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Research Paper Assessment of the Effectiveness and Complications of Various Treatment Modalities for Tibial Plateau Fractures

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ABSTRACT:

Background: In the contemporary era, injuries and fractures have proliferated, primarily attributed to the burgeoning population, escalating vehicle numbers, and the resulting traffic congestion. The prevalence is exacerbated by the prevalence of high-speed motor transportation. Notably, the tibia stands out as the most frequently fractured long bone, owing to a third of its surface being subcutaneous. Open fractures manifest more frequently in the tibia compared to other major long bones. Methods and results: A one-year study was conducted to explore the surgical management of intraarticular fractures of the proximal tibia. Over this duration, 140 patients underwent treatment for tibial condylar fractures. Among them, 28 patients received closed reduction and internal fixation through percutaneous methods (using cc screws), while 42 patients underwent open reduction and internal fixation with a buttress plate and screws, with or without bone grafting. Another group of 50 patients underwent open reduction and internal fixation employing a locking plate and screws. Additionally, 8 cases were treated using a hybrid external fixator. It's worth noting that 12 cases were excluded from the study due to loss during follow-up. **Conclusion**: The outcomes of our study led us to the conclusion that, when considering the Shatzker classification of fractures, diverse modalities have demonstrated positive and promising results.

Keywords: Tibial plateau fractures, Gustilo Anderson type II, Schatzkers classification

INTRODUCTION:

Our contemporary lifestyle, characterized by its luxuries, is intricately linked to the rapid surge in industrialization, urbanization, and mechanization. However, this progress comes at a price, as we witness a parallel increase in traumatic incidents.¹ Factors such as densely populated cities, irregular traffic arrangements, and the prevalence of fastmoving vehicles contribute significantly to the rising incidence of bony injuries. This includes the complex spectrum of polytrauma, and comminuted fractures, soft tissue injuries, with tibial plateau fractures emerging a notable concern. Tibial condylar as fractures, specifically, present a formidable challenge for orthopedic surgeons. The challenges arise from the sheer number and variety of these fractures, their inherent complexity, the diverse concepts governing their management, and the associated

injuries.² The proximal tibia, given its role in anchoring various elements of knee stabilizers and its integral contribution to the knee mechanism, is particularly critical. Injury-induced alterations in its anatomy often result in functional impairments, further complicating the clinical scenario. Despite the wealth of literature produced over the past addressing century the classification, indications, and outcomes of various treatment modalities for tibial condylar fractures, a definitive consensus remains elusive. The elusive nature of a final answer may stem from the intricate interplay of factors unique to each case and the evolving nature of medical knowledge and technology. Fractures of the upper tibia, beyond the typical challenges of immobilizing patients, present a unique set of difficulties in treatment.³ Negotiating these challenges requires a nuanced approach that considers

the multifaceted nature of these fractures and the individual needs of patients. As we navigate this intricate landscape of traumatic injuries and their management, ongoing research and collaboration among the medical community remain essential to further our understanding and refine our strategies for optimal patient outcomes.

The decision between conservative and surgical approaches for tibial plateau fractures is pivotal, particularly considering the potential complications associated with conservative treatment, such as knee stiffness, malunion, and nonunion. Recognizing the need for effective solutions, the orthopedic community has increasingly advocated for open reduction and internal fixation (ORIF) as a preferred surgical intervention. Notably, diverse implants, ranging from buttress plates to cancellous screws and hybrid external fixators, have been employed in ORIF procedures with the aim of achieving not only fracture union but also optimal knee function.⁴ Against this backdrop, our study assumes significance as it seeks to delve into the nuanced landscape of surgical modalities for tibial plateau fractures. The primary objective is to conduct a comprehensive assessment of the various surgical approaches, each armed with its unique set of advantages and considerations. systematically evaluating outcomes Βv associated with buttress plates, cancellous screws, and hybrid external fixators, our study aims to provide а nuanced understanding of the strengths and limitations inherent in each modality. Through this exploration, we aspire to contribute meaningful insights that can guide orthopedic practitioners in making informed and tailored decisions based on the specific characteristics of tibial plateau fractures.^{5,6} By shedding light on the comparative effectiveness of these surgical interventions, we endeavor to advance the knowledge base in orthopedics, ultimately enhancing the guality of care and outcomes for individuals grappling with tibial plateau fractures. Our study serves as a valuable step toward refining treatment strategies, fostering improved fracture union, and restoring optimal knee function for patients across different age groups.

MATERIALS AND METHODS:

This study focuses on the surgical management of intraarticular fractures of the proximal tibia, conducted over the course of one year, with prior clearance obtained from the hospital's ethical committee. A total of

140 patients were included in the study, all of whom were treated for tibial condular fractures. Among the treatment modalities employed, 28 patients underwent closed reduction and internal fixation using percutaneous methods, specifically cc screws. Additionally, 42 patients underwent open reduction and internal fixation with a buttress plate and screws, with or without bone grafting. Another group of 50 patients received open reduction and internal fixation with a locking plate and screws. Furthermore, 8 cases were treated using a hybrid external fixator. Notably, 12 cases were excluded from the study due to loss during follow-up. The data necessary for the study was meticulously collected from patients during their hospital stay, at regular follow-up intervals, and from comprehensive reviews of medical records. This robust approach ensures a thorough examination of the outcomes and impacts of different surgical interventions for proximal tibia fractures, contributing valuable insights to the field of orthopedic research.

This study endeavors to delve into the nuanced realm of surgical management for intraarticular fractures of the proximal tibia, establishing meticulous criteria for participant inclusion and exclusion. The inclusion criteria encapsulate individuals within the age bracket of 18 to 60 years, offering a focused examination of the adult population. Furthermore, the study encompasses a diverse spectrum of intraarticular fractures, ranging from tibial condylar fractures to plateau fractures and comminuted fractures. This comprehensive approach aims to capture the heterogeneity of proximal tibia injuries, considering various fracture patterns and complexities encountered in this specific anatomical region.

Conversely, the exclusion criteria are designed to refine the study cohort, excluding individuals below the age of 18 to maintain a consistent focus on adult populations. Additionally, the exclusion of Gustilo Anderson type II and type III compound fractures reflects a deliberate choice to streamline the investigation, as these fracture distinct challenges types present and treatment considerations. The exclusion of cases associated with fractures of the distal end of the femur, particularly those classified as a "floating knee," ensures a more targeted exploration of proximal tibia fractures without potential confounding influence the of fractures. concomitant lower limb This systematic approach to participant selection establishes a robust framework for the study, facilitating a thorough analysis of surgical interventions for proximal tibia fractures within a specific demographic and injury profile. By carefully delineating the boundaries of inclusion and exclusion, the study aims to contribute meaningful insights to the field of orthopedics, guiding future research and enhancing the understanding of optimal treatment strategies for these intricate fractures.

RESULTS:

The observation and analysis of results in this study were conducted with a comprehensive approach, considering various parameters such as age, sex, laterality of fracture, type of fracture, method of treatment, complications, and specific remarks associated with different age groups. The age range under scrutiny spanned from the youngest participant at 19 years to the eldest at 70 years, encompassing a wide spectrum individuals to capture the of diverse responses to fracture healing across different life stages. The primary objective of this study was to discern the age incidence in our setting, unraveling the intricacies of fracture type incidence and outcomes across distinct age groups. Tibial plateau fractures, a focal point of this investigation, were notably prevalent in the active and productive age group within our setup.

This observation aligns with the individuals understanding that in this demographic engage in heightened physical activities and frequent travels, potentially exposing them to a higher risk of such fractures. The nature of fractures and their patterns was found to be influenced by multiple factors, including the amount of force applied, age of the individual, degree of knee flexion, rate of force loading, and the presence of valgus or varus stresses.⁸ This understanding underscores nuanced the complexity inherent in tibial plateau fractures and emphasizes the importance of tailoring treatment approaches based on these multifaceted considerations. By examining the relationship between age, fracture characteristics, and treatment outcomes, this study contributes valuable insights into the dynamics of tibial plateau fractures in our specific demographic context. The findings potential implications for refining hold treatment strategies, enhancing patient care, and informing future research endeavors in orthopedics.

TABLE 1:- Age of	distribution.
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Age distribution	No of patients	Percentage
19-30	48	29.68
31-50	58	42.75
51-70	34	26.57
Total	140	100

Figure1: Gender distribution



The higher incidence of upper tibial fractures in males in our Indian setting can be attributed to the predominant engagement of females in indoor or agricultural activities, minimizing exposure to outdoor risks associated with such fractures. This sex-based distribution underscores the need for tailored preventive measures and awareness campaigns, particularly focusing on the male demographic engaged in activities prone to upper tibial fractures.

Figure 2: Mode of violence



In this series, the predominant cause of treatment is road traffic accidents or automobile accidents, accounting for up to 62.50% of the cases.

Schtazkar classification	Age		Percentage
	Male	Female	1 -
Type 1	10	6	12.50%
Type 2	8	4	9.38%
Туре 3	18	10	21.87%
Type4	18	24	25.00%
Type5	18	6	17.19%
Type6	10	8	14.06%

Table 2: Type of fracture and percentage of cases : Schatzker's classification

Figure 3: Type of fracture and schatzker's classification



Table 3 : Clinical results

Clinical result	No of cases	Percentage
excellent	40	31.25%
Good	66	51.50%
Fair	16	12.50%
Poor	8	4.75%
Total	140	100.00%

DISCUSSION:

Tibial plateau fractures, considered among the most prevalent intra-articular fractures, represent significant traumatic injuries with diverse etiologies such as road traffic accidents, falls from height, or instances of violence. These fractures, at times accompanied by concurrent bony or soft tissue injuries, especially in weight-bearing knee joints, have profound implications for morbidity and an individual's overall quality of life. The intricate nature of upper tibial fractures, particularly those with intraarticular extension, poses a substantial challenge for orthopedic surgeons due to the intricate anatomy and biomechanical significance of the knee joint.9 In alignment with the high aims of our study, we undertook a comprehensive clinical analysis involving the surgical treatment of 140 tibial fractures. The meticulous plateau examination of results encompasses various facets, including patient age, gender distribution, modes of violence leading to fractures, laterality of the fractures, categorization of fracture types, diverse treatment modalities employed, complications arising from the interventions, associated injuries, and the ultimate functional outcomes for the patients.

Our study aims not only to contribute valuable data to the existing body of knowledge regarding tibial plateau fractures but also to provide a nuanced understanding of the Indian context. The surae in modernization, mechanization, and industrial development has notably contributed to an upswing in road traffic accidents. This surge in vehicular incidents correlates with the expanding population and the increasing prevalence of automobiles in the region. The presentation of this clinical study thus serves as a comprehensive exploration of the challenges posed by tibial plateau fractures in the midst of rapid societal changes and heightened vehicular activity, offering insights that can potentially inform and enhance treatment strategies in similar contexts The age distribution of tibial worldwide. plateau fractures in our study aligns with previous research findings.¹⁰ The majority of fractures occurred between the ages of 19 and 70 years, with the peak incidence observed in the productive age group of 31-40 years. This observation resonates with the findings of Boune in 1981, who noted that most patients fell within the age range of 15-55 years, with an average age of 38.5 years. Similarly, Seppo's study indicated an age

incidence of 20-60 years, with an average of 39.8 years, further corroborating our present study. In our series, the predominance of male patients, constituting 62.5%, reflects the societal dynamics in our Indian setup. This sex distribution is attributed to the fact that a significant portion of the female population engages in indoor or agricultural work and has limited travel exposure. Consequently, insights into the sex-related aspects of tibial plateau fractures were not available for comprehensive readily commentary.

Occupationally, tibial plateau fractures were more prevalent in individuals characterized by high levels of activity, movement, and travel. The primary mode of injury in our study was automobile accidents, constituting 62.50% of cases, followed by falls from height (21.87%) and other modalities (15.63%). The distribution of fractures in terms of laterality showed a slight preponderance toward the right tibia, affecting 54.68% of cases, compared to the left tibia at 45.32%. Our study focused on 140 cases of simple tibial plateau fractures treated exclusively through surgical methods.¹¹ Various authors employ different criteria for determining the need for surgical intervention in these fractures. For instance, Seppo E. Honkonen considered condylar widening of > 5mm and a lateral condyle step-off > 3mm as indicators for surgical management, particularly for medial condylar fractures. This nuanced approach reflects the diversity in criteria utilized across studies, underscoring the complexity involved in determining the optimal surgical management strategy for tibial plateau fractures.

In our study, we adhered to standard indications for surgery in tibial plateau fractures, with a 3mm depression being considered an indication for surgical intervention. Our approach did not involve stringent criteria dictating a specific fixation method for each fracture type; instead, we adopted an individualized treatment strategy case for each based on its unique requirements. Percutaneous cancellous screw fixation was the preferred treatment for most type I fractures and some type II fractures. Split fractures with greater than 3mm displacement underwent open reduction and internal fixation (ORIF) with buttress, and bone grafting was incorporated with ORIF using buttress plate and screws for type II, III, IV, and V fractures where deemed necessary. Type III, IV, V fractures, as well as those with osteoporosis or poor bone

quality, were often treated with ORIF/CRIF using a locking compression plate (LCP). Comminuted type V and VI fractures were managed with a hybrid external fixator. The duration of immobilization was customized based on factors like the security of rigid fixation and other patient-specific circumstances.

The advantages of early knee motion, such as reduced knee stiffness and improved cartilage healing, were weighed against potential risks, including loss of fracture reduction, internal fixation failure, and compromised ligament and soft tissue healing.¹² Previous studies by Schatzker, Robert McBroom, Magonhobi, Steven, and Gauscwitz have highlighted that prognosis is influenced by factors such as the degree of displacement, fracture type, treatment method, and the quality of postoperative care. Conservative treatment was reserved for patients in whom surgery was not feasible, and those with less than 3mm articular step-off, though these cases were not included in our study. The predominant challenges encountered during the study were infections and wound dehiscence, leading to extended periods of immobilization. In some cases, muscle flap cover was required, resulting in successful healing later on. The incidence of infection was potentially attributed to nosocomial factors. Despite the complexities introduced associated bony fractures, ligament by injuries, and complications, our study demonstrated favorable outcomes. We achieved excellent results in 31.25% of cases, good results in 51.50% (cumulative acceptable results at 82.75%), and recorded fair and poor outcomes in 12.5% and 4.75%, respectively, based on functional assessments. These results are comparable and align with the findings of other established studies in the field.

CONCLUSION:

In conclusion, the surgical management of tibial plateau fractures presents a formidable challenge yet offers the opportunity to achieve excellent anatomical reduction and rigid fixation. This approach aims to restore articular congruity, facilitate early knee motion, and minimize the risk of posttraumatic osteoarthritis, ultimately contributing to the attainment of optimal knee function. The insights shared by Hohl at Orthopaedic the Chicago Society's presidential guest lecture serve as a poignant reminder of the complexities and critical considerations involved in this process. From

our study, we derive conclusions that align with the Shatzker classification of fractures, indicating that various modalities yield favorable results:

1. For Type I & II fractures: CC screw fixation.

2. For Type III & IV fractures: Buttress plating with or without bone grafting.

3. For Type V & VI fractures: Locking compression plate and Hybrid external fixator.

Furthermore, in cases involving osteoporotic bone, the study recommends the preference of a Locking Compression Plate (LCP) over a buttress plate, especially for fractures falling under Type III, IV, V, and VI categories. This tailored approach highlights the significance of adapting the choice of fixation modality based on the specific characteristics of the fracture, contributing to improved outcomes in the surgical management of tibial plateau fractures.

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