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Review Article

Fracture of the polyethylene tibial post in a posterior stabilized knee prosthesis: A case report and review of literature

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ABSTRACT

We report a case of fracture of tibial polyethylene post fracture from base in a 56 year old lady 10 years from posterior stabilized total knee arthroplasty following trivial trauma. There have been signs of wear at the base especially anteriorly. After revision of tibial polyethylene component patient developed complete relief of symptom.

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1. Introduction

The Posterior stabilized total knee arthroplasty implant is one of the very successful designs in total knee arthroplasty.^{1–3} It has been considered gold standard for total knee arthroplasty longevity.² This design is a type of posterior cruciate ligament substituting implant where PCL is replaced by a tibial post and femoral cam mechanism.^{3,4} This construct allows for femoral roll-back in knee flexion and prevents posterior tibial subluxation during knee flexion.⁴ Despite its advantages, the cam and post mechanism in some designs has been associated with knee instability and patellar clunking.^{4–6} Plastic deformation and gross damage to the tibial post can occur from anterior or posterior impingement against the femoral component.^{4,7}

There have now been reports of progressive wear of tibial post in the literature.^{4–8} This has led to increased rate of

failure of total knee arthroplasty.⁸ Here we report a case of tibial post fracture 10 yrs after primary total knee replacement.

2. Case report

A 56 year old lady with severe osteoarthritis of bilateral knee underwent simultaneous total knee replacement of both the knee in September 2003. The approach used was the popular midline skin incision with midvastus arthrotomy to implant a NexGen posterior stabilized knee prosthesis. Preoperatively, the patient had varus deformity of 15° and fixed flexion deformity of 10° in the left knee. The range of motion of the knee was 10°–110°. The patient was operated with total knee replacement and intraoperatively insert of size 12 was used. The knee was stable with this insert in full flexion, full

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extension and mid flexion. Post operatively, the patient obtained satisfactory range of motion (0–120° of flexion). The patient was followed initially every 6 monthly for 3 years and yearly thereafter.

However, about 3 months prior to the revision surgery the patient developed sudden onset of pain and swelling in the left knee following slipping out of stairs. The pain and swelling was initially relieved with rest and hot packs but was later progressive. The pain was associated with occasional locking and clicking sensation of the knee. The patient was not able to stand up from sitting position or walk upstairs without support. On examination, there was genu recurvatum in the left knee and associated grade 2 positive posterior drawer test. The range of motion was 0–110°. Radiographs showed mild hyperextension and slight posterior subluxation of the femoral component.

The patient was operated again in August 2013 (Fig. 1). A fracture of tibial post was noted at the base of the tibial insert along with wear at the base of the post (Figs. 2 and 3). The broken post was retrieved from the lateral gutter (Fig. 4). Rest of the components appeared normal. Another insert of size 14 mm was used in place of the fractured one (Fig. 5). The stability and overall alignment of the limb was assessed and found to be satisfactory. The status of patellar component was also checked and tracking was acceptable. Post operatively, the patient recovered well and there was complete relief of previous symptoms.

3. Discussion

Total condylar knee prosthesis had a conforming tibial insert to substitute for the PCL.^{7,9} Limited knee flexion was a concern with these designs. Insall–Burststein prosthesis improved femoral roll back and knee flexion by incorporating a tibial post that engage over a cam on femoral component during knee flexion.¹⁰ Complications related to post and cam include patellar clunk syndrome, wear of tibial post and post fractures. A broken tibial post can manifest as patellar clunk, knee instability and even prosthesis dislocation.^{4,7,11} Diagnosis may be made over plain radiograph when knee is placed in more than 90° flexion (posterior subluxation of femoral component) or computed tomographic arthrography.¹²

Fig. 2 – Intraoperative view of the case.

Fracture of tibial post in a posterior stabilized knee design is a rare complication after total knee arthroplasty. Chi-Sheng Lee¹³ et al reported tibial post fracture in a NexGen LPS-Flex Posterior Stabilized Knee Prosthesis. The fracture occurred only 3 years after primary surgery in a patient with abnormal gait and was secondary to repeated anterolateral impingement between the articulating surface of femoral box and polyethylene tibial post due to this gait. This led to accelerated wear of the polyethylene tibial post resulting in fracture. Mauerhan¹² reported 5 cases of fracture of polyethylene tibial post in posterior stabilized knee design with the symptoms resembling patellar clunk syndrome. In knee extension, there is anterior impingement and damage of tibial post occurs from contact against the femoral component.⁷ In knee flexion the tibial post can contact the femoral cam posteriorly resulting in wear which can be severe enough to result in failure.^{4,7} Tibial post failures occurred in a subset of patients

Fig. 1 – Preoperative X-ray of the case.

Fig. 3 – Intraoperative view of the patient showing fracture of tibial post.

with excessive rotation between femur and tibia. Surgical variables such as excessive femoral component flexion, anterior positioning of tibial tray, excessive posterior tibial slope, joint line alteration of 8 mm or more can predispose to anterior tibial post impingement and failures.^{14,15}

In vivo oxidation may significantly contribute to the surface damage of the posterior stabilized tibial inserts.^{16,17} Gamma sterilisation techniques, both in air and in an inert environment have been associated with oxidation of polyethylene component during shelf storage and implantation.¹⁷ Although our study have no available data regarding sterilisation method of polyethylene and shelf ageing of polyethylene component.

Fig. 4 – Showing polyethylene with fractured and retrieved post.

Fig. 5 – Postoperative X-ray of the case showing exchange liner with increased thickness.

In recent years there has been case report of early tibial post fracture. Our case report is unique in the respect that it occurred 10 years after initial operation and tibial post fracture from base occurred after trivial trauma. There have been signs of burnishing and lamination of tibial post retrieved at its base over anterior aspect. The possible mechanism of failure of polyethylene post in our case is anterior impingement between femoral cam and tibial post associated with trivial trauma resulted in tibial post fracture from base.

4. Message

Our case report aims at directing orthopaedic surgeons towards high index of suspicion of tibial post fracture when patient of posterior stabilized total knee arthroplasty develops sudden onset pain in knee with difficulty in standing up, with radiograph showing posterior subluxation of femoral component. This condition may mimic patellar clunk syndrome. Although rare this condition should be borne in mind as its management is different and requires revision of component.

Conflicts of interest

All authors have none to declare.

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