

# Traumaplasty in Action: Staggered Bilateral Primary Total Knee Arthroplasty for Complex Proximal Tibial Fractures with Osteoarthritis – A Case Report

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## Learning Point of the Article:

Primary TKA can be a safe and effective alternative to ORIF in selected patients with Complex Proximal tibia fractures with advanced arthritis, provided careful planning and expertise.

## Abstract

**Introduction:** Proximal tibial fractures in elderly patients with coexisting advanced knee osteoarthritis pose a significant treatment challenge. Primary total knee arthroplasty (TKA) has emerged as a viable alternative in selected cases, offering stable fixation, early mobilization, and avoidance of staged procedures. To the best of our knowledge, this is the first reported case of bilateral primary TKA performed for bilateral proximal tibial metaphyseal fractures with bilateral tibial tubercle avulsions in the setting of advanced osteoarthritis.

**Case Report:** We report the case of a 68-year-old male who sustained bilateral proximal tibial metaphyseal and fibular fractures with associated tibial tubercle avulsions and advanced bilateral knee osteoarthritis following a fall. After thorough evaluation, the patient underwent staggered bilateral primary TKA in a single admission. Tibial stem extenders were used to bypass the fracture sites, and tibial tubercle fixation was achieved with low-profile plates. Post-operative rehabilitation included early mobilization, progressive weight-bearing, and structured physiotherapy. At 1-year follow-up, the patient demonstrated excellent functional recovery with good knee range of motion and independent ambulation.

**Conclusion:** Primary TKA in the fracture setting can obviate the need for complex secondary procedures, reduce complication risks, and restore function more efficiently than conventional fixation in carefully selected patients. Meticulous pre-operative planning, careful patient optimization, surgical expertise, and the adjunctive use of advanced technologies such as robotics are critical to achieving optimal outcomes.

**Keywords:** Traumaplasty, primary total knee arthroplasty, bilateral tibial fractures, robotics, osteoarthritis.

## Introduction

Proximal tibia fractures are relatively common in the elderly, accounting for nearly 8% of all fractures in patients over 65 years of age [1]. Standard treatment involves open reduction and internal fixation (ORIF), which remains the gold standard in younger patients [2]. However, in the elderly, outcomes following ORIF are often compromised by osteoporosis,

comminution, poor compliance with non-weight-bearing rehabilitation, and the frequent coexistence of advanced knee osteoarthritis. Reported complications include malunion, implant failure, joint stiffness, and progression of secondary osteoarthritis, often necessitating subsequent total knee arthroplasty (TKA) [3].

Conversion TKA after failed fixation is technically demanding

## Author's Photo Gallery



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**Figure 1:** Pre-operative radiograph of both knees, anteroposterior (AP) and lateral. (a) shows AP and lateral views of the right knee. The yellow arrow on the AP radiograph shows the fracture site. The yellow arrow on the lateral shows the avulsion fracture of the tibial tuberosity. Similarly, (b) also describes the fracture site. Note the coexisting Osteoarthritis of both knee joints.

due to issues such as scar tissue, stiffness, poor bone stock, and ligament insufficiency, and it carries a higher risk of complications compared with primary arthroplasty. In this context, primary TKA has emerged as a potential alternative to ORIF in elderly patients with concomitant arthritis [4]. Advantages of this approach include immediate joint stability, early mobilization, faster rehabilitation, and avoidance of complications related to delayed weight-bearing [5].

Despite these potential benefits, the literature on primary TKA for acute proximal tibia fractures remains limited, and reports of bilateral involvement are exceedingly rare. We present a unique case of bilateral proximal tibial metaphyseal fractures in a patient with pre-existing advanced osteoarthritis, managed successfully using a traumaplasty approach with primary TKA.

tibial metaphyseal fractures extending into the metaphyseal-diaphyseal junction, associated proximal fibular fractures, and bilateral tibial tuberosity avulsion fractures. There was also radiographic evidence of advanced tricompartmental osteoarthritis in both knees (Fig. 1).

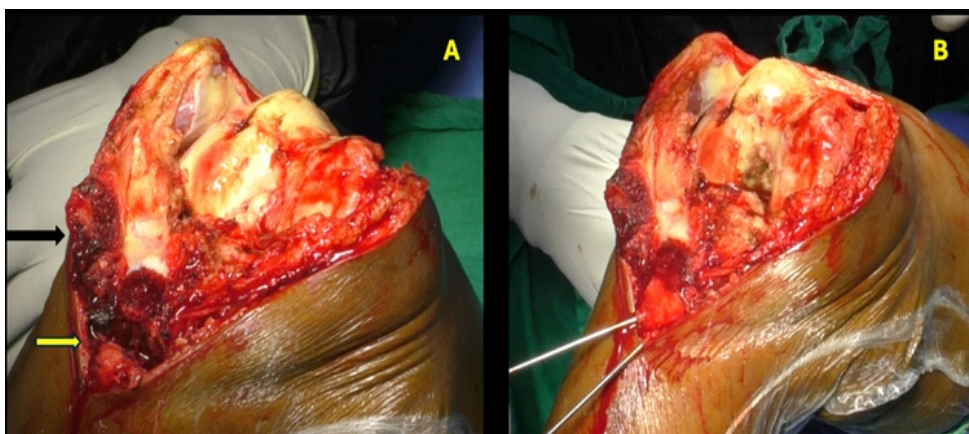
After comprehensive evaluation, optimization of comorbidities, and detailed counseling, a decision was made to proceed with staggered bilateral primary TKA during the same admission.

### Surgical technique

The patient was positioned supine, and a standard midline anterior skin incision was made, extending from just medial to

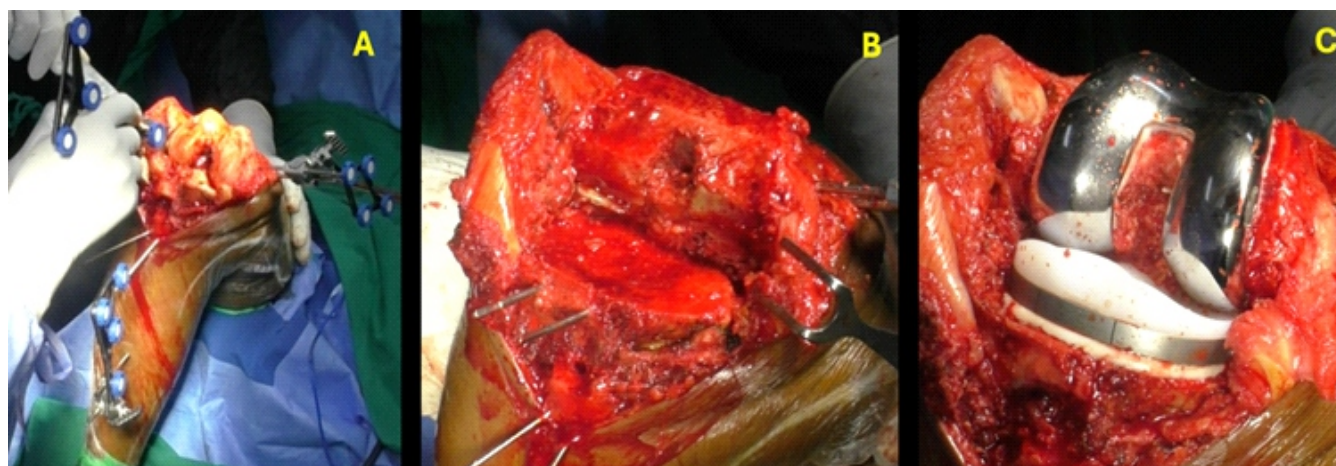
the tibial tuberosity to approximately three fingerbreadths above the superior pole of the patella. A medial parapatellar arthrotomy was performed to gain exposure. The tibial tuberosity fragments were provisionally stabilized with Kirschner wires (Fig. 2).

On both sides, robotic-assisted TKA using the CORI™ imageless robotic system (Smith and Nephew, Watford, UK) was performed. Following registration and mapping of the femoral and tibial condyles,



**Figure 2:** Intraoperative image after exposure of the right knee joint. Black arrow in (a) represents the avulsed part of the tibial tuberosity. Whereas the yellow arrow represents the metaphyseal fracture of the proximal tibia. (b) shows the Proximal tibial metaphyseal fracture provisionally fixed using two K-wires.





**Figure 3:** Intraoperative images of robotic total knee arthroplasty using CORI. (a) shows registration of landmarks during robotic total knee replacement workflow. Image (b) shows the knee joint after tibial and femoral cuts have been done. (c) shows the final implantation of the prosthesis.

bone resection planning was carried out. Sequentially, distal femoral and proximal tibial cuts were executed with robotic guidance. Extension and flexion gaps were then assessed intraoperatively, and femoral component size and rotation were determined. A four-in-one cutting jig was used to complete the anterior, posterior, and chamfer cuts following gap assessment with a spacer block. After trial component placement, stability, coronal alignment, and range of motion (ROM) were verified. Definitive components were implanted after satisfactory trial results (Fig. 3). To address the proximal tibial fracture pattern, a tibial stem extender was utilized bilaterally to bypass the fracture sites and enhance construct stability. In addition, the tibial tuberosity avulsion was stabilized with low-profile T-plates, thereby reinforcing the extensor mechanism (Fig. 4).

### Structured post-operative care and follow-up protocol

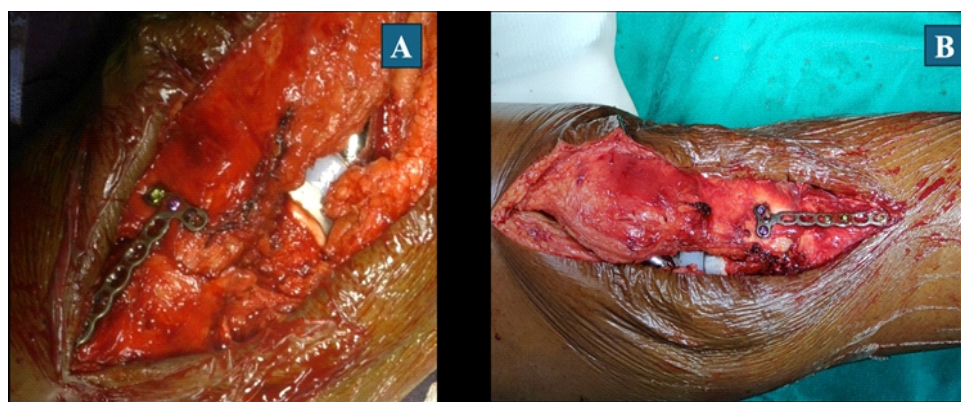
Postoperatively, the patient was managed with multimodal analgesia, thromboprophylaxis, and close monitoring of vitals and wound status. Early rehabilitation was initiated on the 1st post-operative day following the initial surgery. This included active-assisted knee ROM exercises, quadriceps isometric contractions, and ankle pump exercises. Since the contralateral knee fracture was yet to be addressed, the patient was maintained non-weight bearing. After the Contralateral TKA, the patient was advanced to protected partial weight-bearing as tolerated, using a hinged ROM brace to safeguard the extensor mechanism repair (Fig. 5). Progression to full

weight-bearing was achieved gradually between the 3rd and 6th post-operative weeks, under structured physiotherapy supervision. The rehabilitation program emphasized quadriceps and hamstring strengthening, proprioceptive training, and gait re-education. By 6–8 weeks, the patient was able to negotiate stairs and ambulate independently without the use of assistive devices.

At the 1-year follow-up, he reported sustained pain relief, excellent functional recovery, and a return to near-normal activities of daily living, including ROM. Radiographs demonstrated well-fixed implants with no evidence of loosening, subsidence, or mechanical complications (Fig. 6).

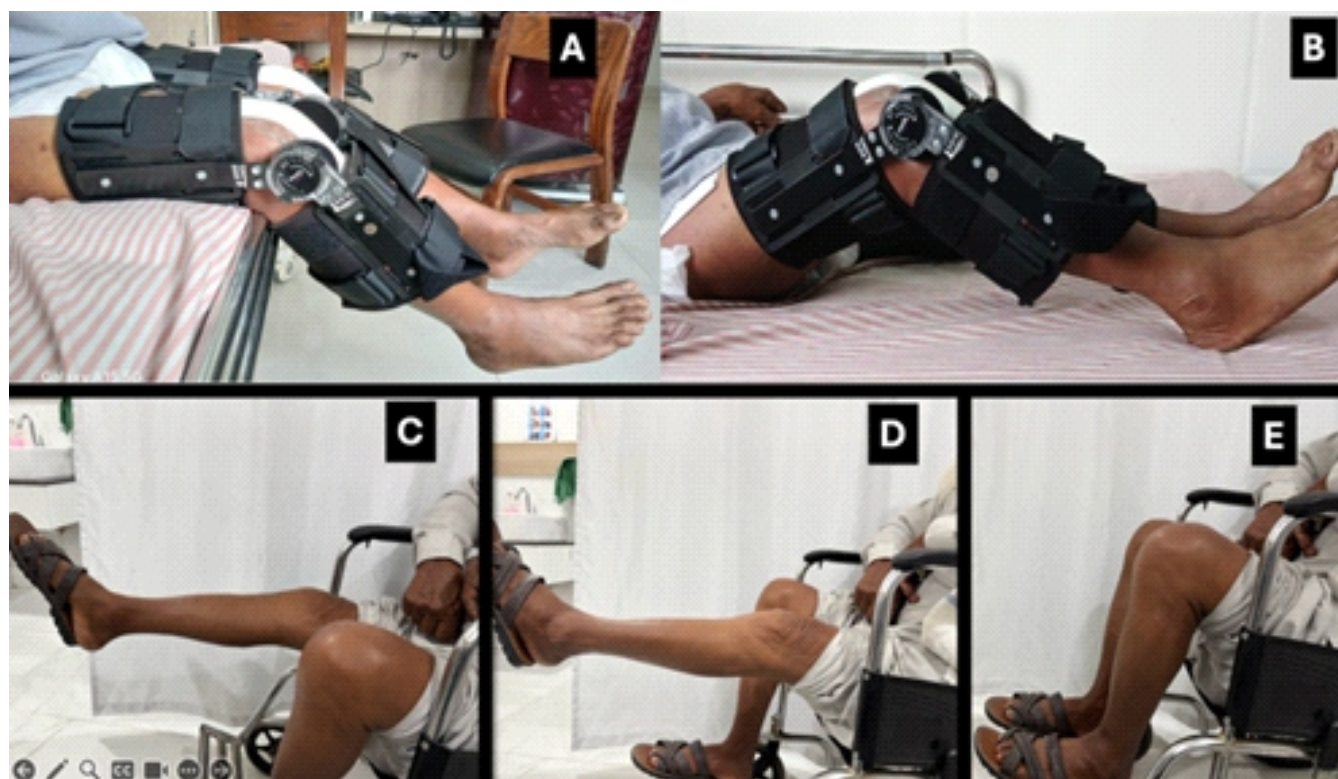
### Discussion

Management of proximal tibial fractures in elderly patients with advanced knee osteoarthritis remains a challenging clinical scenario. While ORIF is traditionally the mainstay for tibial metaphyseal fractures, outcomes in elderly, osteoporotic bone are often complicated by fixation failure, malalignment, and



**Figure 4:** Fixation of tibial tuberosity. (a) Demonstrates the fixation of the right tibial tuberosity avulsion using low-profile T plates for strengthening of the extensor mechanism. (b) shows similar fixation of the left side.



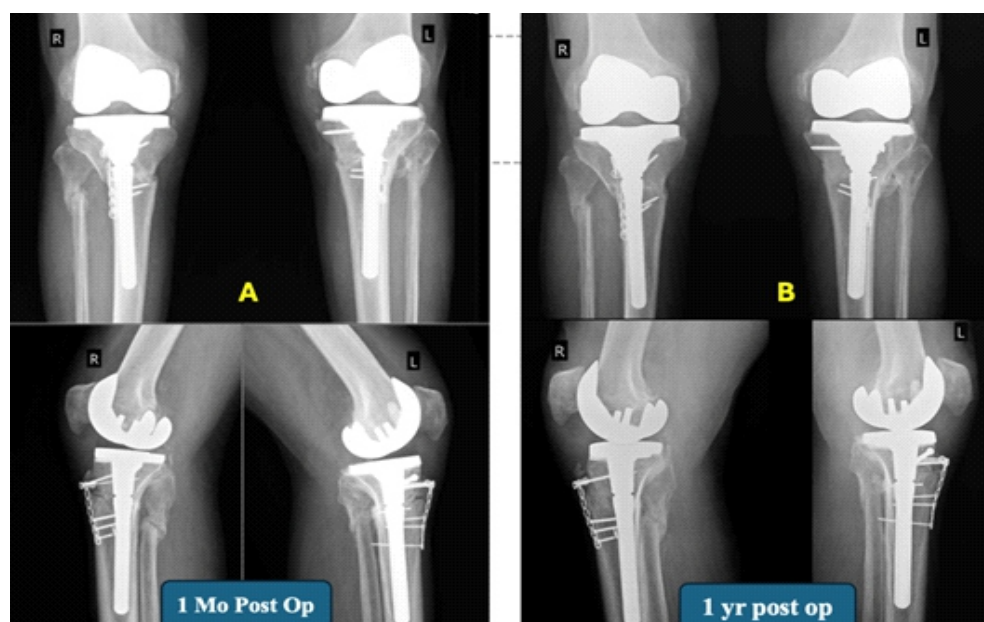


**Figure 5:** Post-operative range of motion (ROM). (a and b) show knee ROM exercises using a hinged knee ROM brace. (c and d) show full extension achieved by both knees. (e) shows flexion ROM of both knees.

delayed mobilization. Furthermore, the need for a subsequent TKA in patients with advanced arthritis of the knee after fracture union increases the complexity of surgery, particularly due to distorted anatomy, retained hardware, and compromised bone stock.

In such complex cases, primary TKA as a definitive solution, often termed a “traumaplasty” approach, has been advocated to address both fracture stabilization and coexisting end-stage arthritis simultaneously. This strategy allows immediate weight-bearing, earlier rehabilitation, and reduces the morbidity associated with a staged procedure. Recent studies, including a systematic review and meta-analysis, have demonstrated that primary TKA for proximal tibial fractures in elderly patients offers functional outcomes and complication rates that are at least comparable and in some cases superior to conventional fixation followed by delayed arthroplasty

[6, 7, 8]. Furthermore, registry data confirm that complex fracture patterns treated with fixation alone carry a significant long-term risk of conversion to TKA [9]. In light of these advantages and the unique complexity of our patient’s presentation, we elected to proceed with primary TKA rather



**Figure 6:** Post-operative radiographs. (a) shows post op X-ray at 1-month follow-up. (b) shows a post-operative X-ray at 1-year follow-up. Notice the union at the fracture site.



than conventional ORIF.

The unique aspect of our case lies in the bilateral, symmetrical proximal tibial metaphyseal fractures with associated tibial tubercle avulsions and fibular fractures, superimposed on severe bilateral tricompartmental osteoarthritis. To the best of our knowledge, such a presentation is extremely rare, with the literature describing mostly unilateral cases. Simultaneous bilateral TKA offers shorter hospital stay and potentially cost savings, but is associated with higher systemic complications in elderly or medically comorbid patients [10]. Treating this constellation of injuries with a staggered bilateral TKA provided the dual benefit of stable fixation and definitive arthritis management, while respecting the physiological reserve of the patient.

Primary TKA for fracture settings requires modifications such as stemmed tibial components to bypass fracture lines, constrained designs when ligaments are compromised, and fixation of avulsed tubercle fragments to maintain extensor mechanism integrity [11]. Accordingly, we used tibial stem extenders and low-profile plates for tubercle fixation to ensure durable stability and protect the extensor mechanism.

Another significant aspect of this case is the utilization of robotic-assisted technology. In the setting of proximal tibial fractures, conventional jig-based TKA can be technically demanding due to altered landmarks, fracture lines, and the risk of inaccurate bone cuts. Robotic-assisted systems have demonstrated superior precision in restoring mechanical alignment and optimizing implant positioning, particularly in complex or deformed knees. Evidence from recent series suggests that robotic TKA reduces outliers in alignment, improves early functional outcomes, and may translate into improved long-term implant survivorship [12]. In our patient, the robotic platform allowed accurate planning, intraoperative simulation of cuts, and real-time adjustments, thereby minimizing the risk of malalignment and improving confidence in execution.

Early mobilization and weight bearing are crucial to minimize

complications such as thromboembolism, pulmonary compromise, and muscle wasting. A series evaluating acute primary TKA for proximal tibial fractures reports early discharge and functional outcomes with good knee society scores [8]. In our patient, early rehabilitation and progressive weight bearing were initiated, resulting in a good ROM and excellent functional outcomes at 1 year, consistent with evidence from prior studies.

## Conclusion

This case highlights the role of primary TKA as a viable and effective option in complex fracture scenarios, particularly when conventional fixation techniques may be associated with higher complication rates. Successful outcomes in such challenging cases require meticulous pre-operative planning, including careful patient selection and optimization for bilateral procedures and thorough counseling regarding the limitations and potential complications of traditional approaches. Intraoperatively, it is imperative to anticipate difficulties by keeping the necessary implants and instruments readily available while ensuring adherence to sound surgical principles and technique. The integration of advanced technologies such as robotics offers an additional layer of precision and confidence, especially in anatomically distorted knees. Ultimately, favorable results can only be achieved when such strategies are coupled with diligent post-operative rehabilitation and structured follow-up, underscoring the importance of a comprehensive, multidisciplinary approach in managing these complex cases.

## Clinical Message

Primary TKA is a viable single-stage alternative for proximal tibial fractures with advanced osteoarthritis in the elderly.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Conflict of interest:** Nil **Source of support:** None

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