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Original Research Article

PRIMARY TOTAL KNEE REPLACEMENT IN OLD UN-UNITED PROXIMAL TIBIA FRACTURE WITH PRIMARY ARTHRITIS OF KNEE

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ABSTRACT

Background: Ununited proximal tibia fractures in older adults present a complex clinical challenge due to poor bone quality, comorbidities, and compromised joint surfaces. These fractures often result in persistent pain, instability, and functional impairment, with conventional fixation techniques showing limited success. The integration of Total Knee Replacement (TKR) with lateral plating provides both mechanical stability and restoration of the articular surface, allowing early mobilization and potentially superior outcomes in this difficult patient population. The aim is to evaluate the clinical, functional, and radiological outcomes of surgical management using TKR with concomitant lateral plating in patients over 55 years of age presenting with ununited proximal tibia fractures.

Materials and Methods: This case series was conducted at a tertiary care hospital and included 20 patients (10 males and 10 females) aged less than 59 years with radiologically confirmed ununited proximal tibia fractures. All patients underwent TKR with cemented prosthesis along with lateral plating for fracture stabilization. Preoperative evaluation included demographic data, comorbidities, and radiological assessment. Functional outcomes were assessed using the Visual Analogue Scale (VAS) for pain and Knee Society Score (KSS), while radiological union and complications were documented.

Results: The mean operative time was 115.30 ± 10.50 minutes and average intraoperative blood loss was 385.40 ± 55.25 ml. Postoperatively, there was significant improvement in VAS (7.80 ± 0.52 to 2.10 ± 0.31; $p<0.001$) and KSS (42.25 ± 5.10 to 85.65 ± 6.20; $p<0.001$). Radiological union was achieved in 18 patients (90.00%), with 2 patients (10.00%) showing delayed union. The overall complication rate was low, with superficial infection in one case (5.00%) and periprosthetic fracture in one case (5.00%). Patient satisfaction was high (90.00%).

Conclusion: TKR with concomitant lateral plating provides reliable fracture stabilization, pain relief, and functional recovery in older patients with ununited proximal tibia fractures. Individualized surgical planning and meticulous perioperative management are vital for optimal outcomes.

Keywords: Ununited proximal tibia fracture, total knee replacement, lateral plating, nonunion, elderly patients.

INTRODUCTION

Management of ununited proximal tibia fractures in patients over 55 years old sits at the intersection of fragility fracture care, post-traumatic joint reconstruction, and nonunion surgery. Proximal tibial injuries in older adults are frequently intra-articular, often follow low-energy mechanisms, and are complicated by osteopenia or osteoporosis, pre-existing osteoarthritis, and medical comorbidities.[1,2]

These factors collectively challenge fixation stability, slow biological healing, and prolong recovery. Nonunion after proximal tibial fracture further compounds the problem by introducing chronic pain, functional limitation, deformity, and, in many cases, progressive joint degeneration that impairs ambulation and independence. For clinicians and health systems, this presentation carries substantial clinical and socioeconomic consequences, including repeated procedures, extended rehabilitation, and increased risk of complications.[1-3] Nonunion is more than a radiographic diagnosis—it reflects failure of mechanical stability, biological vitality, or both. In the metaphyseal region of the proximal tibia, thin cortices, comminution, and articular depression predispose to fixation difficulty and loss of reduction, while compromised biology from soft-tissue injury, infection, tobacco exposure, diabetes, or poor bone stock slows healing.[3,4] Older adults also have altered inflammatory and osteogenic responses and may be deconditioned pre-injury, making timely mobilization pivotal. When a prior attempt at conservative or operative treatment has ended in nonunion, the proximal tibia often exhibits hardware tracks, metaphyseal bone loss, joint surface collapse, malalignment, and secondary osteoarthritis—pathologies that steer decision-making away from simple revision fixation and toward reconstructive strategies that simultaneously restore alignment, stability, and joint function.[3,4] Traditional principles emphasize restoring mechanical axis and joint congruity, achieving stable fixation that permits early motion, and respecting the soft-tissue envelope.[3] In younger patients with good bone quality, these goals are commonly reached with contemporary locking plate constructs and meticulous elevation of depressed fragments with subchondral rafting screws.[3] In older patients with nonunion, however, recurrent instability and poor subchondral support can undermine even well-executed revision fixation. Adjuncts such as autologous bone graft, bone marrow concentrate, structural allograft, or osteoinductive agents may enhance biology, but they cannot fully compensate for severe articular attrition or global cartilage loss that frequently accompanies long-standing nonunion.[4,5] This context has driven interest in arthroplasty-based salvage for carefully selected patients. Total knee replacement (TKR) can address pain from end-stage post-traumatic osteoarthritis, correct varus–valgus malalignment, and immediately restore a stable, load-bearing construct.[2,6] When combined with lateral (or dual-column) plating to control residual metaphyseal instability, arthroplasty may also provide the mechanical environment needed for union at the nonunion site while enabling early mobilization and rehabilitation.[2,7] Implant choice spans cruciate-substituting to constrained condylar designs depending on ligament integrity and bone deficits, and stems or augments may be used to bypass compromised metaphyseal bone. The trade-offs include risks of infection, stiffness, wound complications in tenuous soft tissues, and the long-term demands of a prosthetic joint placed in a post-traumatic limb. For many older patients with symptomatic nonunion and advanced articular damage, however, arthroplasty-assisted stabilization offers a pragmatic, function-restoring path when isolated biological or mechanical strategies are unlikely to succeed.[2,7]

MATERIALS AND METHODS

This case series was conducted at a tertiary care hospital, involving patients who presented with ununited proximal tibia fractures. A total of 20 patients were enrolled, consisting of 10 males and 10 females, all aged less than 59 years. All patients had a history of proximal tibial fracture with nonunion following previous injury and conservative or operative management elsewhere.

Inclusion criteria comprised patients with radiologically and clinically confirmed ununited proximal tibia fracture, persistent pain, limited mobility, and significant functional impairment interfering with daily activities. Exclusion criteria included pathological fractures, active infection at the operative site, systemic inflammatory arthropathies, and patients unfit for anesthesia or surgery. Written informed consent was obtained from all patients prior to inclusion in the study.

Methodology: Preoperative evaluation included detailed demographic data, clinical history, comorbidities (such as diabetes mellitus, hypertension, and osteoporosis), smoking status, and history of previous surgeries. Clinical assessment focused on pain intensity using the Visual Analogue Scale (VAS), knee range of motion, and functional disability. Radiological evaluation was performed using standard anteroposterior and lateral radiographs of the knee, along with computed tomography (CT) scans in selected cases to assess the articular surface disruption and fracture pattern. Bone quality was graded according to Singh's Index for osteoporosis assessment.

Surgical Technique: All patients underwent surgical intervention consisting of Total Knee Replacement (TKR) with cemented prosthesis along with lateral plating for fracture stabilization. The procedure was performed under regional or general anesthesia in a standard operating theater by the same surgical team. Intraoperative variables recorded included operative time, intraoperative blood loss, and any complications such as difficulty in implant placement or neurovascular injury. Perioperative prophylactic antibiotics were administered according to institutional protocol.

Postoperative Management: Postoperative care included pain management with multimodal analgesia, thromboprophylaxis, and early physiotherapy with gradual weight-bearing as tolerated. Standardized rehabilitation protocols were followed for all patients. Follow-up assessments were

conducted at regular intervals to monitor fracture union, implant stability, functional recovery, and possible complications such as infection, implant loosening, or periprosthetic fracture.

Outcome Measures: Primary outcome measures included fracture union, pain relief as assessed by VAS, improvement in range of motion, and functional status evaluated using the Knee Society Score (KSS). Secondary outcome measures included complication rates, requirement of revision surgery, and patient-reported satisfaction. Radiological assessment of implant stability and fracture healing was performed at each follow-up visit.

Statistical Analysis: All collected data were coded and entered into SPSS software, version 26.0, for analysis. Continuous variables such as age, operative time, blood loss, and functional scores were expressed as mean ± standard deviation. Categorical variables such as gender, presence of comorbidities, and complication rates were expressed as frequencies and percentages. Paired t-tests and chi-square tests were applied where appropriate, and a p-value of <0.05 was considered statistically significant.

RESULTS

Demographic Characteristics: The study included 20 patients with ununited proximal tibia fractures, evenly distributed between males (n=10) and females (n=10). The overall mean age was 56.40 ± 2.10 years, with no significant difference between sexes. Among the comorbidities, diabetes mellitus was present in 25.00% of patients, while hypertension and osteoporosis were each seen in 35.00%. Interestingly, osteoporosis was more common among females (50.00%) compared to males (20.00%). A history of smoking was reported in 25.00% of patients, predominantly among males (40.00% vs 10.00%). Nearly half of the patients (45.00%) had undergone some form of previous surgical intervention, highlighting the recurrent and complex nature of nonunited proximal tibial fractures.

Intraoperative and Postoperative Parameters: The mean operative time was 115.30 ± 10.50 minutes, ranging from 100 to 135 minutes. The mean intraoperative blood loss was 385.40 ± 55.25 ml, with a minimum of 300 ml and a maximum of 480 ml. Intraoperative complications were encountered in 2 cases (10.00%), which included technical challenges related to implant placement. Postoperatively, superficial infection occurred in 1 patient (5.00%) and was managed successfully with antibiotics and wound care. No cases of deep vein thrombosis (DVT) or thromboembolic events were observed in the cohort, likely due to standardized prophylactic measures.

Functional Outcomes: There was a statistically significant improvement in all functional parameters postoperatively. The mean preoperative VAS score of 7.80 ± 0.52 dropped to 2.10 ± 0.31 after surgery, indicating marked pain relief ($p < 0.001$). Similarly, the Knee Society Score improved from a mean of 42.25 ± 5.10 preoperatively to 85.65 ± 6.20 postoperatively, reflecting substantial enhancement in functional capacity ($p < 0.001$). Range of motion (ROM) also increased significantly from 65.40 ± 10.20 degrees preoperatively to 108.25 ± 12.10 degrees postoperatively ($p < 0.001$). These results confirm the effectiveness of TKR with lateral plating in restoring both mobility and function in patients with ununited proximal tibia fractures.

Radiological Outcomes: Radiological assessment demonstrated fracture union in 18 patients (90.00%), while 2 patients (10.00%) showed delayed union requiring prolonged follow-up. Implant loosening was noted in 1 patient (5.00%) and another case demonstrated malalignment (5.00%). These radiological complications did not necessitate immediate revision in most cases but were carefully monitored during subsequent follow-up. Overall, the union rate was encouraging given the complexity of proximal tibial nonunion in this age group.

Complications and Patient Satisfaction: Postoperative complications were relatively few. One patient (5.00%) developed superficial infection, while another suffered a periprosthetic fracture (5.00%), both of which required extended treatment. Revision surgery was needed in only 1 patient (5.00%), reflecting a low overall revision rate. Importantly, the majority of patients (90.00%) expressed satisfaction with their outcomes, reporting significant improvement in pain, function, and quality of life. However, 2 patients (10.00%) reported dissatisfaction, primarily due to persistent stiffness and limited functional recovery.

Table 1: Demographic Characteristics of Patients (n = 20)

Parameter	Male (n=10)	Female (n=10)	Total (n=20)	Percentage (%)
Mean Age (years)	56.70 ± 1.95	56.10 ± 2.25	56.40 ± 2.10	-
Diabetes Mellitus	3	2	5	25.00%
Hypertension	4	3	7	35.00%
Osteoporosis	2	5	7	35.00%
Smokers	4	1	5	25.00%
Previous Surgery	5	4	9	45.00%

Table 2: Intraoperative and Postoperative Parameters

Variable	Mean ± SD	Range
Operative Time (minutes)	115.30 ± 10.50	100–135
Blood Loss (ml)	385.40 ± 55.25	300–480
Intraoperative Complications	2 cases (10.00%)	-

Early Post-op Infection	1 case (5.00%)	-
DVT/Thromboembolism	0 cases (0.00%)	-

Table 3: Preoperative vs Postoperative Functional Outcomes

Parameter	Preoperative (Mean ± SD)	Postoperative (Mean ± SD)	p-value
VAS Score (0–10)	7.80 ± 0.52	2.10 ± 0.31	<0.001
KSS Score (0–100)	42.25 ± 5.10	85.65 ± 6.20	<0.001
ROM (degrees)	65.40 ± 10.20	108.25 ± 12.10	<0.001

Table 4: Union Status and Radiological Outcomes

Outcome	Number of Patients	Percentage (%)
Radiological Union Achieved	18	90.00%
Delayed Union	2	10.00%
Implant Loosening	1	5.00%
Malalignment	1	5.00%

Table 5: Overall Complications and Patient Satisfaction

Complication/Outcome	Number of Patients	Percentage (%)
Superficial Infection	1	5.00%
Periprosthetic Fracture	1	5.00%
Revision Surgery Needed	1	5.00%
Overall Satisfaction	18	90.00%
Dissatisfied	2	10.00%

DISCUSSION

Our cohort had a mean age of 56.40 ± 2.10 years, with 35.00% hypertension and 35.00% osteoporosis, the latter more frequent in females (50.00% vs 20.00%). This aligns with evidence that osteoporosis impairs multiple stages of fracture healing—callus formation, mineralization, and remodeling—contributing to fixation challenges in peri-articular tibial pathology. Gorter et al. reported that osteoporosis negatively influenced healing biology across most included studies, underscoring the need for osteoporosis assessment and optimization in surgical planning; our relatively high osteoporosis prevalence frames the technical demands and the need for rigid fixation and biological augmentation in this group.[8]

Smokers comprised 25.00% of our series (male predominance 40.00% vs 10.00%), a notable risk factor when interpreting healing outcomes. Pearson et al.'s meta-analysis showed smokers have approximately double the risk of nonunion across fracture, fusion, osteotomy, and nonunion surgery populations. In this context, achieving a 90.00% union in our series despite a quarter being smokers suggests that stable fixation (lateral plating) combined with TKR-facilitated early rehabilitation may mitigate, though not eliminate, smoking-related risk.[9]

Our mean operative time (115.30 ± 10.50 min) and blood loss (385.40 ± 55.25 mL) reflect the added complexity of arthroplasty performed as a salvage strategy in post-traumatic knees with nonunion. Literature reviewing TKA for tibial plateau fractures highlights increased surgical difficulty and higher complication propensity compared with primary osteoarthritis cases due to scarred soft tissues, bone loss, and malalignment—features common in our patients with previous surgery (45.00%). Softness et al. emphasized these challenges when TKA is used either primarily in complex fractures or secondarily after failed fixation.[10]

We observed 5.00% superficial infection and no deep infections, outcomes that compare favorably with reports highlighting elevated infection risk when converting plateau fracture patients to TKA, particularly in those with prior infection. Larson et al. reported high complication rates—including deep infection—after TKA in the setting of previous tibial plateau fracture and especially when prior infection existed. Our lower infection burden likely reflects strict peri-operative protocols and exclusion of active infections, but vigilance remains warranted in this high-risk population.[11]

No DVT or thromboembolic events occurred in our cohort under standardized chemoprophylaxis and early mobilization. Contemporary arthroplasty cohorts report low—but non-zero—VTE rates with modern prophylaxis; for example, Simon et al. found a 30-day VTE incidence of 1.19% after lower-extremity arthroplasty in a multicenter cohort of 29,264 patients. Our 0.00% rate is therefore within the expected range for well-prophylaxed patients, and supports aggressive prevention protocols in complex post-traumatic reconstructions.[12]

Pain (VAS) improved from 7.80 ± 0.52 to 2.10 ± 0.31 and KSS from 42.25 ± 5.10 to 85.65 ± 6.20, with ROM increasing from 65.40° ± 10.20° to 108.25° ± 12.10° (all $p < 0.001$). These gains are consistent with studies of arthroplasty used in tibial plateau fractures. Sabatini et al. reported mean postoperative KSS knee scores around 83 (±16) after primary TKA for plateau fractures, similar to our postoperative KSS (85.65), supporting the role of arthroplasty to restore function in structurally compromised knees.[13]

Radiological union occurred in 90.00% of our patients after TKR with concomitant lateral plating, with 10.00% delayed unions and 5.00% each for loosening and malalignment. When contrasted with external fixation strategies for tibial nonunion, union

rates in modern Ilizarov series often range from roughly 80–90% depending on infection and host factors; for example, Mankar et al. reported union in 83.30% for infected tibial nonunions treated with Ilizarov rings. Our 90.00% union rate therefore compares favorably while leveraging arthroplasty to address joint surface compromise and allow earlier rehabilitation.[14]

Overall satisfaction was 90.00% in our series, with a 5.00% revision rate. Prior comparative work indicates that while post-traumatic TKA can achieve substantial symptom relief, complication and revision risks are typically higher than in primary osteoarthritis cohorts. Scott et al.—in a matched comparison of TKA after tibial plateau fracture vs primary OA—reported meaningful improvements in patient-reported outcomes alongside higher complication burdens in the post-traumatic group, broadly mirroring our high satisfaction yet non-trivial complication profile (infection 5.00%, periprosthetic fracture 5.00%).[15]

CONCLUSION

Surgical intervention involving TKR with concomitant lateral plating can be an effective treatment strategy for ununited proximal tibia fractures in older patients, offering pain relief, improved joint function, and enhanced quality of life. However, individualized assessment and careful consideration of patient-specific factors are essential in determining the most appropriate treatment approach.

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