

COMPARATIVE ANALYSIS OF ORTHOPEDIC TRAUMA INTERVENTIONS: A REGISTRY-BASED STUDY ON TREATMENT OUTCOME

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Abstract: Musculoskeletal injuries represent a substantial public health challenge, significantly burdening healthcare providers and hospitals in developing nations. Efficiently managing the diagnosis and treatment of these injuries can result in cost savings in healthcare and a reduction in the duration of preventable disabilities among affected patients. This study aimed to analyze and compare the treatment outcomes of various orthopedic trauma interventions. In this retrospective cohort study conducted at the SMBB Institute of Trauma, a Tertiary Care Hospital, between January 2017 and December 2021, 4557 limb injuries sustained by 4557 patients were investigated. The study included patients with both upper and lower limb trauma. Detailed information regarding the injuries, trauma management strategies, and subsequent outcomes was meticulously extracted from the patient's medical records. Data analysis was conducted using SPSS version 27 to uncover relevant patterns and insights in the management and outcomes of these limb injuries. A total of 4557 patients with 4557 limb injuries were enrolled in the study. The incidence of upper and lower limb injuries was 24.5% (n=1108) and 75.5% (n=3449), respectively. Surgical intervention was employed in 4191 (92%) cases, while the remaining 366 (8%) were managed conservatively. Open reduction and internal fixation (ORIF) were the most common surgical procedure performed, accounting for 1441 cases (34.4%), followed by Intramedullary Nailing with 491 cases (11.7%) and external fixation in 434 cases (10.4%). The overall mortality rate was 16 (0.35%), among which 10 cases were not associated with either the trauma itself or its management. The assessment of outcomes associated with injuries identifies potential areas of trauma care that require enhancement and suggests strategies to reduce the mortality rate. Registry data has the potential to aid in the formulation of preventative strategies and enhance the effectiveness of management protocols.

Keywords: Orthopedic Trauma, Limb Injuries, Outcomes, Tibia Shaft

Introduction

Musculoskeletal injuries pose a significant public health challenge, burdening emergency healthcare providers and hospitals in developing nations (Ahmad et al., 2019; Lau et al., 2020). These injuries have an amplified impact in these regions due to resulting labor and economic productivity losses. Therefore, exploring the demographic patterns of musculoskeletal injuries in these areas and developing innovative treatment approaches and necessary interventions is imperative (Sumrein et al., 2017; Williamson et al., 2009). Efficiently managing the diagnostic and treatment processes reduces healthcare expenditures and minimizes the duration of preventable disabilities in individuals with musculoskeletal injuries (Bedard et al., 2020; Bulto et al., 2018). Consequently, improving the current infrastructure and service conditions, based on a comprehensive evaluation of orthopedics and traumatology databases within emergency healthcare providers, holds significant promise for advancement (Fleet et al., 2019; Gabbe et al., 2016).

Musculoskeletal trauma encompasses injuries to bones, muscles, or soft tissues, which can occur in isolation or concurrently with injuries to other systems, often within a single limb (Kisitu et al., 2016; Moore et al., 2017). While

not all these injuries may be severe, their management can be intricate, often necessitating decisions regarding non-operative approaches or various surgical interventions (Stewart et al., 2016). Moreover, new treatment devices are continuously introduced, often claimed to offer substantial advantages over existing ones, albeit typically at a higher cost (Anderson and Althausen, 2016). National registries have become increasingly crucial data sources, making it essential to analyze all recorded data in contemporary research comprehensively (Sumrein et al., 2017). The accurate and thorough registration of musculoskeletal injury data presents various challenges from regional and national perspectives (Hamadani et al., 2019).

Ensuring that emergency healthcare providers in Pakistan maintain up-to-date and precise records is particularly challenging, given the simultaneous management of multiple registry processes for many patients. Therefore, the primary aim of this study is to analyze and compare the treatment outcomes of various orthopedic trauma interventions. This research presents a comprehensive examination of treatment outcomes in orthopedic trauma interventions, utilizing data recorded in a dedicated registry. This study aims to compare the effectiveness and success rates of various orthopedic trauma treatments, ultimately

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contributing to a better understanding of best practices in the field. This study aims to provide valuable insights that can inform clinical decision-making and enhance patient care in orthopedic trauma scenarios by analyzing a substantial dataset of real-world cases.

Methodology

A retrospective cohort study was conducted at the Department of Orthopedics, Shaheed Mohtarma Benazir Bhutto (SMBB) Institute of Trauma Tertiary Care Hospital in Karachi, from January 2017 to December 2021. The study aimed to examine 4,557 limb injuries in patients, primarily focusing on upper and lower limb extremity trauma. Cases involving pathological fractures were excluded from the study.

The orthopedic data of the participants were retrieved from the Pakistan Trauma Registry (Registered). Data collection encompassed a comprehensive set of variables, including demographic information, details of the traumatic event, treatment options administered, and in-hospital mortality rates. All information was meticulously extracted from patients' medical records.

Throughout the study, ethical considerations were of paramount importance. Ethical approval was obtained from the relevant institutional review board (IRB), and strict measures were implemented to safeguard patient confidentiality and privacy. Data quality checks were regularly performed to ensure the accuracy and completeness of the dataset.

In conclusion, this study employed a rigorous methodology, including patient recruitment, data collection, outcome assessment, and data analysis. It adhered to ethical principles and employed validated assessment tools, ultimately providing valuable insights into the management and outcomes of limb injuries in the specified population. Statistical analysis of the collected data was conducted using SPSS version 27, allowing for robust data management and comprehensive analysis.

Results

In this study, 4557 patients with limb injuries were enrolled for analysis. The incidence of upper limb injuries accounted for 1,108 cases (24.3%), while lower limb injuries were more prevalent, comprising 3,449 cases (75.7%). Among these cases, 4191 (92%) underwent surgical intervention, whereas 366 (8.0%) were managed conservatively. Regarding the type of fractures, 232 cases (18.1%) were open fractures, and 1047 cases (81.8%) were closed fractures in the upper limbs. In contrast, there were 876 cases (26.7%) of open fractures and 2403 cases (73.3%) of closed fractures in the lower limbs. When analyzing the gender distribution based on anatomical site, among males, 907 cases (23.7%) involved upper limb injuries, and 2980 cases (78.1%) involved lower limb injuries. Among females, 201 cases (29.9%) had upper limb injuries, and 469 cases (70.0%) had lower limb injuries. (Table I)

The most common surgical procedure performed was Open Reduction and Internal Fixation (ORIF), accounting for 1441 cases (34.4%). Intramedullary Nailing (IM Nailing) was performed in 491 cases (11.7%), and external fixation was utilized in 434 cases (10.4%). Close Reduction Internal Fixation (CRIF) was employed in 293 cases (6.9%), while 224 cases (5.3%) required amputation. K-wiring was done in 36 cases (0.86%), and 1272 (30.3%) underwent other surgical procedures. (Table II)

The mechanisms of injuries were primarily due to Road Traffic Accidents (RTA) in 3046 cases (66.8%) and falls in 1263 cases (27.7%). Blunt trauma accounted for 65 cases (1.4%), firearm injuries/gunshots for 102 cases (2.2%), assaults for 49 cases (1.1%), blasts for 6 cases (0.1%), and 26 cases (0.5%) were classified under other unknown mechanisms. The overall mortality rate was 16 cases (0.35%), out of which 10 cases were not directly associated with either the trauma itself or its management. (Figure I)

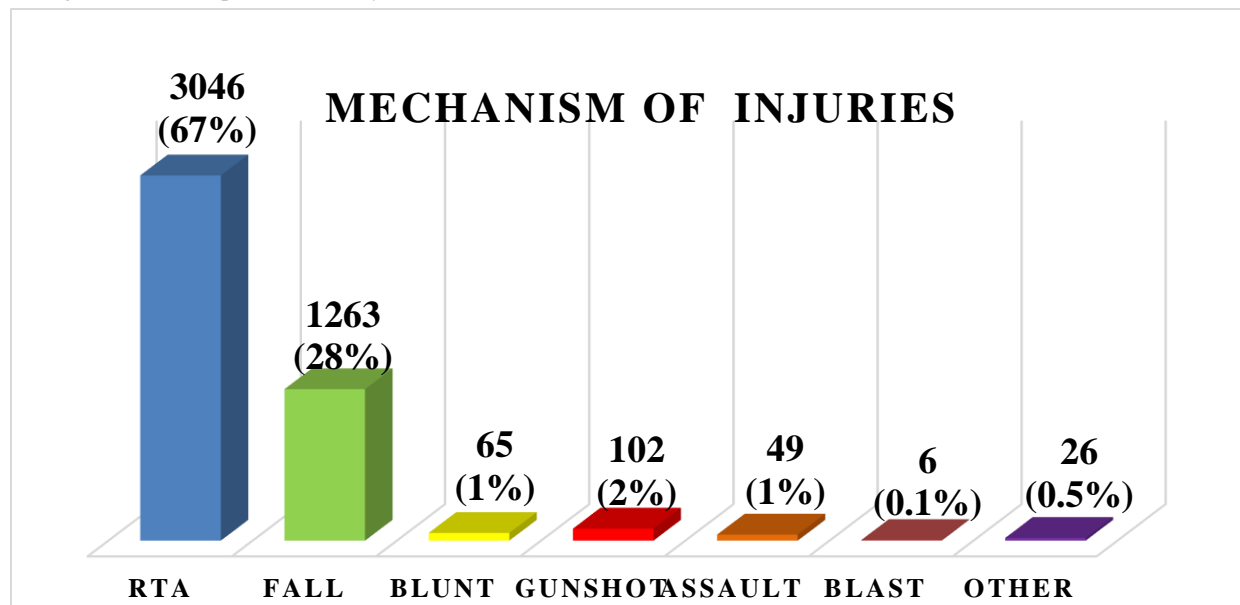


Figure I- Mechanism of Injuries (N=4557)

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Table I Comparison of open versus closed fractures and the distribution of gender based on the anatomical site of the fracture (N=4557)

Variables	Upper Limbs n(%)	Lower Limbs n(%)
Gender		
Male	907 (23.7)	2980 (78.1)
Females	201 (29.9)	469(70.0)
Fracture types		
Open fracture	232(18.1)	1047 (81.8)
Closed fracture	876 (26.7)	2403 (73.3)

Discussion

Establishing a trauma registry can be particularly challenging for an underdeveloped countries where healthcare resources and associated funding are limited. However, given the rising prevalence of trauma due to violence and disasters, along with the resulting loss of life and increased morbidity in our nation, it becomes crucial to ensure ongoing enhancements in trauma care, and this necessitates the collection of data. We have shown that it is possible to create and maintain a comprehensive orthopedic trauma registry, demonstrating that progress in this critical area is achievable even with limited resources. However, it's important to note that we have yet to analyze and discuss data regarding the outcomes of other upper and lower limb fractures with healthcare providers. Our findings indicated that intramedullary (IM) nailing is the surgical procedure that yields the most favorable clinical and functional outcomes. Nevertheless, it's crucial not to overlook the complexity of clinical decision-making when evaluating the results of a surgical procedure. Several factors must be considered, including any associated medical conditions, the type of fracture, its proximity to joints, soft tissue injuries, concurrent injuries (poly-trauma), anesthetic considerations, and various patient-related factors.

In this study, Open reduction and internal fixation was the most frequently used surgical procedure, followed by Intramedullary Nailing (IM Nailing), external fixator, closed reduction and internal fixation (CRIF), amputations, and K-wiring. An earlier study of 3,406 multiple trauma patients admitted to a Level 1 Trauma Centre revealed that numerous traumatic injuries are associated with the musculoskeletal system, and about 85% of patients had single or multiple fractures (Isles et al., 2017). Additionally, a report on 81,946 hospital admissions for unintentional injuries indicated that fractures, especially in the upper (17%) and lower extremities (15%), along with open wounds (16%), were the most prevalent diagnoses. Although it is widely acknowledged that musculoskeletal trauma is common, there is a lack of information regarding the management and outcomes of these injuries (Laurila et al., 2019).

Several studies have delved into localized trauma incidents. For instance, Mulwafu et al., in their study, examined the incidence of tibia fractures resulting from isolated acute trauma in the Finland registry. They discovered that 57.3% of acute tibia fractures occurred in males (Mulwafu et al., 2017). Similarly, another study conducted by Shah et al.

Table II Surgical procedure performed in fractures (N=4191)

Surgical Procedure	N (%)
Open reduction and internal fixation (ORIF)	1441 (34.4)
Intramedullary Nailing (IM Nailing)	491(11.7)
External fixator	434 (10.4)
Close Reduction Internal fixation (CRIF)	293 (6.9)
Amputation	224(5.3)
K-wiring	36(0.86)
Other	1272 (30.3)

explored the incidence of shoulder dislocations in England. This study revealed that 72% of shoulder dislocations due to acute trauma were observed in males (Shah et al., 2017). In our study, we observed a significantly higher incidence of trauma exposure in the male population. This observation was attributed to the fact that men often work in occupations that require more significant physical effort, consequently exposing them to a higher risk of trauma incidents.

Musculoskeletal traumas are becoming increasingly common, emphasizing the need to manage these injuries comprehensively from various perspectives (O'Connell et al., 2018; Ridderikhof et al., 2017). Many healthcare facilities are seeing a substantial influx of patients with musculoskeletal trauma, making it essential for effective management planning. By maintaining proper records and archives of trauma cases, management can conduct more informed planning, assess cost-effectiveness, and analyze the financial implications associated with different types of traumas. Various studies that discuss various data registries for health services play a crucial role in this context (Happonen et al., 2021; Jansson et al., 2019).

The effectiveness of the initial intervention hinges on the alignment between the initial diagnosis and the final diagnosis made at the treatment center (Costa et al., 2016; Newgard et al., 2019; Sharif-Alhoseini et al., 2019). The proper utilization of registry systems can facilitate several in-service training and planning procedures following the analysis of patient data. Consequently, this could lead to developing training programs for emergency service providers, focusing on musculoskeletal system approaches and planning processes. Furthermore, when organizing emergency healthcare services, studying the regional distribution of patient volume can aid in making informed decisions, such as deploying additional service providers during periods and time frames when patient volume is notably higher (Haider et al., 2020).

The presentation of the results concerning tibia shaft fractures offered valuable insights for determining the optimal surgical approach with the most favorable outcomes. Notably, it's worth highlighting that no unfavorable outcomes were observed in the intramedullary (IM) nailing group during the 6-month follow-up period.

Conclusion

The comprehensive assessment of injury-associated outcomes in this study has illuminated critical areas within the domain of trauma care that warrant refinement, offering the promise of reducing mortality rates. The utilization of

registry data, as demonstrated in this research, is a potent tool in the arsenal of healthcare professionals. It provides a means to discern areas needing improvement and serves as a foundational resource for crafting preventative strategies and optimizing the efficacy of management protocols. This study underscores the vital role of data-driven approaches in shaping a more resilient and responsive healthcare system poised to address the challenges of traumatic injuries with greater precision and effectiveness.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned.

Consent for publication

Approved

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Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

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Coordination of collaborative efforts.

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Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript

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Manuscript revisions, critical input.

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Data acquisition, analysis.

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Data entry and Data analysis, drafting article

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Data acquisition, analysis.

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