



Case report

Atraumatic Fracture of the Medial Femoral Condyle of a Total Knee Arthroplasty

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ABSTRACT

The fracture of the femoral component is a rare complication of a total knee arthroplasty (TKA). This article presents a case in which a 70-year-old man underwent a left press-fit Advance Medial-Pivot Knee System TKA (MicroPort Orthopedics, Arlington, TN) in 2000. Twenty years later, he experienced a nontraumatic onset of knee pain after standing up from a lunge position. Radiographs and CT scans revealed a complete fracture of the medial condyle of the femoral component. Revision surgery was performed confirming the broken component. A cemented Triathlon Total Stabilizer (Stryker Orthopedics, Kalamazoo, MI) prosthesis was used for the revision. The authors recommend that surgeons maintain a high level of suspicion of component fracture when patients present with persistent severe knee pain and instability after a TKA.

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Introduction

The failure of a total knee arthroplasty (TKA) component is a rare occurrence and comprises less than 1% of indications for a revision TKA [1]. However, when component failure does occur, it is more commonly present in the tibial component or the polyethylene insert on the tibia, as opposed to the femoral component [1–8]. An isolated fracture of the femoral component is rare, and only a few reports have been documented. Swamy et al. described the first reported case of a nontraumatic fracture of the posterior medial condyle of the femoral component in a TKA [3]. This fracture occurred in a cemented left TKA using a PFC Sigma posterior cruciate retaining total knee prosthesis (DePuy Orthopedics, Warsaw, IN) and was reported in 2014 [3]. Afterward, Sarraf et al. describe a case of a fatigue fracture of the femoral medial condyle component with the suspected cause of the fracture likely related to obesity [1]. Schuh et al. reported a fracture of the lateral condyle of a cemented fixed TKA which they attributed to poor cementing technique [4]. In 2016, Thompson emphasized how an isolated fracture of a femoral component is a rare event and described another case in which the medial femoral condyle was fractured [2]. Interestingly, this

occurred in a cemented left TKA using a PFC Sigma posterior cruciate retaining total knee prosthesis (DePuy Orthopedics, Warsaw, IN), similar to the one reported by Swamy et al. [3]. However, Thompson attributed the component failure to a traumatic event involving the patient pushing a broken-down car down a highway [2]. Since 2019, more case reports have been published detailing the mechanisms of femoral component fracture; however, this is the first known case in which the medial femoral condyle fractured atraumatically in an Advance Medial-Pivot Knee System (MicroPort Orthopedics, Arlington, TN) [4,6–9].

Case report

The patient provided complete verbal informed consent to participate in this case report. A 70-year-old man (height = 191 cm/6 ft. 4 in. and weight = 116.1 kg/355 lbs.; BMI = 43.2) underwent a left press fit Advance Medial-Pivot Knee System (MicroPort Orthopedics, Arlington, TN) TKA in 2000 for severe tricompartmental osteoarthritis. No intraoperative nor immediate postoperative complications were documented after surgery including neurovascular injury, infection, persistent effusion or pain, or range of motion deficits. The patient was able to return back to activities of daily living without any significant issues. He was not instructed to continue with routine evaluations 6 months after surgery and went several years without having a formal knee examination.

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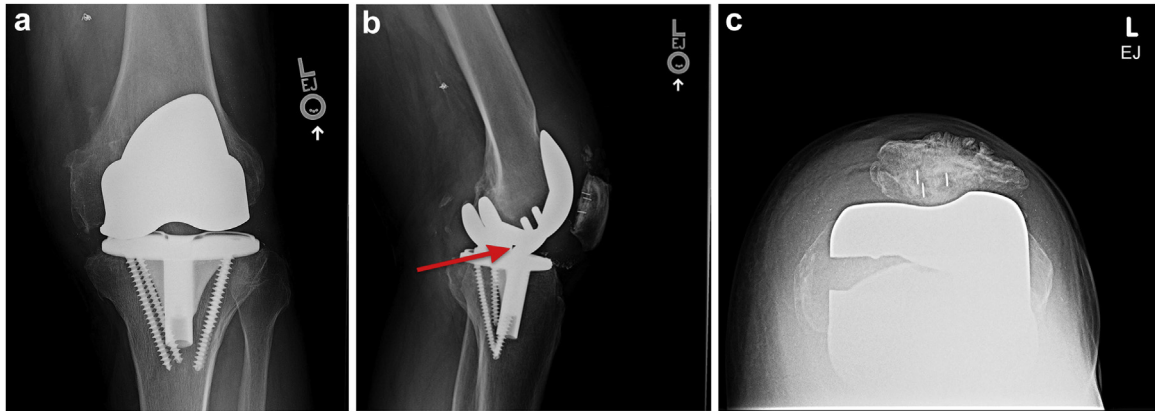


Figure 1. (a) Radiograph AP view of the left knee showing significant wear of the medial polyethylene insert with contact between the medial femoral and tibial components. (b) Radiograph lateral view of the left knee demonstrating fracture of the medial condyle of the Advance Medial-Pivot Knee System prosthesis (indicated with the red arrow). (c) Radiograph sunrise view of the left knee demonstrates a complete fracture of the medial condyle of the Advance Medial-Pivot Knee System prosthesis.

In August 2020, the patient was picking up an object off the floor while in a lunge position with his left leg forward, and as he stood up, he felt and heard a “pop” within the knee. The patient denied any prior traumatic accident or event leading up to the “pop.” He presented to the authors’ clinic about 1 week after the initial incident with significant knee swelling and pain. In addition, he ambulated with an antalgic gait and reported a sensation of significant instability in the knee that prevented full weight bearing unless the knee was positioned in a particular manner.

On physical examination, the patient had a large effusion, and the left knee was warm to touch, but not hot. The anterior knee incision remained well healed. He was particularly tender along the

medial tibial condyle as well as the distal femoral condyle. While he was standing and bearing weight on his left side, he was able to produce a loud audible pop as well as a visible shift within the knee when he thrust the knee laterally.

Radiographs taken that day displayed significant wear to the medial compartment of the polyethylene liner (Fig. 1) as well as possible metal fragments anterior to the tibial component on the lateral projections (Fig. 1b). The sunrise view revealed the medial condyle of the femoral component to be fractured (Fig. 1c). Given the patients’ radiographs and physical examination, a left knee CT scan with 3D reconstruction was ordered to confirm and further characterize fracture on the femoral component (Fig. 2). Given the abnormal radiographs suggestive of component fracture with no other hardware loosening, systemic signs of infection, or global inflammatory process, infectious and inflammatory diagnostics were foregone, and revision of the left knee was recommended. The patient agreed and provided a fully informed written consent to proceed with the operation. About 4 weeks after initially presenting to the author’s clinic, the patient underwent a revision of the TKA in September 2020.

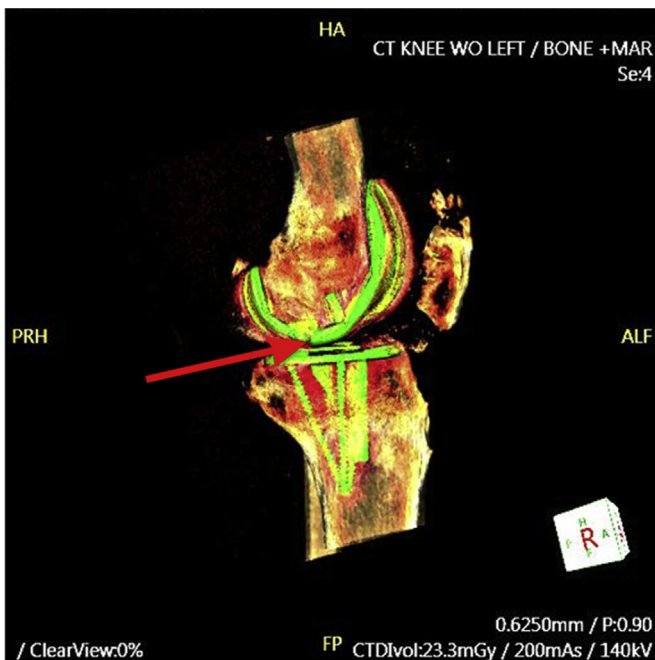


Figure 2. CT scan with MAR and 3D reconstruction demonstrates a medial condyle fracture of the Advance Medial-Pivot Knee System prosthesis (indicated with the red arrow).



Figure 3. Intraoperative photograph displaying the fractured medial component of the Advance Medial-Pivot Knee System. In particular, this photo shows that loose medial component flipped 180 degrees.



Figure 4. Intraoperative photograph displaying the fractured medial component of the Medial-Pivot Knee System once the prosthesis was fully extracted.

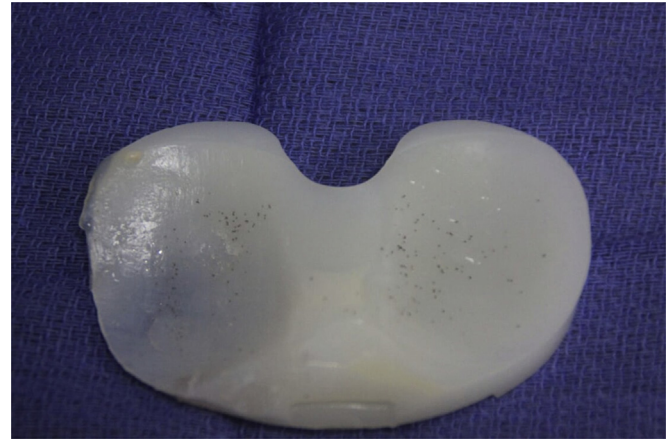


Figure 5. Intraoperative photograph displaying the severe medial polyethylene wear.

The previous midline incision was used. Gross examination of the knee prosthesis was pursued, and the fracture of the medial femoral condyle was confirmed (Figs. 3 and 4). However, not only was the component fractured, the free-floating fractured component had flipped 180 degrees (Fig. 3). We theorize that the patient's sense of instability was likely due to the fractured medial compartment component moving freely within the joint. In addition to the component fracture, Figure 5 also demonstrates the severe wear of the polyethylene insert, particularly in the medial compartment. The knee was revised with a cemented Triathlon Total Stabilizer (Stryker Orthopedics, Kalamazoo, MI) without any immediate complications. Radiographs taken 2 weeks after the revision TKA demonstrate excellent positioning of total knee prosthesis with no evidence of lysis, loosening, or fracture (Fig. 6a and b). All evaluations through the 6-month post-operative period have been uneventful.

Discussion

The most common indication for a TKA revision is aseptic loosening (35%) followed by infection (23%) and pain (18%), with revisions making up about 6% of all TKAs performed [1]. Failure of metal implants is a rare but devastating complication of arthroplasty, typically requiring surgical intervention. It is not explicitly clear how or why this patient fractured the femoral component. However, it is suspected that the patient was participating in more rigorous activities than instructed, causing atypical stress on the femoral joint. This patient is a farmer and has disclosed the large amount of rigorous physical activity he partakes in, such as loading hay bales onto a trailer, which may have been one factor leading to failure. In addition, this patient has a large and muscular build with a BMI of about 43 which is likely another contributing factor in hardware failure as it has been reported that the major patient-associated risk factor for implant fatigue fracture is a BMI greater than 40 [1].

Atraumatic and aseptic hardware fracture requires the component to experience an uneven distribution of forces through the implant. Previous evidence demonstrates that uncemented, porous-coated prostheses often restrict bone growth to isolated areas potentially leading to nonuniform load bearing through the implant [5]. This might make cementing the component more

favorable than noncementing, especially in large patients as this may allow a more uniform force distribution during weight bearing. In addition, Sarraf et al. reported that of the 24 fatigue fractures reported in literature, 20 have been uncemented femoral components [1]. Thus, the authors concluded that the combination of obesity with high physical activity and uncemented components likely led to the failure of the implant [1]. In addition, we believe the age of the component could be a significant contributing factor.

As the number of people with high BMI in the United States as well as in other parts of the world continue to increase, we agree with Schuh et al. who postulate that total knee revisions due to fatigue fractures will continue to increase and become a more prevalent complication [4]. This is also likely the reason why there has been an increase in reported femoral component fractures within the last few years. Consequently, surgeons should be aware, remain vigilant, and evaluate their patients routinely after a TKA. If a patient presents with atraumatic severe swelling, altered gait, and instability within the knee after a TKA, surgeons should strongly consider the possibility for a component fracture. To prevent component fracture in future patients, the authors recommend that surgeons confirm there is full and stable contact between hardware and bone through perfect bone cuts when implanting uncemented components, especially in larger patients [5].

Summary

The authors suspect that the fracture of the femoral component may have been due to a combination of increased physical activity, high BMI, the age of the component, and the use of a press fit technique in a large patient. We recommend surgeons be aware of prosthetic component fracture, remain vigilant, and evaluate their patients routinely after a TKA. If a patient presents with atraumatic severe swelling, antalgic gait, and instability within the knee after a TKA, surgeons should be suspicious of a component fracture.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

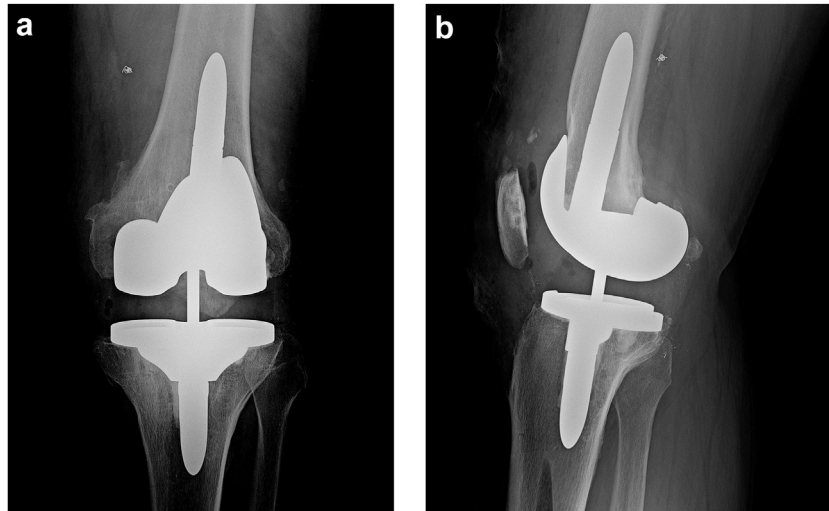


Figure 6. (a) Postoperative radiograph AP view displaying the new Triathlon Total Stabilizer (Stryker Orthopedics, Kalamazoo, MI) implant. (b) Postoperative radiograph lateral view displaying the new Triathlon Total Stabilizer (Stryker Orthopedics, Kalamazoo, MI) implant.

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