Patients with instability have variable presentations, depending on the integrity of the surrounding ligamentous structures and component positioning. Although some have only subtle symptoms, the most severe cases may lead to complete dislocation. Modern surgical techniques and attention to component placement have reduced the incidence of gross instability and dislocation after TKA to less than 0.5%. Although dislocation is rare, its consequences can be disastrous. The most feared complication is neurovascular damage, most commonly involving the popliteal artery, common peroneal nerve, or tibial nerve. If these structures are not properly evaluated emergently, ischemia, necrosis, and/or compartment syndrome can follow, potentially requiring amputation of the affected limb.

Although instability is a common cause of failure after TKA, knee dislocation is rarely seen and less often reported. Further, chronic dislocation, defined as dislocation present for 4 weeks or more, is even less common. To the authors’ knowledge, this article is the first report of this event. The authors report 3 patients with chronically dislocated TKAs who presented to their institution for revision between February 2012 and March 2014.

Case Reports
Patient 1
A 46-year-old woman with a history of cerebral palsy and obesity underwent primary left TKA at an outside institution in September 2013. On the night of surgery, she noted a “popping” sensation while ambulating to the rest room. She had persistent pain, impaired knee extension, and difficulty ambulating, and she was referred to the authors’ office in March 2014. On examination, she had a body mass index of 41 kg/m². She ambulated with a walker despite left knee pain, could not fully extend the left knee, and had a nonpalpable left pedal pulse. Active and passive range of motion was deferred because of potential vascular compromise. Radiographs showed left TKA dislocation and patellar tendon rupture (Figure 1). The erythrocyte sedimentation rate and C-reactive protein level were obtained to rule out periprosthetic joint infection, and the patient was admitted for revision TKA with extensor mechanism reconstruction. Vascular surgery confirmed the patency of the lower extremity via arteriogram. Revision surgery was planned for the next day.

The knee was exposed through the previous medial parapatellar arthrotomy. The tibia was loose, and all components were removed. Because of disruption of the extensor mechanism, the remaining patella bone was excised. Hinged revision components were placed, and the extensor mechanism was reconstructed with an allograft consisting of the tibial tubercle, patellar tendon, patella bone, and quadriceps tendon tensioned in extension. Postoperatively, the patient was placed in a long cast, and touch-down weight bearing was permitted. She was neurovascularly intact, and radiographs showed appropriate position of the implants (Figure 2). The patient was discharged in a cast and was non-weight bearing until the 4-week follow-up appointment.

The cast was removed at 4 weeks and reapplied for an additional 2 weeks, according to the authors’ routine protocol for an extensor mechanism allograft procedure. At 6 weeks, the patient was transitioned to a hinged knee brace locked in extension

Figure 1: Preoperative left knee anteroposterior (A) and lateral (B) radiographs of a patient with total knee arthroplasty dislocation and patellar tendon rupture.

Figure 2: Postoperative left knee anteroposterior (A) and lateral (B) radiographs of Patient 1 after total knee arthroplasty revision and extensor mechanism reconstruction showing appropriately placed implants.
that was to be worn at all times except during physical therapy, and she was allowed to bear weight. Physical therapy was directed to start range of motion from 0° to 30° for the first 2 weeks and to increase range of motion by 30° every 2 weeks. The patient progressed in physical therapy at weeks 6 to 12, and the hinged brace was discontinued at the 12-week follow-up appointment. At 6-month follow-up, the patient was doing well. The extensor mechanism was intact (with slight extensor lag, likely as a result of quadriceps weakness), and the patient had flexion to just past 90°.

**Patient 2**

A nonobese 65-year-old woman with a history of hyperlipidemia, transient ischemic attack, and end-stage degenerative joint disease underwent primary left TKA in May 2012. After primary replacement, she underwent 2 revisions at an outside hospital in February and March 2013 to correct malalignment, but continued to have left knee pain and stiffness. She was referred to the authors’ clinic in early August 2013 and had knee pain, stiffness, and an antalgic gait, and she required assistance with a cane. Physical examination showed gross deformity of the left knee, with active range of motion of 0° to 10° and passive range of motion of 0° to 20°. The patient did not recall how long the range of motion had been impaired. Radiographs (Figure 3) showed a dislocated left TKA. The erythrocyte sedimentation rate and C-reactive protein level were obtained to rule out periprosthetic joint infection. The patient was cleared by vascular surgery and underwent revision surgery 2 days later.

The knee was exposed through the previous incision, and the stable tibial and femoral components were removed, with a cavitary defect noted in the proximal tibia. A small porous tantalum cone was press-fit into the tibia, and the hinged tibial and femoral components were cemented into place. Distal augments were placed on the femur to restore the joint line. Postoperatively, the patient was neurovascularly intact, and radiographs showed excellent position of the components (Figure 4).

The patient was discharged in a knee immobilizer after being cleared by physical therapy and instructed to return for follow-up in 4 weeks. Given the severity of instability on presentation, combined with the patient’s complicated history of failed revisions, it was deemed most appropriate to recommend a period of immobilization after the procedure to ensure maximal stability while addressing resultant stiffness secondarily. There was also significant tension at the incision site with flexion beyond 70°, warranting further protection of the wound. At 4 weeks, the knee immobilizer was removed and range of motion was 0° to 30°. The need for future manipulation under anesthesia was discussed. The patient elected to begin slow, progressive range of motion work with outpatient physical therapy, with follow-up in 2 weeks. At that time, the patient was dissatisfied that the range of motion had not improved and elected to undergo manipulation under anesthesia. At 6 months postoperatively, the patient was doing well overall, with minimal pain, but continued to have significant stiffness, with range of motion limited to 0° to 40°. At the most recent follow-up, she was contemplating arthroscopic lysis of adhesions with concomitant manipulation under anesthesia.

**Patient 3**

A 60-year-old woman with a history of hypertension, aortic aneurysm repair, obstructive sleep apnea, obesity (body mass index, 52 kg/m²), and degenerative joint disease underwent primary bilateral TKAs in October 2000. The patient functioned relatively well until December 2011, when she fell and had a buckling injury to the right knee. The patient was referred to the authors’ clinic in February 2012 and was diagnosed with chronic dislocation of the right TKA and chronic patellar tendon rupture (Figure 5). The erythrocyte sedimentation rate and C-reactive protein level were obtained to rule out periprosthetic joint infection. Vascular patency was confirmed, and the patient underwent revision TKA with extensor mechanism allograft reconstruction the next day.

Intraoperatively, the components were noted to be loose, with a moderate amount...
of adjacent bone loss, and they were removed. The bone loss encountered required use of a large femoral and medium porous tantalum tibial cone. A hinged knee prosthesis was placed, and the extensor mechanism was reconstructed with an allograft consisting of tibial tubercle, patellar tendon, patella bone, and quadriceps tendon tensioned in extension. The patient was neurovascularly intact, and postoperative radiographs (Figure 6) showed appropriate implant positioning. The original cast caused a small pressure ulcer on the heel that was managed by the wound care team with dressing changes.

The patient was discharged to a skilled nursing facility in a cast in full extension and was non-weight bearing for 6 weeks (with cast removal, examination, and cast reapplication performed at 2 and 4 weeks). At 6 weeks, the patient was transitioned to a hinged knee brace and given the same directions and physical therapy protocol as described for Patient 1. At 3 months postoperatively, the patient was doing well, with range of motion of 0° to 60°. Unfortunately, the patient had an extensor mechanism disruption on the contralateral side that required operative reconstruction, and this significantly disrupted her progress. At 1 year postoperatively, the patient had minimal pain, a 5° extensor lag, and flexion to 95°, and she ambulated 50 feet with a walker while recovering from contralateral knee surgery.

Discussion

Instability is a common reason for revision surgery after primary TKA. In a case series of 253 consecutive patients who underwent primary TKA, Le et al7 found that instability accounted for approximately 26% of early revisions and 18% of late revisions. These findings were consistent with previously reported values by Fehring et al.8 High-risk patients should undergo annual clinical evaluation, including weight-bearing radiographs, to ensure adequate surveillance of the prosthesis and avoid a delay in diagnosis.9

Although instability may account for 18% to 26% of TKA revisions, chronic dislocation after TKA is a rare complication, with virtually no representation in the literature.7,8 Therefore, no evidence-based treatment algorithm exists, and the plan must be determined on a case-by-case basis. Acute knee dislocation requires an urgent attempt at closed reduction, with careful evaluation of neurovascular status.1 If unsuccessful, the patient likely requires open reduction with subsequent immobilization for 3 to 10 weeks.2 If the patient continues to have symptoms of instability, revision surgery is likely necessary.

Instability can range from minor laxity to complete dislocation, and the approach varies accordingly. In patients with subtle instability, it is important to consider the etiology because this will dictate the operative plan. Medical records, including operative reports and pre- and postoperative radiographs, should be obtained, along with the erythrocyte sedimentation rate and C-reactive protein level to rule out periprosthetic joint infection. Additionally, it is important to consider whether the instability is seen in flexion, extension, or both.4 Chronic instability in extension involves imbalance of the coronal stabilizers, leading to varus or valgus malalignment. This usually occurs when the patient initially presents with severe varus or valgus deformity and the contracted side is not adequately released.4 Chronic instability in flexion is more difficult to diagnose because the patient may not present with a gross deformity, but will have more subtle signs and symptoms. Common causes of
chronic flexion instability include an undersized femoral component and excessive posterior tibial slope. More severe instability and dislocation are often the result of component loosening or extensor mechanism failure occurring concomitantly with previously mentioned factors. These findings were encountered in the authors’ cases, where the initial approach was focused on ruling out neurovascular compromise, followed by an urgent revision procedure. Component loosening raises concern about infection, which should be evaluated with a diligent history, preoperative laboratory studies, joint aspiration as indicated, and evaluation of the intraoperative gross appearance or histologic findings, if necessary.

In most patients, a medial capsular approach with extensive intra-articular synovectomy provides adequate exposure for revision. If further exposure is required, a quadriceps snip to free the proximal extensor mechanism is typically the next step. From there, the approach to revision is the same as that for primary arthroplasty: restore mechanical alignment, restore the joint line, balance the ligaments in the coronal and sagittal planes, balance the flexion and extension spaces, and restore the Q angle.

In addition to the surgical approach and technique, prosthesis selection is of paramount importance. Prosthesis selection should be individualized, based on the patient’s level of instability, age, history, and expectations. Ideally, the lowest level of constraint required to maintain a stable knee is the best choice for implant longevity and maximal function. Avoiding excessive constraint to preserve range of motion is especially important in patients with subtle instability. However, the approach to gross dislocation should focus on harm reduction because the risks associated with repeated dislocation can be severe. The authors’ experience suggests that the use of a constrained hinged prosthesis is most appropriate when patients present with frank dislocation. Because of its linked design, the risk of future dislocation is decreased; however, increased stress at the prosthetic–bone interface can become a problem because the joint can no longer dissipate stress effectively. This can result in early aseptic loosening and/or component failure. Nevertheless, if constraint is not increased, subtle instability can remain and lead to recurrent swelling, pain, and the potential for future dislocation.

As seen in 2 of the current cases, extensor mechanism rupture can further complicate the management of patients presenting with chronic TKA dislocation. Extensive tissue loss and retraction can occur with chronic extensor failure. Treatment options include medial gastrocnemius flaps, Achilles tendon allografts, and complete extensor mechanism allografts. The graft must be fixed in full extension because the natural stretch of the graft over time can lead to extensor lag. Despite the use of this operative technique, failure rates remain high. In a recent study of extensor mechanism allograft repairs in 50 patients, Rosenberg noted a failure rate of approximately 38% at a mean follow-up of 5 years. In this study, failure was defined as a Knee Society Score of less than 60 points, extensor lag of greater than 30°, or additional revision surgery. Most commonly, failure was associated with a Knee Society Score of less than 60 points and/or extensor lag greater than 30°. The other reasons for failure were recurrent lag and deep infection. Patient outcomes seem to depend on the amount and quality of local tissue, the function of the underlying arthroplasty, and individual patient characteristics.

CONCLUSION

Instability is a common cause of failure after TKA; however, frank dislocation is rarely seen and less often reported. Chronic dislocation is even less common. It is important to examine the patient who presents with chronic dislocation after primary TKA for neurovascular compromise. After a thorough neurovascular workup, revision surgery should proceed as soon as possible. The authors recommend replacement with a more constrained prosthesis while bone defects are managed to reestablish the native joint line. These patients are at high risk for extensor mechanism disruption, which may be treated with allograft reconstruction. Although many patients benefit from these interventions, the rate of failure is more than negligible, especially in those with extensor mechanism disruption. In the authors’ experience, before intervention is planned, it is appropriate to discuss the risks and benefits of revision surgery with the patient, noting the expected rates of failure. In this way, the expectations of the patient and the surgeon can be aligned.

REFERENCES