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Case report

Acute, recurrent total knee dislocation: Polyethylene dislocation and malreduction

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ABSTRACT

A 62-year-old man underwent total knee arthroplasty using a mobile-bearing prosthesis. Four days post-operatively the patient experienced the first of several acute knee dislocations. Closed reduction was performed at an outside hospital a total of three times prior to presentation at this institution. A two-stage exchange of the TKA was recommended due to the clinical suspicion for an infected prosthesis. Upon surgical exploration, it was discovered that the polyethylene insert had spun out completely to 180°. Closed reduction attempts of a posterior dislocation of a mobile-bearing knee prosthesis may contribute to complete 180° spinout of the polyethylene insert.

Introduction

Mobile-bearing total knee arthroplasty (TKA) was developed to address the issues of polyethylene wear and osteolysis associated with some fixed-bearing TKA designs [1]. However, the superiority of mobile-bearing TKA over the fixed design has yet to be proven clinically [2–5].

Although rare, bearing subluxation and dislocation from beneath the femoral implant is a potential early complication unique to the mobile-bearing design. In approximately 1% of cases, rotating platform dislocation – or, "spinout" – occurs following primary surgery [6]. We present an extremely rare case of complete 180° rotatory dislocation of the polyethylene insert in a mobile-bearing TKA design.

The patient we present in this case was informed that operative and outcome data would be submitted for publication and he provided consent.

Case history

A 62-year-old man with a history of post-traumatic osteoarthritis and associated valgus deformity of the right knee underwent TKA at an outside hospital. Four days post-operatively the patient heard a loud "pop" while getting out of bed; radiographs confirmed posterior dislocation of the right knee. Fluoroscopy-assisted closed reduction was performed under general anesthesia. The patient was immobilized in a brace and made weight bearing as tolerated. Post-reduction radiographs were reviewed when he presented to our institution, which retrospectively showed persistent subluxation (Figure 1).

One month later, the patient returned to the outside hospital with continued knee dislocations and wound dehiscence at the incision site. Radiographs confirmed posterior dislocation of the tibia. The decision was made to postpone revision surgery – due to wound complications – and proceed with closed reduction, which was performed under general anesthesia for a second time. The patient was placed in a long leg cast.

A month later, the patient returned due to recurrent dislocations after having his cast removed at a different outside hospital. The patient underwent closed reduction under general anesthesia for a third time. The patient was again placed in a long leg cast.

Four months afterward, the patient presented to this institution for a second opinion. The patient reported that he had right knee pain and daily dislocations of his right knee. The patient reduced his knee with the aid of traction using a rope tied to a bannister. Radiographs revealed a posteriorly dislocated tibia (Figure 2), and

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Fig. 1. Lateral knee radiograph after attempted closed reduction revealing persistent subluxation. Outline illustrates the posterior to anterior sloping of the polyethylene insert.

Fig. 2. Lateral knee radiograph at presentation to our clinic revealing posterior dislocation of the tibia. Outline illustrates the posterior to anterior sloping of the polyethylene insert.

reduction was achieved using longitudinal traction. An audible "clunk" was observed on reduction.

The presence of a superficial 2 × 5 mm wound over the lateral aspect of the incision prompted aspiration of the knee and evaluation of erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) to rule out infection. Approximately 20 mL of cloudy fluid was aspirated. White blood cell count was 1407 and neutrophil count was 82%. There was no growth on cultures. The ESR and CRP were within normal limits (ESR of 12, CRP of 0.4). However, based upon the patient's symptoms and borderline white blood cell count on aspiration, a two-stage exchange of the TKA was recommended to the patient. Surgical risks and benefits were discussed in detail with the patient and the patient agreed with the plan.

The first stage of the exchange involved total knee resection and the placement of an antibiotic spacer in the right knee. Upon surgical exploration, it was discovered that the polyethylene insert had spun completely to 180° with the anterior lip of the polyethylene insert lying posteriorly (Figure 3A and B). Figure 3B also exhibits gapping of the lateral compartment in flexion. Exploration revealed a severed popliteus. The patellar, femoral, and tibial components were removed without any bone loss, extensive synovectomy was performed, and the knee was irrigated. An articulating spacer was fixed on both the femur and tibia with antibiotic impregnated cement. The patient was made weight bearing as tolerated with a hinge brace (0°–30°) and placed on a six-week course of intravenous vancomycin. The patient was discharged four days postoperatively without complication.

Eight weeks later, right total knee reimplantation was performed without complication. A highly constrained implant with a rotating platform was chosen. Even given the prior history of problems with a mobile bearing implant, the added benefits of reduced strain on the highly constrained polyethylene were felt to be worthy of its use. Radiographs revealed normal positioning of the prosthesis components with no abnormalities.

At the time of this submission, the patient was doing well and his recovery was uneventful.

At one-year follow-up from the index procedure, the patient was doing well, had full range of motion, and was without instability or pain.

Discussion

Complete 180° rotatory dislocation of the polyethylene insert is an extremely rare complication; few case reports exist describing this phenomenon [7,8]. Turki and Trick reported a complete 180° rotatory dislocation in a cruciate-retaining mobile-bearing prosthesis, which occurred following closed reduction of a partial rotatory subluxation of the polyethylene component [7]. Similarly, Lee et al. reported complete 180° rotatory dislocation of a posterior-stabilized mobile-bearing prosthesis of the high flexion type following closed reduction of a posterior dislocation five weeks postoperatively [8].

Several risk factors have been identified for rotating platform dislocation. Fisher et al., who identified spinout in seven of 1255 cruciate-retaining mobile-bearing TKA procedures (0.56%), attempted to identify predisposing factors for these dislocations. All the patients with bearing spinout in this study were obese women with preoperative valgus deformity, suggesting the potential for greater risk in this subset of patients [9]. The authors encouraged that consideration be given to the use of a posterior-stabilized version of the mobile-bearing design or a fixed-bearing design when performing TKA on patients with preoperative valgus deformity.

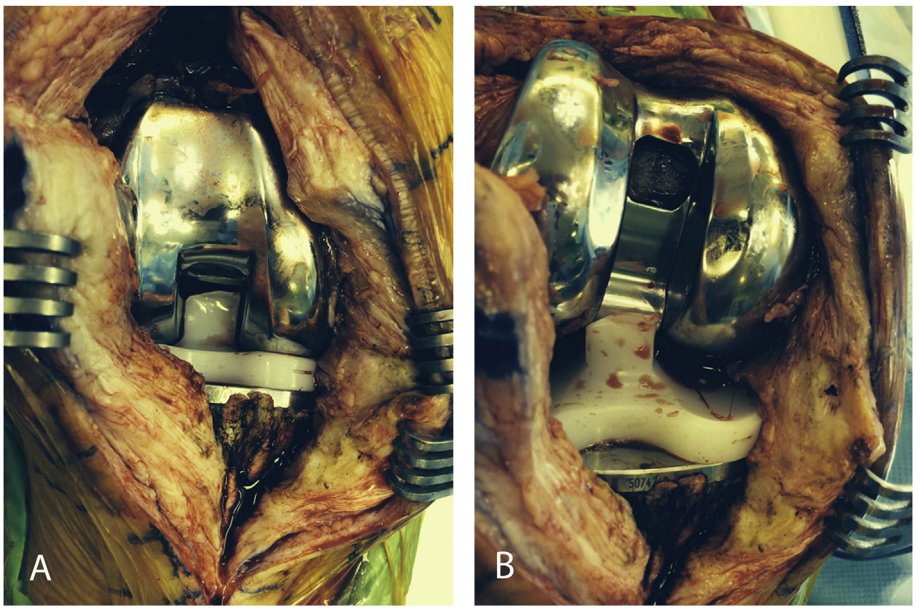

Fig. 3. Intraoperative photos revealing 180° spinout of the polyethylene insert (A) as well as the lateral gapping in flexion (B).

Thompson et al. identified rotating platform dislocation after primary Low Contact Stress TKA as a complication of 10 patients from a one-surgeon series of 2485 patients (0.4%). They found that the patient-associated risk factors for dislocation included advanced age, preoperative valgus malalignment, and previous patellectomy [6]. Thompson et al. hypothesized that the underlying mechanism of platform spinout is flexion gap instability resulting from surgical error in soft tissue balancing [6]. Flexion gap instability allows for excessive rotation of the insert when the femur translates on the tibia. The flexion gap is tighter on one side, and the femoral condyle on the tighter side causes the platform to rotate excessively, which turns the insert almost 90° around the central axis. Surgical error in soft tissue balancing is more likely to occur in patients with valgus deformity, which may explain why dislocation is more often associated with valgus misalignment [6]. Previous patellectomy is believed to be a risk factor due to disturbance of the extensor mechanism caused by patella removal, which compromises the anterior-posterior stability of the knee.

Flexion at the knee joint causes the femoral contact point to translate posteriorly relative to the tibia [10,11]. Flexion instability therefore may produce added stress on the posterior portion of the polyethylene insert allowing for lift of the anterior rim when the insert is not cemented to the tibia [12,13]. Kobayashi et al. used a sawbone model to confirm this theory. With the femoral component located slightly posteriorly, minimal knee flexion resulted in downward force on the posterior portion of the insert, allowing for anterior lift-off and easy dislocation of the insert [14].

In our case, we believe that flexion instability resulting from a severed popliteus caused posterior dislocation and resulted in 90° spinout of the polyethylene insert. We believe the closed reduction performed at the outside hospital rotated the insert an additional 90° to complete the 180° spinout. The first of three closed reduction attempts likely caused the complete spinout, as the lateral radiograph obtained prior to the second closed reduction at the outside hospital reveals a 180° spinout of the polyethylene insert (Figure 1). This spinout was presumably missed. Additionally, the patient had valgus deformity of the right knee, which is visible on the patient's original pre-operative radiograph prior to primary TKA. As discussed above, valgus deformity is a known risk factor for rotating platform dislocation, which likely predisposed this patient to dislocation. An alternative theory is that the polyethylene insert was positioned backwards in this patient during the primary surgery.

This case indicates that closed reduction attempts of a posterior dislocation may contribute to complete 180° dislocations of the rotating platform. Caution needs to be exercised with the use of both anterior-posterior and lateral radiographs when closed reduction is attempted to confirm correct reduction of the platform and to ensure that further spinout has not occurred. Additionally, this case highlights the value of plain digital radiography, which allows for enhancement of polyethylene density, and arthrography in diagnosing this complication [8].

Summary

Rotating platform dislocation is a potential early complication of the mobile-bearing total knee arthroplasty design — occurring in approximately 1% of cases. The authors present an exceedingly rare case of complete 180° rotatory dislocation of the rotating platform following multiple closed reduction attempts of a posteriorly dislocated right knee. This case highlights that valgus deformity and flexion instability may contribute to rotating platform dislocation and that closed reduction attempts may result in a complete 180° rotatory dislocation. Attention needs to be given to anterior-posterior and lateral radiographs following closed reduction to ensure the insert is properly reduced and not rotated 180°. Additionally, if closed reduction attempts fail then open interventions are necessary to evaluate and address any blocks to reduction.

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