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A Solitary Study Of Distribution And Determinance Of Traumatic Soft Tissue Injury In A Tertiary Care Centre

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Abstract

Trauma care presents significant challenges in medicine due to its strong association with morbidity and mortality. This research aims to determine the distribution and determinants of traumatic soft tissue injuries among patients attending a tertiary care center in Chennai, India. The study assesses the pattern of traumatic soft tissue injuries, demographic variables associated with these injuries, and the clinical presentations and outcomes of affected individuals. Inclusion criteria for the study were patients with soft tissue injuries of up to one week's duration, across all age groups and genders. Exclusion criteria included individuals with assault-related injuries involving severe medico-legal implications, patients requiring advanced management or complicated follow-up, and those who did not consent to participate. The prospective study was conducted in a solitary tertiary care center in Chennai, Tamil Nadu, from October 2022 to March 2024, with a sample size of 281 patients attending the casualty and general surgery OPD.By employing chi-squared analysis, the study identifies significant associations between demographic factors, injury patterns, and clinical outcomes. This enables healthcare providers to anticipate complications, personalize treatment plans, and foster multidisciplinary collaboration, ultimately improving patient outcomes and reducing morbidity. Early intervention, appropriate wound care, and rehabilitation are critical for minimizing complications and promoting recovery. The findings of this study will contribute to evidence-based practices in managing soft tissue injuries, optimizing care through data-driven approaches and interdisciplinary teamwork for better patient satisfaction and long-term health outcomes.

Keywords: *Abbreviated Injury Score, Anatomical Profile, Body Mass Index, Injury Severity Score, New Injury Severity Score, Road Traffic Accident, Revised Trauma Score, Soft Tissue Injury, World Health Organization*

Introduction

Traumatic soft tissue injuries represent a substantial healthcare burden globally, contributing to significant morbidity, mortality, and strain on healthcare resources. These injuries range from minor abrasions to complex

lacerations, contusions, and avulsions, and are frequently encountered in emergency departments.[1] Despite their high prevalence, there is a lack of comprehensive data that specifically addresses the distribution, risk factors, and outcomes of traumatic soft tissue injuries, particularly in regional settings such as Chennai, India. Identifying patterns and determinants is crucial to improving the management and prevention strategies for these injuries, ultimately optimizing recovery and reducing long-term complications.[2]
Several advancements have been made in the management of traumatic soft tissue injuries, including the development of wound care protocols, the use of advanced surgical techniques, and the implementation of rehabilitation strategies. [3] These treatments typically involve primary closure for minor injuries and multi-stage reconstruction for more severe cases. [4] However, existing solutions tend to be generalized and do not fully account for regional variations in injury patterns, patient demographics, and the specific complexities of managing severe trauma. There remains a need for more tailored, region-specific approaches to injury management and prevention.[5]

Currently, there is no universal "best" solution for managing traumatic soft tissue injuries, as treatment must be adapted to the injury's severity, location, and the patient's individual circumstances.[6] However, a multidisciplinary approach that includes early intervention, personalized care plans, and post-injury rehabilitation has been found to be the most effective in ensuring optimal outcomes [7].This approach integrates advanced surgical techniques, wound care management, and psychosocial support, which together improve recovery times and reduce complications associated with these injuries.[8,9]

This study aims to generate valuable insights into the prevalence, distribution, and determinants of traumatic soft tissue injuries, particularly in the context of a tertiary care hospital in Chennai. By identifying high-risk groups, understanding injury patterns, and analysing treatment outcomes, the research will contribute to more effective prevention strategies and help refine clinical management approaches for these injuries. The findings will also offer recommendations for improving trauma care protocols and support systems for affected individuals.

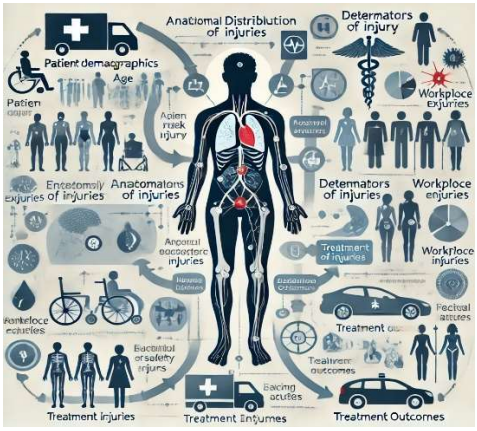

Figure 1: Graphical Representation Of Abstract

The primary objective of this study is to investigate the prevalence, patterns, and determinants of traumatic soft tissue injuries among patients presenting to a tertiary care hospital in Chennai. The specific goals are to:

1. Assess the distribution of injuries by anatomical site and demographic factors.
2. Identify significant risk factors associated with the occurrence of soft tissue injuries.
3. Evaluate treatment outcomes and the effectiveness of management strategies.

This study offers a novel contribution to the understanding of traumatic soft tissue injuries by focusing on a specific regional context. Unlike broader national or international studies, this research provides insights into the unique factors influencing soft tissue injury patterns in Chennai, India. By considering a range of demographic, anatomical, environmental, and clinical factors, the study will enhance knowledge about the complexities of managing these injuries in an Indian healthcare setting. The findings have the potential to inform region-specific

trauma care protocols, prevention programs, and policy development, ultimately improving the quality of care for trauma patients.

Materials and Methods

The study was conducted at Sree Balaji Medical College & Hospital, Chennai, a tertiary care center located in Tamil Nadu, India. The hospital serves as a major referral center for a wide range of traumatic injuries, providing comprehensive trauma care and specialized surgical interventions.

This is a prospective study conducted from October 2022 to March 2024. The study included patients presenting to the casualty and general surgery OPD with traumatic soft tissue injuries. A total of 281 patients were included based on sample size calculation using Dabson's formula. Data collection was facilitated using a predesigned proforma that encompassed clinical examinations, biochemical tests, and imaging studies. The study focused on the distribution, severity, and outcomes of soft tissue injuries, with most cases being managed conservatively.

Biochemical investigations, including glycosylated hemoglobin (HbA1c) measurements, were conducted to assess the metabolic status of the patients. Radiological assessments, including X-rays, CT/MRI scans, and diagnostic ultrasound, were used to evaluate the extent of injury. Additional tests like Doppler ultrasound and computed tomography angiography were utilized for selected patients with severe extremity injuries to evaluate vascular involvement. Data were collected through medical records and the computerized patient record system.

Descriptive statistics were used to summarize patient demographics and injury characteristics. Frequencies and percentages were computed for categorical variables. The Chi-Squared test was employed to assess associations between different variables. The Clavien–Dindo classification was used to grade the severity of infections and postoperative complications. The study analyzed hospital stay duration, wound infection rates, wound adherence assessments, and limb survival post-surgical interventions. All statistical analyses were conducted using SPSS software.

Results

The study findings underscore critical insights into the demographics, injury mechanisms, treatment approaches, and outcomes of complex soft tissue injuries, with a dominant role of road traffic accidents (RTAs), which accounted for 75.09% of cases. A substantial portion of these injuries affected males (84%), primarily within the working-age group of 19–64 years (77.78%), emphasizing the vulnerability of this demographic to high-energy trauma in urban environments, particularly in Chennai (74.73%). Delays in reaching medical facilities were a notable concern, with 22.07% of patients arriving after six hours and 7.48% beyond 24 hours post-injury, often correlating with increased rates of amputation due to the risk of prolonged ischemia, particularly in cases involving vascular injuries.

The analysis revealed significant associations between injury mechanism and acuity ($p < 0.001$), underscoring the effect of high-energy trauma on prognosis and treatment complexity. Polytrauma cases (21.71%) were associated with higher Injury Severity Scores (ISS ≥ 9), requiring multiple procedures such as vascular and bone repairs, compared to isolated extremity injuries, which were typically less severe and required fewer interventions. Surgical interventions, including split-thickness skin grafting (62.28%) and flap procedures (17.80%), played a crucial role in managing these injuries, with nerve and tendon repairs yielding favorable outcomes. However, cases delayed in reaching care showed a higher incidence of amputation, reinforcing the importance of swift response times.

Imaging assessments, primarily MRI (51.60%) and plain radiographs (42.70%), were indispensable for evaluating injury extent, especially in cases involving bony (51.95%) and vascular (45.91%) injuries. Statistical analysis further indicated significant correlations between injury location and preexisting conditions like osteoarthritis and peripheral vascular disease ($p = 0.008$), highlighting the intricate relationship between injury and comorbidities. Overall, the findings emphasize the necessity for prompt intervention and a coordinated,

multidisciplinary approach to optimize outcomes, particularly in cases where delayed care may exacerbate morbidity and mortality.

Discussion

The results of this study align with the study's initial objectives, which sought to investigate the prevalence, severity, and management of complex soft tissue injuries, with a focus on road traffic accidents (RTAs). The findings show that RTAs are the leading cause of soft tissue trauma, accounting for a large portion of cases, with patients often requiring multi-disciplinary interventions due to polytrauma. Additionally, the study highlighted the importance of timely hospital presentation, particularly in relation to amputation rates, where delays in presentation were associated with worse outcomes. Our findings corroborate those of Sanyang et al.[15] and Ong and Dudley, who also identified RTAs as the predominant cause of soft tissue injuries. Specifically, a similar male predominance was observed in our study (84%), which aligns with the research of Ong and Dudley (1999)[13], where male patients had higher rates of injury, especially involving the face and extremities. Furthermore, the higher mortality rates seen in pediatric cases within our cohort are consistent with the work of Sharma et al. and Chagomerana et al.,[17] emphasizing the critical role of early intervention in reducing mortality, especially in cases of hemorrhagic shock. A significant portion of our patients (22.07%) presented to the hospital after a delay of six hours or more. This delayed presentation is a critical factor that could contribute to poor outcomes such as amputation. Similar studies, including those by Dua et al. [11]and Huh et al., [16]have reported that delayed hospital presentation significantly increases the risk of limb loss. The delayed arrival exacerbates ischemic conditions, especially when combined vascular and bone injuries are present, leading to higher amputation rates. This highlights the importance of improving pre-hospital care systems and reducing time to definitive care. Polytrauma, particularly cases with combined extremity injuries, was shown to have more severe outcomes, requiring multiple procedures and longer hospital stays. These patients had significantly higher Injury Severity Scores (ISS), necessitating a more intensive, multidisciplinary approach. This is in line with the research of Gopinathan et al., which stresses the importance of a collaborative approach to managing polytrauma. Effective coordination between surgeons, orthopedists, and trauma specialists is crucial for optimizing outcomes, especially when multiple systems are involved in the injury. Our study found that 62.28% of patients required split-thickness skin grafting (STSG), highlighting the critical role of timely wound management in preventing infection and promoting healing. This aligns with the findings of Sanyang et al. (2017)[14], who noted the effectiveness of primary wound debridement and subsequent skin grafting in treating complex injuries. Moreover, nerve and tendon repair procedures had a high success rate in restoring function, which underscores the importance of early surgical intervention. Despite these successes, however, the relatively high rate of amputations, particularly secondary amputations, illustrates the challenges faced in limb salvage, especially in cases where treatment was delayed.

Conclusion

Trauma care remains a complex and demanding field, particularly in the context of soft tissue injuries, which contribute significantly to morbidity and mortality worldwide. This study aimed to analyze the distribution and determinants of traumatic soft tissue injuries among patients attending a tertiary care center in Chennai, India. By assessing the patterns of injury, demographic factors, clinical presentations, and treatment outcomes, this research offers essential insights that may inform more targeted, region-specific management strategies.

The results demonstrate that road traffic accidents (RTAs) are the predominant cause of soft tissue injuries in Chennai, accounting for most cases and often involving complex, high-energy trauma that requires multidisciplinary management. Male patients, particularly those of working age, are disproportionately affected, underscoring the need for focused prevention and education efforts within this demographic. The study's findings also highlight the critical impact of timely medical intervention, as delayed presentation was associated with increased risks of complications such as amputation, especially in cases involving vascular injuries.

By revealing significant associations between injury mechanisms, injury sites, and comorbidities, this study supports the value of data-driven approaches in trauma care. Early and coordinated interventions, such as timely surgical procedures, wound management, and rehabilitation, were shown to improve patient outcomes, reduce the risk of long-term complications, and enhance recovery. The study also underscores the necessity for pre-hospital

care systems that minimize delays in definitive care, which is especially vital in urban settings where RTAs are prevalent.

These findings emphasize the importance of a comprehensive trauma care protocol that integrates multidisciplinary collaboration, personalized treatment planning, and early intervention. The insights generated from this research can guide healthcare providers in developing more effective management and prevention strategies tailored to the specific patterns of traumatic injuries observed in Chennai. The study provides a foundation for future work aimed at optimizing trauma protocols, supporting policy development, and ultimately enhancing the quality of care for trauma patients.

Figures and Tables

Table 1: Distribution of Complex Soft Tissue Injuries and Associated Parameters

Parameter	Category	Number of Cases	Percentage (%)
Distribution of Cases by Age Group	0 < 18	60	22.22
	19–64	210	77.78
	65 and above	11	4.08
Distribution of Cases by Gender	Male	236	84.00
	Female	45	16.00
Distribution of Cases by Regional Background	Chennai	210	74.73
	Kanchipuram	26	9.25
	Chengalpatu	25	8.90
	Tiruvallur	20	7.12
Distribution of Cases by Mode of Transport	Private Vehicle	124	44.13
	Ambulance	62	22.06
	Police Van	45	16.01
	Others	50	17.80
Distribution of Cases by Time to Reach Hospital	0–1 hour	27	9.61
	1–6 hours	219	77.93
	6–24 hours	14	4.98
	>24 hours	21	7.48
Distribution of Cases by Mechanism of Injury	Road Traffic Accident (RTA)	211	75.09
	Occupational Injury	35	12.46
	Fall from Height	24	8.54
	Assault and Others	11	3.91
Triage Categories at Initial Presentation	Red	212	75.45
	Yellow	42	14.95
	Green	27	9.60
Types of Complex Soft Tissue Injuries and Procedures	Isolated Extremities	220	78.29
	Polytrauma	61	21.71
	Bony Injuries	146	51.95

Parameter	Category	Number of Cases	Percentage (%)
	Vascular Injuries	129	45.91
	Nerve Injuries	56	19.93
	Nerve Repair	35	62.50
	Tendon Injuries	46	16.37
	Tendon Repair	38	67.86
	Fixation of Bone without Vascular Injury	53	18.86
	Fixation of Bone with Vascular Repair	76	27.04
	Primary Amputation	20	7.12
	Secondary Amputation	40	14.23
	Split-Thickness Skin Grafting (STSG)	175	62.28
	Flap Procedures	50	17.80
Types of Soft Tissue Injuries	Lacerations	120	42.70
	Avulsions	65	23.13
	Contusions	70	24.91
	Abrasions	26	9.25

Table 2: Comparison of Outcomes Between Isolated Extremity Injuries and Combined Injuries

Parameter	Isolated Extremity Injuries	Percentage (%)	Combined Injuries	Percentage (%)
Injury Severity Score (ISS)				
ISS < 9	180	83.72	35	15.35
ISS ≥ 9	35	16.28	193	84.65
Number of Procedures Required				
1-2 Procedures	190	88.37	70	30.70
≥ 3 Procedures	25	11.63	158	69.30
Length of Hospital Stay				
≤ 7 Days	150	69.77	40	17.54
> 7 Days	65	30.23	188	82.46
Mortality				
Alive	215	100.00	184	80.70
Dead	0	0.00	44	19.30

Table 3: Assessment, Imaging, Clinical Findings, and Statistical Analysis of Soft Tissue Injuries

Parameter	Category	Number of Cases (n=281)	Percentage (%)
Assessment of Soft Tissue Injuries Based on History	Acute Injury	175	-
	Chronic Injury	106	-
	Total	281	100
Imaging Studies for Soft Tissue Injuries	Plain Radiographs	120	42.70
	MRI	145	51.60
	Diagnostic Ultrasound	95	33.81
	Total (N=281)	-	100
Clinical Examination Findings for Soft Tissue Injuries	Full Examination	281	100
	Bilateral Examination	281	100
	Peripheral Vascular and Neurologic Exam	281	100
Outcome Measures for Soft Tissue Injuries	Mean Hospital Stay	-	18 days
	Wound Infection	35	12.46
	Wound Adherence	246	87.54
Statistical Analysis of Descriptive Variables	Acute Injuries	210	74.73
	Chronic Injuries	71	25.27
	Motor Vehicle Accident (MVA)	132	47.05
	Inversion Sprains	56	19.93
	Other Mechanisms	93	33.12
	Osteoarthritis	45	16.01
	Rheumatoid Arthritis	30	10.68
	Peripheral Vascular Disease (PVD)	22	7.83
	Prior History of Injuries	78	27.76
	Overuse Injuries	56	19.93
Association Between Variables (Chi-Squared Analysis)	Mechanism of Injury vs. Acuity	23.45	<0.001
	Mechanism of Injury vs. Location	12.76	0.002
	Acuity vs. Associated Disease	18.92	<0.001
	Location vs. Associated Disease	9.81	0.008

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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