

CASE SERIES

Periprosthetic Distal Femur Fractures after Total Knee Arthroplasty: A Three-Case Experience from a Resource-Constrained LMIC Tertiary Care Center

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Background: Periprosthetic distal femur fractures (PDFFs) following total knee arthroplasty (TKA) are increasingly encountered in elderly patients. These fractures present a complex challenge, particularly in low- and middle-income countries (LMICs) where implant options and surgical infrastructure may be limited.

Case Presentation: We present three elderly female patients with PDFFs managed at a tertiary care center in Pakistan. All cases involved low-energy trauma and well-fixed TKA components. Diagnostic evaluation included radiographs and CT imaging with metal artifact reduction. Patients were treated using three distinct strategies: (1) open reduction and internal fixation (ORIF) with a locking plate; (2) retrograde intramedullary nailing with insert exchange; and (3) distal femoral megaprosthesis for a comminuted fracture with poor bone stock. All patients were optimized preoperatively and followed for six months, showing satisfactory radiographic and functional outcomes.

Conclusions: In LMICs, where modular revision total knee implants may be unavailable, osteosynthesis and megaprosthesis reconstruction remain the most accessible and effective options. Careful surgical planning and patient selection are critical to achieving favorable outcomes even within resource-limited environments.

Keywords: Periprosthetic fracture; total knee arthroplasty; distal femur; locking plate; retrograde nail; megaprosthesis; LMIC

How to cite: Noor SMN, Jamil M, Lakdawala RH. Periprosthetic Distal Femur Fractures after Total Knee Arthroplasty: A Three-Case Experience from a Resource-Constrained LMIC Tertiary Care Center. (JBSS). 2026; 01(03): 17-20

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Introduction

Periprosthetic distal femur fractures (PDFFs) are increasingly observed as the number of total knee arthroplasties (TKAs) rises globally, particularly among aging populations^{1,2}. Registry data indicates an incidence of 0.3%–2.5% in primary TKAs, with significantly higher rates in octogenarians and patients with underlying osteoporosis or frailty^{3,4}. The pathophysiology of PDFFs is multifactorial, with low-energy falls, implant-related stress shielding, and decreased cortical bone integrity contributing to fracture susceptibility in the elderly⁵. Female patients are disproportionately affected, partly due to postmenopausal osteoporosis and sarcopenia^{3,6}. In high-income countries, advanced implant systems and perioperative infrastructure support timely surgical management. However, in LMICs, limited access to revision implants, variable quality of prosthetics, and financial constraints challenge standard treatment algorithms^{1,7}. Despite these barriers, some tertiary care centers in resource-constrained regions now have access to locking plates, retrograde nails, and oncologic megaprotheses, enabling tailored interventions.

Classification systems such as those by Lewis and Rorabeck and Su et al. help guide surgical planning by stratifying fractures based on implant stability and fracture morphology. Internal fixation techniques like locking plate osteosynthesis (LPO) and retrograde intramedullary nailing (RIMN) remain primary strategies when the implant is well-fixed and bone stock is sufficient⁸. In cases of significant bone loss or loose implants, reconstruction with a distal femoral megaprosthesis (DFM) may be necessary^{7,9}.

This case series presents three elderly female patients managed using diverse surgical strategies at a tertiary-level LMIC hospital, illustrating the adaptability required in low-resource environments.

Case Presentations

Case 1:

A 70-year-old woman with diabetes and ischemic heart disease sustained a supracondylar fracture around a well-fixed TKA. A midline incision was used to confirm implant stability, followed by lateral exposure and ORIF with a distal femur locking plate in bridge mode. The patient progressed from bed-to-chair mobilization postoperatively to full weight-bearing at six weeks, with union confirmed by six months. [Fig 1]



Figure 1: Case 1 – pre-operative, intra-operative fluoroscopic and post-operative radiographs following locking-plate osteosynthesis of a periprosthetic distal femur fracture around a well-fixed total knee arthroplasty.

Case 2:

A 70-year-old woman with renal insufficiency and COPD presented with a PDFF. A metal reduction sequence CT scan was suggestive of a well-fixed implant. After medical optimization, we proceeded with a midline approach to the

knee joint to confirm stability of the implant. Followed by retrograde intramedullary nailing and polyethylene insert exchange. Full weight-bearing was achieved at six weeks, and fracture healing was radiographically complete by six months. [Fig 2]



Figure 2: Case 2 – pre-operative, intra-operative fluoroscopic and post-operative radiographs following retrograde intramedullary nailing.

Case 3:

A 69-year-old woman, recently operated for bilateral TKA, sustained a PDFF following a fall on post op day 15. Imaging showed extensive bone loss and compromised metaphysis.

Given the unavailability of revision implants, the team proceeded with a distal femoral megaprosthesis reconstruction. The patient completed rehabilitation and returned to full assisted ambulation by six months, without complications. [Fig 3]

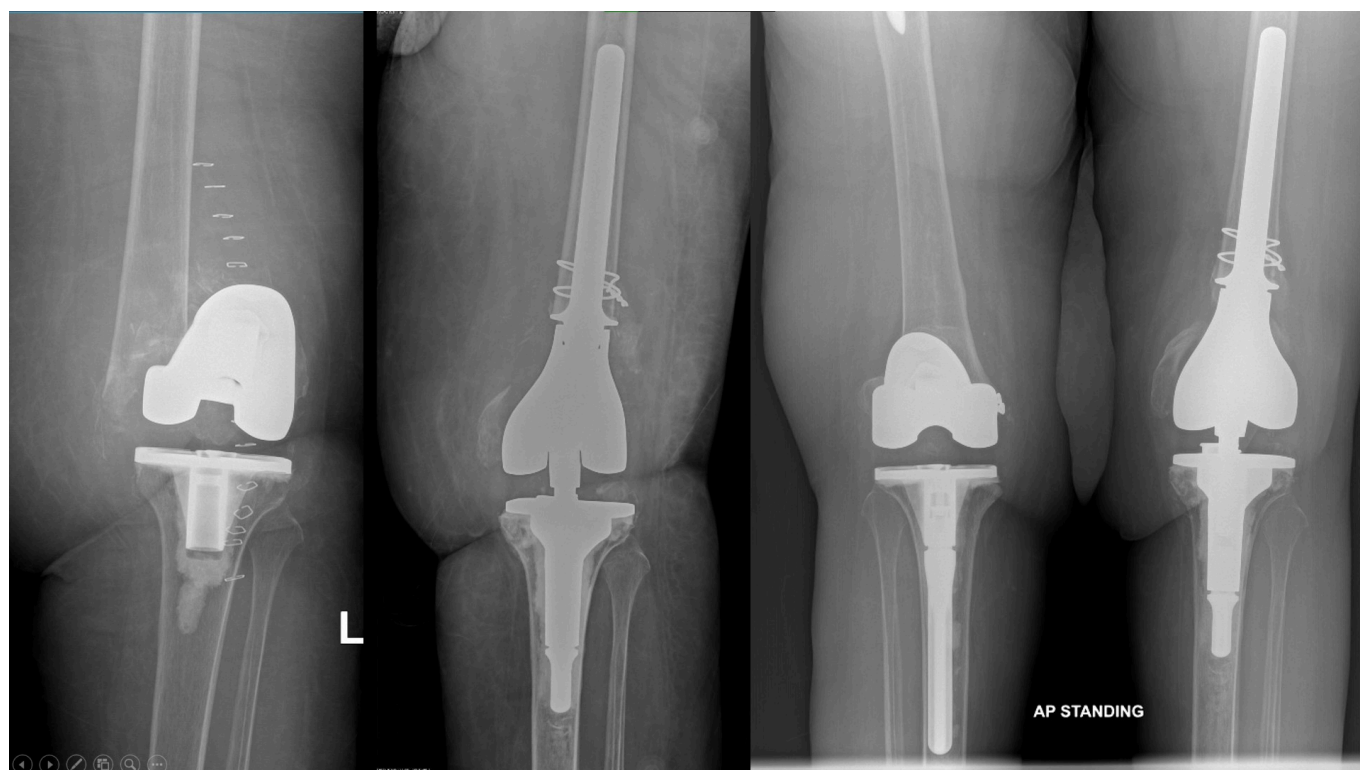


Figure 3: Case 3 – pre-operative, intra-operative and post-operative radiographs of the reconstruction.

Discussion

Periprosthetic distal femur fractures (PDFFs) represent a growing orthopedic challenge due to increasing total knee arthroplasty (TKA) volumes and extended life expectancy globally^{2,4}. The elderly are particularly vulnerable, with low-energy trauma being the most common mechanism of injury^{3,4}. These fractures are further complicated by reduced bone mineral density, comorbidities, and impaired healing capacity^{4,6}. In patients with a stable implant and preserved bone stock, internal fixation is generally preferred. Both locking plate osteosynthesis (LPO) and retrograde intramedullary nailing (RIMN) are validated strategies with comparable union rates and complication profiles⁸. A 2021 meta-analysis found no significant difference in time to union or non-union rates between the two modalities, although locking plates may provide enhanced stability in osteoporotic or comminuted fractures⁹. Our first two cases support this approach, with both patients achieving fracture union and early mobilization. When significant metaphyseal bone loss is present, or when the femoral component is loose, the treatment algorithm shifts toward reconstruction. Ideally, this would involve revision total knee arthroplasty (rTKA) using modular stems and augments. However, in LMICs, these systems are often unavailable due to supply chain limitations or cost constraints.

Consequently, surgeons in these environments may need to resort to megaprosthesis constructs (typically designed for oncologic resections) as a salvage solution for non-tumor indications such as severe PDFFs⁷. Megaprosthesis reconstruction offers immediate weight-bearing capability and high construct stability, which is particularly advantageous in elderly patients with limited rehabilitation potential. Though cost-intensive and associated with specific risks such as aseptic loosening or extensor mechanism disruption, they remain a viable and often the only reconstructive option in many LMIC tertiary centers^{1,7}. A recent European multicenter study reported that 85% of elderly patients undergoing distal femoral megaprosthesis (DFM) for non-oncologic indications regained assisted ambulation within six weeks¹⁰. Our third case mirrored these findings, highlighting the utility of this approach in the absence of standard revision implants.

Preventive measures are equally important in mitigating PDFF risk. Osteoporosis management, fall-risk screening, perioperative nutritional optimization, and prehabilitation should be embedded into arthroplasty protocols for elderly patients^{4,6,10}. In LMIC settings, where treatment options may be limited, prevention becomes even more critical. This case

series has limitations. It presents only three cases with six months of follow-up and does not include standardized patient-reported outcomes. Advanced imaging such as weight-bearing CT was unavailable, which could have enhanced fracture assessment. However, the cases presented reflect real-world surgical adaptation in resource-limited environments and reinforce the role of multidisciplinary planning and tailored surgical intervention. PDFFs are complex injuries requiring nuanced decision-making. In settings where revision TKA systems are unavailable, osteosynthesis and megaprosthesis represent the primary surgical pathways. Careful case selection, interdisciplinary care, and use of available implant technologies can yield favorable outcomes, even under constrained circumstances.

Conflict of Interest: The authors declare no conflicts of interest related to this manuscript.

Funding: No external funding was received for this study.

Ethics Approval: This case series was conducted in accordance with institutional ethical standards.

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