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RESEARCH ARTICLE

Prospective Comparative Analysis of Blunt and Sharp Force Injuries in Assault Victims: A One-Year Hospital-Based Study from a Tertiary Care Centre in Eastern India

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ABSTRACT

Background: Assault-related injuries constitute a significant component of medico-legal workload and represent an important public health concern worldwide. Blunt and sharp force injuries differ considerably in their mechanisms, clinical manifestations, medicolegal implications, and outcomes. Understanding injury patterns among assault victims provides valuable epidemiological information that may assist forensic investigations, trauma management, and violence prevention strategies.

Objective: To compare demographic characteristics, injury patterns, anatomical distribution, severity, and medicolegal outcomes between blunt force and sharp force assault injuries.

Methods: A prospective comparative observational study was conducted in the Department of Forensic Medicine and Toxicology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, from January 2025 to December 2025. A total of 109 assault victims presenting for medico-legal examination were included. Victims were categorized according to predominant injury mechanism into blunt force injury group and sharp force injury group. Demographic characteristics, injury characteristics, anatomical distribution, severity, hospitalization, and medico-legal outcomes were analysed. Statistical analysis was performed using Chi-square test, independent t-test, and logistic regression where appropriate. Statistical significance was considered at $p<0.05$.

Results: Among 109 assault victims, blunt force injuries constituted the majority of cases (65.1%, n=71), while sharp force injuries accounted for 34.9% (n=38). Young adults aged 21–40 years represented the most affected age group in both groups. Head and neck involvement was significantly more common among blunt force injuries (57.7% vs 28.9%, p=0.004), whereas chest and abdominal involvement occurred more frequently in sharp force injuries (39.5% vs 16.9%, p=0.011 and 28.9% vs 9.9%, p=0.014, respectively). Sharp force injuries demonstrated significantly greater wound depth (65.8% vs 28.2%, $p<0.001$), higher hospitalization rates (55.3% vs 25.4%, p=0.002), and increased surgical intervention requirements (42.1% vs 12.7%, $p<0.001$).

Conclusion: Blunt force injuries remain the predominant mechanism of assault; however, sharp force injuries demonstrate greater severity and increased healthcare burden. Understanding these injury patterns may improve forensic documentation, trauma care, and violence prevention programs.

Keywords: Assault; Blunt force injury; Sharp force injury; Forensic medicine; Injury pattern; Medico-legal examination

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INTRODUCTION

Interpersonal violence remains an important contributor to morbidity, mortality, disability, and socioeconomic burden globally. Assault-related injuries constitute a major proportion of medico-legal examinations performed in emergency departments and forensic centres [1]. The increasing burden of violence particularly affects low- and middle-income countries where rapid urbanization, socioeconomic disparities, substance abuse, and interpersonal conflicts contribute substantially to injury occurrence [2].

Forensic evaluation of assault injuries plays a crucial role in criminal justice systems because accurate documentation assists reconstruction of events, determination of weapon characteristics, assessment of injury severity, and judicial decision making [3]. Distinguishing blunt force injuries from sharp force injuries is among the most fundamental aspects of forensic trauma assessment [4].

Blunt force injuries result from impact caused by objects lacking sharp cutting surfaces and typically produce abrasions, contusions, lacerations, fractures, and crush injuries depending upon force transmission and tissue characteristics [5]. These injuries are frequently encountered during interpersonal violence and may result from fists, sticks, rods, stones, or other blunt objects [6].

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Sharp force injuries arise from instruments possessing cutting edges or pointed surfaces capable of producing incised wounds, stab wounds, chop wounds, or combinations thereof [7]. Sharp force trauma is associated with substantial morbidity because deeper tissue penetration may involve neurovascular structures and vital organs [8].

Several epidemiological studies have demonstrated age-specific and sex-specific variations in assault-related injuries, with young adult males disproportionately affected [9]. Socioeconomic factors, alcohol consumption, occupational exposures, and environmental influences further contribute to assault vulnerability [10].

Understanding injury distribution patterns is important because anatomical location frequently reflects defensive behaviour, weapon characteristics, assault dynamics, and victim-offender interaction [11]. Upper limb injuries often represent defensive actions whereas head injuries may indicate targeted violence associated with increased morbidity [12].

The comparative analysis of blunt and sharp force injuries has important clinical implications beyond forensic reconstruction. Injury severity influences hospitalization requirements, surgical interventions, rehabilitation needs, and long-term disability outcomes [13].

Despite increasing assault-related workload in tertiary healthcare institutions, prospective comparative data evaluating blunt and sharp force injuries from eastern India remain relatively limited [14]. Regional epidemiological variations necessitate institution-specific evidence for improving trauma services and medico-legal protocols [15].

Therefore, the present study was undertaken to prospectively compare blunt and sharp force injuries among assault victims presenting to a tertiary care teaching hospital.

MATERIALS AND METHODS

Study Design

Prospective comparative observational study.

Study Duration

January 2025 to December 2025.

Study Setting

Department of Forensic Medicine and Toxicology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand.

Study Population

Assault victims presenting for medico-legal examination during the study period.

Sample Size

Total sample size: 109 assault victims.

Sampling Technique

Consecutive sampling.

Inclusion Criteria

- Confirmed assault victims
- Age ≥18 years
- Medico-legal examination performed within study period
- Consent provided

Exclusion Criteria

- Self-inflicted injuries
- Road traffic injuries
- Falls
- Accidental trauma
- Incomplete records

STUDY VARIABLES

Demographic Variables:

- Age

- Sex
- Residence
- Occupation

Clinical Variables

- Mechanism of injury
- Anatomical distribution
- Number of injuries
- Severity
- Hospitalization
- Surgical intervention

Statistical Analysis

Data were analyzed using SPSS software version 26. Continuous variables were expressed as mean ± standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. Comparisons between continuous variables were performed using the independent t-test. Categorical variables were analyzed using the Chi-square test or Fisher's exact test wherever appropriate. Logistic regression analysis was performed to identify independent predictors associated with study outcomes. A p-value of less than 0.05 was considered statistically significant throughout the analysis.

RESULTS

A total of 109 assault victims fulfilling the eligibility criteria were included during the study period. Victims were categorized according to predominant injury mechanism into blunt force injury group (n=71) and sharp force injury group (n=38). All enrolled participants completed medico-legal evaluation and were included in final analysis.

Demographic Characteristics of Study Participants

The majority of assault victims belonged to younger age groups, with maximum cases occurring between 21–40 years. Males constituted the predominant proportion of victims in both groups. Baseline demographic characteristics are summarized in Table 1.

Table 1 demonstrates comparable demographic distribution between groups without statistically significant differences.

Injury Characteristics

Blunt force injuries demonstrated significantly greater frequency of multiple injuries compared with sharp force injuries, whereas sharp force injuries demonstrated greater wound depth and increased frequency of severe injuries. Injury characteristics are shown in Table 2.

Table 2 demonstrates significantly greater injury severity among sharp force assaults.

Anatomical Distribution of Injuries

The head and neck region was the most frequently affected anatomical site among blunt force injuries, whereas upper extremities and trunk involvement were relatively more frequent among sharp force injuries. Anatomical distribution is summarized in Table 3 and illustrated in Figure 1.

Table 3 demonstrates significant variation in anatomical distribution between injury mechanisms.

Figure 1 illustrates greater head involvement among blunt injuries and greater trunk involvement among sharp force injuries.

Hospitalization and Clinical Outcomes

Sharp force injuries demonstrated significantly greater hospitalization requirements and surgical intervention rates. Findings are shown in Table 4.

Table 4 demonstrates significantly greater healthcare burden associated with sharp force injuries.

Severity Assessment

Injury severity classification demonstrated significant

Table 1: Demographic Characteristics of Assault Victims

Variable	*Blunt Force (n=71)*	*Sharp Force (n=38)*	*p-value*
Mean Age (years)	31.8 ± 10.7	33.6 ± 11.2	0.421
Age 18–20 years	12 (16.9%)	5 (13.2%)	
Age 21–40 years	41 (57.7%)	23 (60.5%)	0.887
Age >40 years	18 (25.4%)	10 (26.3%)	
Male	59 (83.1%)	31 (81.6%)	0.842
Female	12 (16.9%)	7 (18.4%)	
Rural Residence	45 (63.4%)	22 (57.9%)	0.573
Urban Residence	26 (36.6%)	16 (42.1%)	

Table 2: Injury Characteristics Among Assault Victims

Variable	*Blunt force*	*Sharp force*	*P-value*
Mean number of injuries	3.8 ± 1.9	2.6 ± 1.4	0.002
Single injury	19 (26.8%)	17 (44.7%)	
Multiple injuries	52 (73.2%)	21 (55.3%)	0.048
Superficial injury	51 (71.8%)	13 (34.2%)	
Deep injury	20 (28.2%)	25 (65.8%)	<0.001
Severe injury	11 (15.5%)	15 (39.5%)	0.006

Table 3: Anatomical Distribution of Injuries

Anatomical site	*Blunt force*	*Sharp force*	*P-value*
Head and neck	41 (57.7%)	11 (28.9%)	0.004
Upper limb	32 (45.1%)	24 (63.2%)	0.072
Lower limb	18 (25.4%)	8 (21.1%)	0.614
Chest	12 (16.9%)	15 (39.5%)	0.011
Abdomen	7 (9.9%)	11 (28.9%)	0.014

differences between groups. Moderate-to-severe injury patterns occurred more frequently among sharp force assault victims. Severity distribution is shown in Table 5 and Figure 2.

Table 5 demonstrates significantly greater severe injury burden among sharp force victims.

Figure 2 demonstrates greater severe injury burden among sharp force assaults.

Predictors of Hospitalization

Binary logistic regression analysis was performed to identify predictors of hospitalization. Deep injury pattern

Table 4: Clinical Outcomes and Hospitalization

Variable	*Blunt force*	*Sharp force*	*P-value*
Hospitalization Required	18 (25.4%)	21 (55.3%)	0.002
Surgical Intervention	9 (12.7%)	16 (42.1%)	<0.001
Mean Hospital Stay (days)	2.8 ± 1.9	5.4 ± 2.6	<0.001
ICU Admission	3 (4.2%)	6 (15.8%)	0.036

Table 5: Injury Severity Distribution

Severity category	*Blunt force*	*Sharp force*	*p-value*
Mild	39 (54.9%)	11 (28.9%)	
Moderate	21 (29.6%)	13 (34.2%)	
Severe	11 (15.5%)	14 (36.9%)	0.011

and sharp force mechanism independently predicted hospitalization.

Table 6 demonstrates that injury mechanism and injury depth independently predicted hospitalization.

Summary of Major Findings

The present study demonstrated that blunt force injuries constituted the predominant mechanism of assault. However, sharp force injuries demonstrated significantly greater severity, deeper wounds, higher hospitalization rates, increased surgical intervention requirements, and prolonged hospital stay. Anatomical distribution differed significantly between groups, suggesting differing mechanisms and assault dynamics.

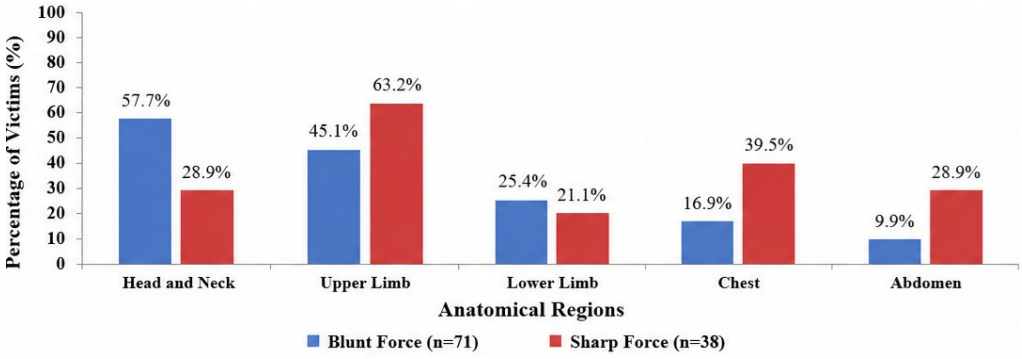


Figure 1: Anatomical Distribution of Blunt and Sharp Force Injuries

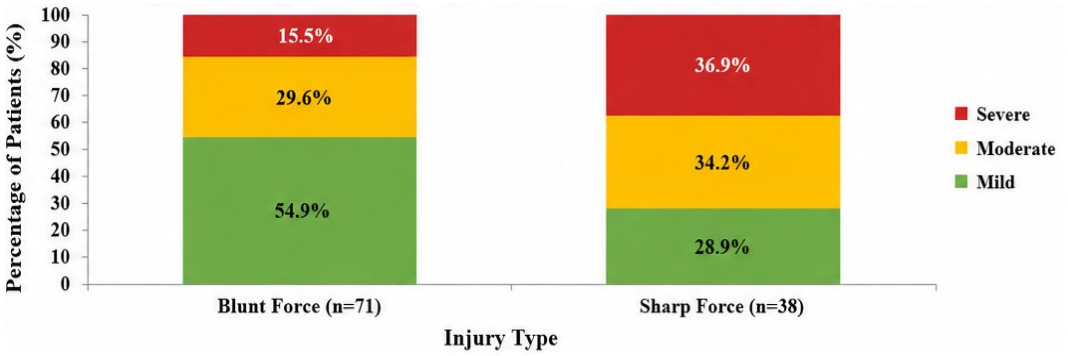


Figure 2: Comparison of Injury Severity Between Groups

Table 6: Logistic Regression Analysis for Predictors of Hospitalization

Variable	*Odds ratio*	*95% CI*	*p-value*
Sharp force injury	2.84	1.31–6.17	0.008
Deep Injury	3.76	1.64–8.58	0.002
Age >40 years	1.21	0.58–2.51	0.603
Male Sex	1.12	0.47–2.69	0.791

DISCUSSION

The present prospective comparative study evaluated injury patterns, anatomical distribution, severity, and clinical outcomes among assault victims sustaining blunt force and sharp force injuries. The findings demonstrated that blunt force trauma constituted the predominant mechanism of assault; however, sharp force injuries were associated with significantly greater severity, increased hospitalization requirements, and greater healthcare burden. These findings provide important epidemiological and medico-legal insights regarding assault-related trauma patterns within a tertiary care setting.

One of the principal findings of the present study was the predominance of blunt force injuries among assault victims. Nearly two-thirds of cases involved blunt trauma, which is consistent with observations reported in previous forensic studies where interpersonal violence commonly involved fists, sticks, stones, wooden objects, and other readily available blunt instruments [16]. The predominance of blunt force trauma may reflect the accessibility of blunt objects during interpersonal conflicts and the impulsive nature of many assault incidents.

The majority of victims belonged to younger age groups, with individuals aged 21–40 years constituting the largest proportion of cases. Similar age distribution patterns have been reported previously, suggesting that young adults remain disproportionately affected because of greater social interaction, occupational exposure, interpersonal conflicts, and increased participation in high-risk activities [17]. The concentration of assault-related injuries among economically productive age groups also indicates substantial socioeconomic consequences associated with interpersonal violence.

Male predominance observed in both injury groups was another important finding of the present study. More than four-fifths of victims were male, which is comparable with previous studies demonstrating greater exposure of males to interpersonal violence, occupational hazards, outdoor activities, and high-risk behavioural patterns [18]. Social and cultural factors may further contribute to this sex-based disparity.

The present study demonstrated significant differences in injury characteristics between blunt and sharp force trauma. Victims sustaining blunt force injuries experienced significantly greater numbers of injuries per victim, whereas sharp force injuries demonstrated significantly greater depth and severity. This observation may be explained by the differing mechanisms of energy transfer. Blunt trauma often produces multiple impact sites during physical assault, whereas sharp force trauma produces localized but deeper tissue destruction [19].

Anatomical distribution demonstrated significant variation between injury mechanisms. Head and neck injuries predominated among blunt force trauma victims, whereas trunk involvement was significantly greater among sharp force injuries. The predominance of craniofacial involvement in blunt assaults may reflect targeted strikes toward vulnerable regions during physical altercations [20]. Greater chest and abdominal involvement among sharp force injuries may reflect intentional weapon use aimed at vital structures.

Upper extremity involvement occurred frequently in both groups and may represent defensive injuries sustained while victims attempted to protect themselves during assault. Previous forensic literature has consistently demonstrated that defensive injuries commonly involve hands, forearms, and upper extremities because of instinctive protective responses during violent encounters [21].

An important finding of the present study was the significantly greater hospitalization burden associated with sharp force injuries. Hospitalization, surgical intervention, prolonged hospital stay, and ICU admission occurred more frequently among sharp force victims. These findings suggest that penetrating trauma frequently produces greater tissue destruction and consequently requires more extensive medical management [22]. Increased resource utilization associated with sharp force injuries has important implications for trauma systems and healthcare planning.

The severity analysis demonstrated significantly greater proportions of severe injuries among sharp force assault victims. This observation is consistent with previous studies suggesting that penetrating injuries possess greater potential for neurovascular injury, organ involvement, and life-threatening complications [23]. The increased severity observed among sharp force injuries further supports the need for rapid clinical evaluation and early intervention.

Logistic regression analysis demonstrated that sharp force mechanism and deep injury independently predicted hospitalization. These findings suggest that injury characteristics may provide valuable prognostic information during initial medico-legal assessment. Early recognition of these predictors may assist clinicians in identifying high-risk victims requiring aggressive management [24].

From a forensic perspective, the present findings reinforce the importance of systematic injury documentation. Distinguishing blunt from sharp force trauma has significant medico-legal implications because injury morphology frequently assists reconstruction of assault mechanisms, determination of weapon characteristics, and interpretation of victim-offender interactions [25].

The findings of the present study possess important public health implications. Interpersonal violence contributes substantially to healthcare expenditure, disability, and social disruption. Improved understanding of regional assault patterns may assist policymakers in developing violence prevention strategies, strengthening trauma services, and improving medico-legal documentation systems.

The present study possesses several strengths including prospective design, systematic data collection, and comparative evaluation of distinct assault mechanisms. However, certain limitations should be acknowledged. The study was conducted in a single tertiary care centre which may limit generalizability. The relatively modest sample size may reduce statistical power for subgroup analyses. Additionally, long-term outcomes including disability, psychological impact, and functional recovery were not evaluated.

Overall, the present findings demonstrate that although blunt force trauma remains the predominant assault mechanism, sharp force injuries produce significantly greater severity and healthcare burden. These observations highlight the importance of mechanism-specific clinical management and forensic evaluation among assault victims.

CONCLUSION

The present study demonstrated that blunt force injuries constituted the majority of assault-related trauma cases, whereas sharp force injuries were associated with greater severity, deeper wounds, increased hospitalization, and higher surgical intervention rates. Significant differences were observed in injury patterns, anatomical distribution, and clinical outcomes between the two injury mechanisms. These findings highlight the importance of mechanism-specific clinical management and systematic forensic evaluation for improving victim care, medico-legal documentation, and violence prevention strategies.

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