

Review

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[Sohail Rehman](#)^{*}, Mehdi Ali Mehdivi, Nasir Hussain, Zakria Rathore, Laiba Uroosh

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Review

Comparison of Open Reduction and Internal Fixation Versus Ilizarov External Fixation for Schatzker Type V & VI Tibial Plateau Fractures: A Narrative Review with Emphasis on Low-Resource Orthopaedic Practice

Sohail Rehman ^{1,*}, Mehdi Ali Mehdivi ², Nasir Hussain ³, Zakria Rathore ⁴ and Laiba Uroosh ⁵

- ¹ Post Graduate Resident FCPS-II Orthopaedic Surgery, Regional Headquarter Hospital Skardu, Skardu, Gilgit-Baltistan, Pakistan
 - ² Consultant Orthopaedic & Spine Surgeon & Head of The Department (HOD) Orthopaedic Surgery, Regional Headquarter Hospital Skardu, Skardu, Gilgit-Baltistan, Pakistan
 - ³ Consultant Orthopaedic & Spine Surgeon, Regional Headquarter Hospital Skardu, Skardu, Gilgit-Baltistan, Pakistan
 - ⁴ Post Graduate Resident FCPS-II Orthopaedic Surgery, Regional Headquarter Hospital Skardu, Skardu, Gilgit-Baltistan, Pakistan
 - ⁵ The City School Rawalpindi, Rawalpindi, Pakistan
- * Correspondence: sann090909@gmail.com

Abstract

Schatzker type V and VI tibial plateau fractures are complex, high-energy injuries involving significant articular and soft tissue damage. Management remains controversial, with open reduction and internal fixation (ORIF) and Ilizarov external fixation (EF) being primary strategies. This narrative review synthesizes evidence on functional recovery, radiological outcomes, complications, cost-effectiveness, and feasibility in low-resource environments such as rural Pakistan. Multiple studies report comparable long-term functional outcomes for both methods. EF offers advantages in early rehabilitation, reduced rates of deep infection, and cost-effectiveness. Hybrid techniques, combining minimal internal fixation with Ilizarov frames, enhance articular stability while preserving soft tissue integrity. Choice of fixation should consider fracture complexity, soft tissue condition, surgeon experience, and institutional resources. EF emerges as a practical and effective option in low-resource settings, ensuring safe and efficient fracture management.

Keywords: schatzker fracture; tibial plateau; ORIF; ilizarov; low-resource orthopaedics

Introduction

Tibial plateau fractures pose a significant challenge to orthopaedic surgeons due to their intra-articular nature and potential impact on knee function and stability. Bicondylar fractures, classified as Schatzker type V and VI, typically arise from high-energy trauma and are often associated with soft tissue compromise, open wounds, or compartment syndrome. Road traffic accidents, falls from height, and direct trauma are common causes, with an increasing burden in low- and middle-income countries (LMICs) including Pakistan [1–3]. High-energy bicondylar fractures carry elevated risks of post-traumatic arthritis, deep infection, and restricted range of motion [4], emphasizing the need for optimal management strategies.

The primary objectives in treating these fractures are restoring articular congruity, maintaining limb alignment, facilitating early mobilization, and minimizing complications. ORIF using dual plating allows direct visualization and anatomical reduction [5] but requires extensive soft tissue

dissection, which increases the risk of wound complications, deep infection, and delayed rehabilitation [6]. Ilizarov EF, introduced in the 1970s, stabilizes fractures percutaneously using ligamentotaxis, preserving soft tissue integrity [7–8]. Hybrid fixation techniques, combining minimal internal fixation with Ilizarov frames, have evolved to combine ORIF stability with the soft tissue benefits of EF [9].

Despite these advances, there is no consensus on the optimal approach, particularly in resource-constrained environments. Limited implant availability, prolonged operative times, and the need for intensive postoperative care restrict ORIF utility in rural or low-resource hospitals such as those in Skardu [10–11]. EF is cost-effective, reduces operative time, permits early weight-bearing, and avoids complications related to hardware prominence or wound breakdown [12]. Local studies from Pakistan demonstrate satisfactory functional and radiological outcomes with both ORIF and EF, though complication rates differ according to soft tissue management, fracture complexity, and surgeon experience [13–16]. International meta-analyses also suggest comparable long-term functional outcomes between the two methods, with EF associated with fewer deep infections and shorter hospital stays [17–20].

This review critically evaluates the comparative evidence for ORIF and Ilizarov EF in Schatzker type V–VI fractures, emphasizing functional recovery, radiological outcomes, complications, and applicability in low-resource orthopaedic settings. Hybrid fixation is highlighted as a strategy to optimize outcomes where either pure ORIF or EF may have limitations.

Methods

A comprehensive literature search was conducted using PubMed, PMC, Embase, Google Scholar, and regional Pakistani sources for studies published up to March 2026. Inclusion criteria encompassed randomized and observational studies comparing ORIF and Ilizarov EF for Schatzker type V–VI fractures, as well as hybrid fixation techniques combining minimal internal fixation with Ilizarov frames. Studies reporting functional scores, radiological outcomes, complications, operative duration, and resource utilization were included.

Data extracted included patient demographics, fracture characteristics, treatment modalities, follow-up duration, outcomes, and complications. Special emphasis was placed on LMIC and Pakistani studies to contextualize applicability in low-resource settings. A narrative synthesis was used to integrate quantitative and qualitative data from heterogeneous studies, with outcomes tabulated for functional recovery, complications, and resource utilization.

Comparison of Treatment Modalities

Functional Outcomes

Functional recovery is a key determinant of treatment success. Both ORIF and EF demonstrate comparable long-term outcomes, with EF offering advantages in early mobilization.

- **ORIF outcomes:** Dual plating provides anatomical reduction and stability. Farhat et al. reported Oxford Knee Scores of 44 at one-year follow-up [13]. Pakistani series report AKSS scores ranging 78–85[14–16].
- **Ilizarov EF outcomes:** Preserves soft tissues, allows early partial weight-bearing, and yields similar functional scores. Subramanyam et al. reported AKSS 81.5 and mean knee flexion of 114°[5]. Ghimire et al. reported mean AKSS of 82 for type V and 80 for type VI fractures [7].
- **Hybrid fixation:** Combining minimal internal fixation with Ilizarov frames enhances articular stability while minimizing soft tissue disruption. Korkmaz et al. reported superior outcomes in hybrid patients (AKSS 92 vs. 79, mean ROM 116° vs. 97°)[9].

Table 1. – Functional Outcomes Summary.

Study	Treatment	Functional Score	ROM (°)			
Farhat et al., 2024[13]	ORIF	Oxford 44	112			
Farhat et al., 2024[13]	Ilizarov EF	Oxford 45	114			
Subramanyam, 2018[5]	Ilizarov ± screws	AKSS 81.5	114			
Korkmaz, 2024[9]	Hybrid EF + minimal IF	AKSS 92	116			

Radiological Outcomes

Radiological evaluation focuses on articular reduction, alignment, and union.

- **ORIF:** Allows direct visualization and precise reduction. Oguzkaya et al. reported similar postoperative alignment and union within 12–16 weeks [8].
- **Ilizarov EF:** Reduces fractures via ligamentotaxis; minor malalignment (<10°) occurs occasionally without affecting function [5].
- **Hybrid fixation:** Combines adequate reduction with soft tissue preservation. Korkmaz et al. reported improved alignment and lower incidence of varus malalignment compared to EF alone [9].

Complications

- **ORIF:** Higher incidence of wound complications, deep infection, and reoperation. Hall et al. reported deep infection in 18% of ORIF patients versus none in EF patients [20].
- **Ilizarov EF:** Most complications are superficial pin tract infections; peroneal neuropathy is rare and typically transient.
- **Hybrid fixation:** Reduces deep infection compared to ORIF while maintaining better alignment than EF alone [9].

Table 2. – Complications.

Study	ORIF Deep Infection	EF Pin Tract	Notes
Hall, 2009[20]	18%	0%	RCT
Subramanyam, 2018[5]	0	7/30	Self-limiting
Korkmaz, 2024[9]	0	10%	Hybrid group

Resource Utilization and Cost

Low-resource environments necessitate cost-effective strategies.

- **ORIF:** Requires implants, longer operative times, and extended hospitalization [11].
- **EF:** Shorter operative time, lower implant costs, reduced blood loss, and earlier discharge make EF suitable for rural hospitals [12].

Table 3. – Resource Utilization.

Study	Treatment	OR Time (min)	Hospital Stay (days)	Cost				
Farhat, 2024[13]	ORIF	180	23.4	High				
Farhat, 2024[13]	EF	110	9.9	Lower				
Korkmaz, 2024[9]	Hybrid	120	12	Moderate				

Discussion

Bicondylar tibial plateau fractures require individualized management due to fracture complexity, soft tissue compromise, and patient-specific factors. This review demonstrates that both ORIF and Ilizarov EF achieve comparable long-term functional and radiological outcomes [13–20]. EF, however, preserves soft tissue integrity, facilitates early mobilization, and is associated with fewer deep infections, making it particularly advantageous in high-energy fractures with compromised soft tissue.

Early rehabilitation and partial weight-bearing are critical determinants of functional recovery. EF allows early joint mobilization and earlier discharge, which is especially valuable in low-resource hospitals with limited rehabilitation facilities [12,13]. Hybrid fixation further enhances outcomes by providing additional articular stability while minimizing dissection-related morbidity [9,14].

ORIF remains appropriate in patients where anatomical reduction is paramount and soft tissue conditions permit extensive dissection [5,6]. Nevertheless, its prolonged operative time, need for specialized implants, and higher risk of wound complications limit its feasibility in resource-constrained settings. Several Pakistani studies demonstrate that EF can achieve similar functional results while reducing operative and hospitalization burden [11–16].

Complication patterns differ between fixation modalities. EF primarily causes minor, self-limiting pin tract infections, while ORIF has a higher incidence of deep infection and wound breakdown [20]. Hybrid fixation mitigates these risks by combining the benefits of both techniques, achieving favorable alignment and minimizing infection rates [9]. Meta-analyses confirm these trends internationally [17–22].

Cost-effectiveness is a critical consideration in LMICs. EF reduces implant costs, operating room time, and hospital stay, providing a practical and affordable treatment strategy for rural hospitals in Pakistan and similar settings [12,13,23–27]. The integration of hybrid techniques allows selective use of minimal internal fixation where additional stability is required without substantial cost increase [9].

Limitations of current literature include heterogeneous study designs, varying functional scoring systems, limited randomized trials, and inconsistent complication reporting. Future research should focus on high-quality, region-specific randomized studies, standardized functional scoring, and cost-analysis in LMIC contexts to optimize clinical decision-making.

Conclusion

Management of Schatzker type V–VI tibial plateau fractures must be individualized. Both ORIF and Ilizarov EF achieve acceptable long-term functional and radiological outcomes. EF offers advantages in soft tissue preservation, early rehabilitation, lower complication rates, and cost-effectiveness, making it particularly suitable for low-resource settings such as rural Pakistan. Hybrid fixation is recommended in select cases to balance stability and soft tissue protection. Clinical

decisions should integrate fracture severity, soft tissue condition, surgical expertise, and institutional resources to optimize outcomes.

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Data Availability: All data used in this study were obtained from previously published articles and are available in the public domain.

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