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Published: 2026.XX.XXTibial Post Fracture in a Posterior-Stabilized
Knee Prosthesis: A Case Report and Review
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Data Interpretation D
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Financial support: None declared
Conflict of interest: None declared**Patient:** Male, 92-year-old
Final Diagnosis: Fracture of tibial post
Symptoms: Pain
Clinical Procedure: —
Specialty: Orthopedics and Traumatology**Objective:** Unusual clinical course**Background:** Tibial post fracture is an uncommon but likely underrecognized complication of posterior-stabilized (PS) total knee arthroplasty (TKA) that often remains undiagnosed because conventional radiographs may be unrevealing. We report a late tibial post fracture in a previously well-functioning PS TKA, highlighting the role of dynamic fluoroscopy in raising preoperative suspicion and the successful use of isolated polyethylene insert exchange in a carefully selected patient.**Case Report:** A 92-year-old man presented with acute mechanical pain, recurrent clicking, and subjective instability 16 years after primary PS TKA following a low-energy flexion-rotation movement. Plain radiographs showed no evidence of periprosthetic fracture, component loosening, or implant failure. Dynamic fluoroscopy during flexion, which reproduced the patient's symptoms, demonstrated abnormal anterior translation of the femoral component relative to the tibial insert during knee flexion, raising suspicion of cam-post mechanism failure. Revision surgery confirmed a fracture of the polyethylene tibial post with chronic wear at its base; the metallic components remained well fixed, without gross malposition. Isolated polyethylene insert exchange with a thicker insert restored intraoperative stability. At 4.5 months postoperatively, the patient demonstrated complete resolution of mechanical symptoms, with full extension, 100° to 110° of flexion, and preserved varus-valgus and antero-posterior stability.**Conclusions:** This case illustrates how dynamic fluoroscopy may raise preoperative suspicion of tibial post fracture in selected patients with symptomatic late PS TKA and inconclusive conventional radiographs. In our patient, isolated polyethylene insert exchange was effective after confirmation of preserved component fixation, alignment, and overall stability, supporting its use in appropriately selected cases.**Keywords:** Case Management • Case Reports • Knee • Knee Prosthesis • Tibial Fractures**Full-text PDF:** <https://www.amjcaserep.com/abstract/index/idArt/954794> 2295 — 5 2 17

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Introduction

Normal knee kinematics depend in part on the posterior cruciate ligament (PCL), which serves as the primary restraint to posterior tibial translation and contributes to rotational stability, particularly with increasing knee flexion. PCL insufficiency therefore produces multiplanar instability, with increased passive anteroposterior translation and rotational laxity; compensatory mechanisms may limit these abnormalities during level walking [1]. Biomechanical modeling suggests that loss of PCL function redistributes stabilizing demands to secondary structures, especially the medial and lateral collateral ligaments, and may increase tibiofemoral contact forces [2]. In posterior-stabilized (PS) total knee arthroplasty (TKA), in which the PCL is resected, these stabilizing demands are partly transferred to the prosthetic construct. The femoral cam engages the polyethylene tibial post during flexion to constrain sagittal translation and facilitate femoral rollback, thus substituting for an important component of native PCL function [3]. Consequently, the cam-post articulation becomes an important interface for load transfer and stabilization.

The mechanical interaction between the femoral cam and tibial post depends not only on the PS mechanism itself but also on its geometry, the timing of cam-post engagement, and the functional alignment of the knee. Biomechanical and retrieval studies have demonstrated that variations in implant design, component positioning, and post-cam mechanics may influence tibial post loading, contributing to impingement and progressive polyethylene damage [4]. Consistent with these observations, retrieval analyses of PS implants revised for various indications have documented substantial tibial post wear and deformation, highlighting the susceptibility of this component to mechanical damage [5,6].

The Genesis II system (Smith & Nephew, UK) is a widely used TKA platform available in both cruciate-retaining and PS configurations. Although implant-specific cam-post geometry influences the timing and pattern of engagement, tibial post wear and fracture are not unique to the Genesis II system and have been reported across PS designs. More broadly, factors such as joint-line elevation, tibial component positioning, patellofemoral mechanics, and deep flexion may alter cam-post contact and promote impingement and polyethylene wear [7,8].

Although tibial post fracture is an uncommon complication, several reports have associated it with mechanisms such as hyperflexion, repetitive impingement, and alterations in knee biomechanics. Clinically, patients may present with mechanical pain, audible or palpable clicking, and flexion instability; radiographic findings are often inconclusive, delaying definitive diagnosis until revision surgery. In this context, identification of the underlying failure mechanism is essential to guide

treatment. When potential causes such as component malposition, malrotation, or aseptic loosening have been excluded, isolated polyethylene insert exchange may be sufficient to restore knee stability and function [9-11].

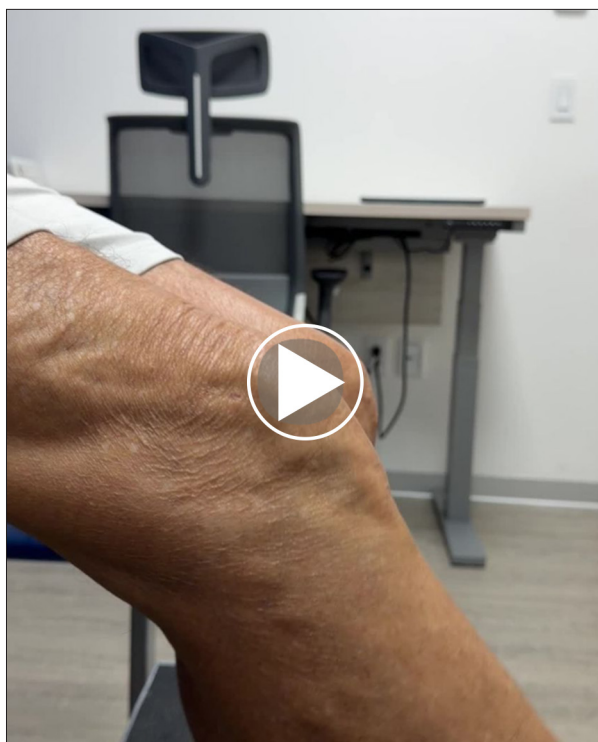
The objective of this narrative literature review was to summarize available evidence regarding the biomechanical mechanisms, risk factors, clinical presentation, diagnostic approaches, and treatment strategies associated with tibial post fracture in PS TKA.

A narrative literature search was conducted using PubMed/MEDLINE, Scopus, and Google Scholar with combinations of the following keywords: “arthroplasty, replacement, knee,” “case report,” “prosthesis failure,” “polyethylene,” and “fluoroscopy.” Relevant case reports, case series, biomechanical studies, retrieval analyses, and review articles were considered. Additional publications were identified through manual screening of the reference lists of relevant articles. Studies were selected based on their relevance to the mechanisms of failure, diagnostic evaluation, and surgical management of tibial post fracture. The findings were synthesized narratively to contextualize the present case, with particular emphasis on dynamic fluoroscopy and isolated polyethylene insert exchange.

Case Report

We present the case of a 92-year-old man who underwent right TKA in 2009 for end-stage knee osteoarthritis using a Genesis II PS prosthesis (Smith & Nephew, UK). The index procedure was uneventful, and the patient achieved excellent postoperative recovery, with a functional range of motion and independent ambulation. He maintained satisfactory clinical and functional outcomes for more than 16 years, without documented complications or relevant mechanical symptoms prior to the index event. Detailed information regarding body weight, body mass index, habitual activity level, functional demands, and potentially relevant comorbidities was unavailable in the medical record. Approximately 16 years after TKA, while performing a combined flexion-rotation movement, he experienced an audible pop accompanied by sudden pain and swelling of the right knee. Thereafter, he developed persistent mechanical instability and recurrent clicking during knee motion.

The patient continued to experience mechanical instability, recurrent clicking, and an abnormal sensation during knee motion, with progressive worsening of symptoms during subsequent weeks. Physical examination revealed a well-healed surgical incision without signs of infection, as well as an intact extensor mechanism. Active and passive range-of-motion testing reproduced distinct clicking associated with perceived prosthetic subluxation and spontaneous reduction. Functional



Video 1. Active range of motion of the right knee demonstrating a prosthetic reduction (relocation) phenomenon characterized by abnormal anterior translation of the femoral component relative to the polyethylene tibial insert during knee flexion, reproducing the patient's mechanical symptoms.

range of motion was preserved, and varus-valgus stability remained intact (**Video 1**).

Preoperative anteroposterior and lateral radiographs (**Figure 1**) demonstrated satisfactory component positioning without evidence of migration, aseptic loosening, or gross coronal or sagittal malposition. Lateral radiography demonstrated that the tibial component exhibited a near-neutral posterior tibial slope. Because full-length weight-bearing radiographs were unavailable, mechanical coronal alignment and joint-line position could not be quantitatively assessed. Similarly, rotational alignment was not evaluated through dedicated computed tomography; therefore, subtle rotational malalignment could not be definitively excluded. Dynamic fluoroscopic evaluation (**Figure 2, Video 2**) demonstrated anterior translation of the femoral component relative to the tibial insert at approximately 80° of knee flexion, reproducing the patient's mechanical symptoms.

A comprehensive workup for periprosthetic joint infection yielded negative results. Preoperative synovial fluid analysis demonstrated a leukocyte count of 200 cells/ μ L with 18% polymorphonuclear cells. A multiplex molecular panel of synovial fluid showed negative findings for all tested pathogens.



Figure 1. Lateral radiograph of the right knee demonstrating the tibial, femoral, and patellar components without evidence of periprosthetic fracture, component migration, or aseptic loosening. The radiolucent polyethylene tibial insert is visualized in position. No gross sagittal component malposition is identified.

Intraoperatively, synovial fluid and intra-articular fibrous tissue samples were obtained for microbiological analysis. Aerobic and anaerobic culture results were negative, and Gram staining revealed no bacteria. Fungal and acid-fast bacilli cultures also showed negative results throughout their respective incubation periods. These findings did not support a diagnosis of periprosthetic joint infection.

Given the persistent mechanical instability and high suspicion of cam-post mechanism failure, revision surgery was performed approximately 3 months after symptom onset. Intraoperatively, a fracture of the polyethylene tibial post was identified, with associated wear at its base (**Figure 3**). The specific polyethylene formulation and sterilization method of the original insert could not be established from available implant records. The fractured fragment was retrieved from the joint. The remaining prosthetic components were well positioned and stable, without evidence of aseptic loosening. The fractured 11-mm polyethylene tibial insert was removed, and the tibial component was confirmed to be stable.

A 13-mm trial insert was subsequently placed and demonstrated satisfactory stability throughout the range of motion,

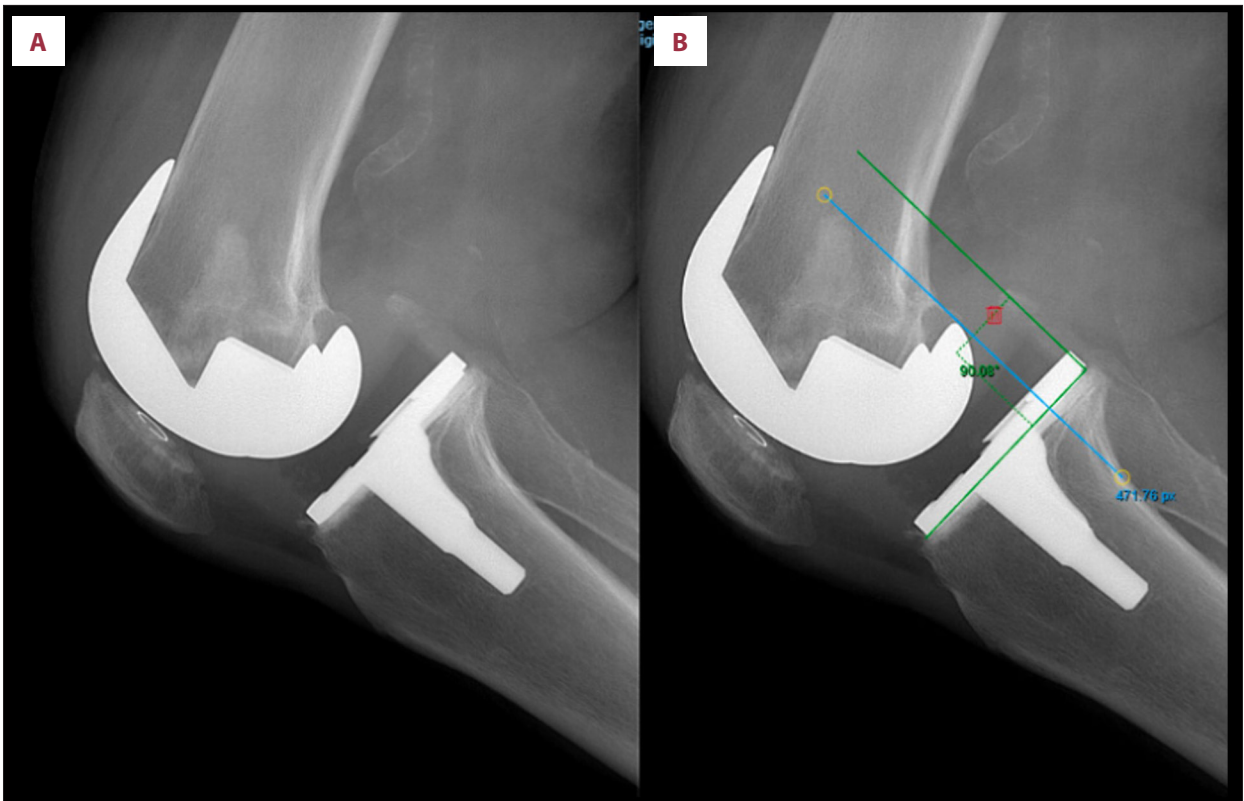


Figure 2. Lateral fluoroscopic images of the right knee obtained during dynamic evaluation at 90° of flexion. (A) Original fluoroscopic image demonstrating abnormal anterior translation of the femoral component relative to the tibial component. (B) Corresponding annotated image showing reference lines used to assess prosthetic component orientation and sagittal alignment. Green and blue lines illustrate the orientation of the femoral and tibial components, respectively; angular markers indicate their relative alignment. The white line follows the tibial baseplate, demonstrating a near-neutral posterior tibial slope. These findings support the presence of abnormal sagittal translation consistent with cam-post mechanism dysfunction.



Video 2. Dynamic lateral fluoroscopic evaluation of the right knee demonstrating abnormal anterior translation of the femoral component relative to the polyethylene tibial insert at approximately 80° of knee flexion, reproducing the patient's mechanical symptoms.

without medial or lateral opening under stress. Based on this intraoperative assessment, a 13-mm Genesis II PS tibial insert (size 7-8) was implanted (Figure 4). The increase in insert thickness from 11 to 13 mm was based on the satisfactory intraoperative stability achieved with the trial insert, without evidence of excessive tightness or coronal imbalance throughout the tested range of motion. The specific polyethylene formulation of the replacement insert was not documented in operative records. At 4.5 months postoperatively, the patient demonstrated complete resolution of preoperative instability and mechanical symptoms. Clinical examination revealed full extension, 100° to 110° of flexion, preserved varus-valgus and anteroposterior stability, and no clinically significant joint effusion (Figure 5).

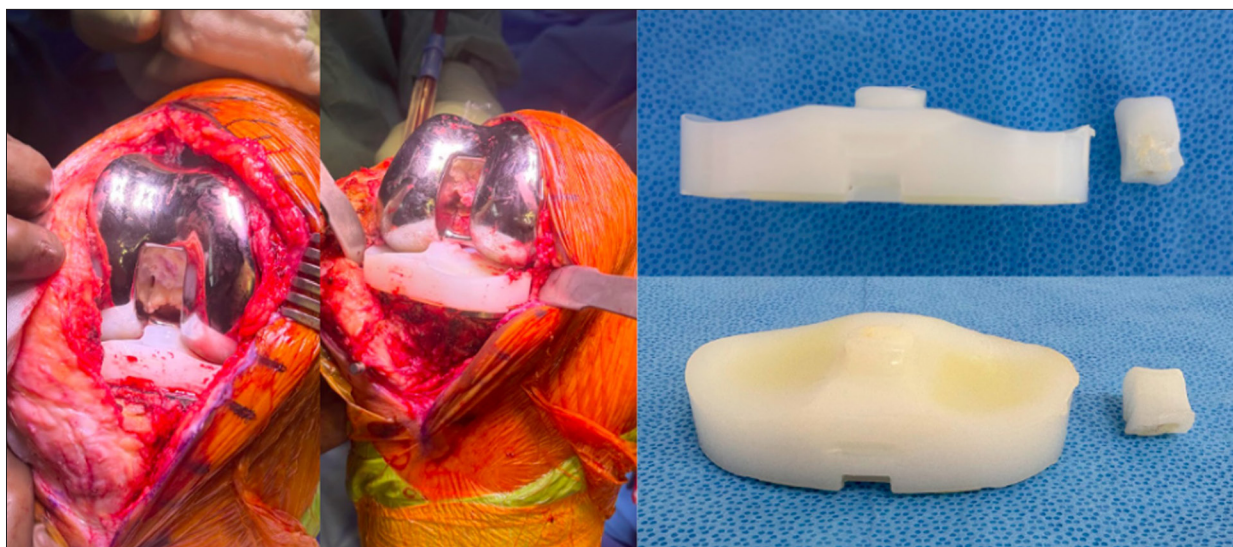


Figure 3. Polyethylene tibial insert demonstrating a fracture at the base of the tibial post. Pronounced wear is evident along the posterior aspect of the post base.

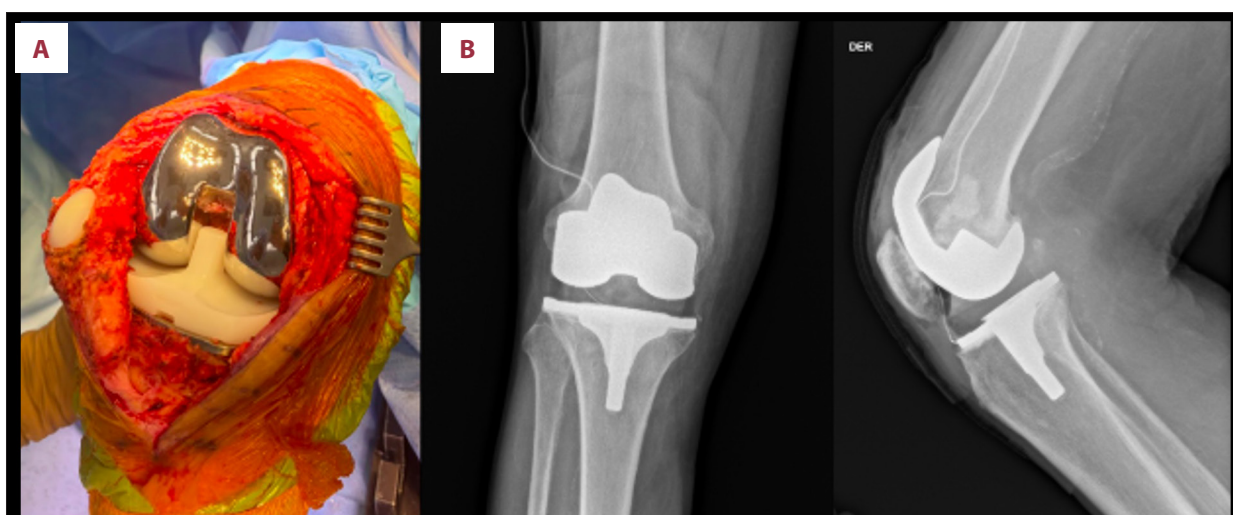


Figure 4. Isolated polyethylene tibial insert exchange. (A) Intraoperative photograph obtained after insertion of the new polyethylene insert. (B) Immediate postoperative anteroposterior and lateral radiographs demonstrating appropriate positioning and alignment of the prosthetic components.

Discussion

Tibial post fracture in PS TKA is an uncommon but clinically significant complication, with reported incidences generally below 1%. However, relatively recent reports suggest that this complication may be underdiagnosed, particularly in patients who present with nonspecific mechanical symptoms and inconclusive findings on conventional radiographs [4,12].

The cam-post mechanism was developed to functionally replace the PCL, facilitating posterior femoral rollback during knee flexion while preventing posterior tibial subluxation. Notably, this design creates a focal load-transfer interface between

the femoral cam and tibial post, subjecting the polyethylene to repetitive compressive, shear, and contact stresses. Over time, these forces can lead to plastic deformation, progressive wear, impingement, and ultimately structural failure of the tibial post [5,6].

Historically, tibial post fracture was considered a consequence of cumulative material fatigue. However, recent biomechanical evidence has challenged this theory as the sole mechanism of failure. Garvin et al demonstrated that both conventional and highly cross-linked polyethylene can withstand repetitive physiological loading without fracture in long-term fatigue models, concluding that mechanical fatigue alone is unlikely



Figure 5. Clinical photographs obtained at postoperative follow-up demonstrating full knee extension and approximately 100° to 110° of flexion, with restoration of a functional range of motion.

to cause most clinically observed fractures. Instead, preexisting tibial post wear likely represents a prerequisite for late structural failure [13]. In addition to mechanical factors, long-term polyethylene aging, oxidation, and material degradation may contribute to the progressive loss of mechanical properties and increased susceptibility to wear or structural failure. In the present case, the specific polyethylene formulation and sterilization method of the original insert could not be established; therefore, the potential contribution of material-related degradation could not be determined [14].

Our intraoperative findings support the hypothesis that preexisting post wear precedes fracture. The retrieved polyethylene insert demonstrated predominant wear at the base and posterior aspect of the tibial post, with an associated oblique fracture line. This pattern is consistent with the retrieval analysis reported by Kahlenberg et al, who demonstrated that most tibial post fractures originate at the posterior edge of the post and are associated with preexisting damage, including burnishing, delamination, and progressive thinning in this region [15]. Such findings suggest that acute fracture represents the final stage of a chronic process of mechanical deterioration, rather than an isolated event.

Several biomechanical factors have been implicated in tibial post failure, including increased posterior tibial slope, excessive

flexion of the femoral component, anterior positioning of the tibial baseplate, joint-line elevation, and femorotibial rotational malalignment. Each of these factors can alter the timing and location of cam-post engagement, promoting abnormal impingement and localized overload [12,16]. In the present case, conventional radiographs showed no evidence of component migration, aseptic loosening, or gross coronal or sagittal malposition; a near-neutral posterior tibial slope was observed. Intraoperatively, both metallic components were well fixed and showed no gross evidence of malposition. However, because full-length weight-bearing radiographs and dedicated computed tomography scans were unavailable, mechanical coronal alignment, joint-line position, and rotational alignment could not be quantitatively assessed; subtle malalignment could not be definitively excluded. In our patient, chronic polyethylene wear followed by structural failure of the tibial post represents the demonstrated sequence, whereas repetitive cam-post impingement and localized mechanical overload should be considered possible contributing mechanisms rather than definitively established causes.

A notable contribution of the present case is the preoperative documentation of dynamic sagittal instability via fluoroscopy, which demonstrated abnormal anterior translation of the femoral component at approximately 80° of knee flexion and

reproduced the patient's mechanical symptoms. Although dynamic imaging has previously been described for the assessment of translational instability after TKA, reports specifically documenting this finding in relation to late tibial post fracture in a PS implant remain limited [10,11]. In this context, the present case provides a practical illustration of how dynamic fluoroscopy may increase preoperative suspicion of cam-post failure in carefully selected symptomatic patients with inconclusive conventional radiographs, rather than establishing a novel diagnostic modality [17].

Computed tomography may provide complementary assessment when conventional radiographs are inconclusive, particularly if component position or rotational alignment is concerning; however, it was not performed in the present case. Accordingly, this case may serve as an educational example of fluoroscopy-assisted preoperative recognition of tibial post failure in a patient who presented with late symptomatic PS TKA and radiographically inconclusive mechanical instability.

Furthermore, the clinical presentation in our patient is consistent with the mechanism proposed by Kumar et al, in which a low-energy traumatic event serves as the final trigger for complete fracture of a tibial post structurally compromised by chronic wear [16]. Regarding treatment, the current literature emphasizes that the revision strategy should be individualized according to the underlying cause of failure. When tibial post fracture occurs in the absence of aseptic loosening, severe component malposition, or global ligamentous instability, isolated polyethylene insert exchange can provide excellent clinical outcomes. Nevertheless, the durability of isolated insert exchange depends on appropriate patient selection and the correction or absence of underlying mechanical factors responsible for post failure. Conversely, delayed diagnosis may allow progression to multiplanar instability and secondary ligamentous insufficiency, ultimately requiring revision with a more constrained prosthetic construct [12].

In the present case, the metallic components were well fixed, without evidence of aseptic loosening, gross malposition, or additional mechanical failure. Accordingly, isolated polyethylene insert exchange restored intraoperative stability and was followed by complete resolution of mechanical symptoms at 4.5 months. Such findings suggest that this management

strategy may be appropriate in carefully selected patients with symptomatic late PS TKA, high clinical suspicion of cam-post failure, preserved collateral ligament and overall knee stability, and intraoperative confirmation that revision of the fixed components is unnecessary. Conversely, this case does not address the management or outcomes of patients with component loosening, malposition, advanced instability, or other indications warranting more extensive revision surgery.

Conclusions

Tibial post fracture in PS TKA is an uncommon but likely underrecognized complication that should be considered in patients who present with late-onset mechanical pain, clicking, recurrent effusion, or instability after a previously well-functioning knee replacement. In the present case, chronic polyethylene wear preceded structural failure of the tibial post; repetitive cam-post impingement and localized mechanical overload remain possible contributing mechanisms, rather than definitively established causes. In carefully selected patients with inconclusive conventional imaging, dynamic fluoroscopy may serve as a useful adjunct to raise preoperative suspicion of tibial post failure. In our patient, isolated polyethylene insert exchange was effective after confirmation of preserved component fixation and overall knee stability, supporting its use in appropriately selected patients while avoiding more extensive revision surgery.

Institution Where the Work Was Performed

ABC Medical Centre, México City, México.

Patient Consent

Written informed consent was obtained from the patient for publication of this case report and the accompanying clinical images and videos.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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