

HOMICIDAL HEAD INJURIES AT A TERTIARY CENTRE IN JHARKHAND: A CROSS-SECTIONAL AUTOPSY STUDY

Kishore R¹, Ashok Kumar N¹¹Senior Resident, Department of Forensic Medicine, PJMCH, Dumka, Jharkhand, India

Received : 10/06/2025
 Received in revised form : 02/08/2025
 Accepted : 21/08/2025

Keywords:

Homicide, Head injury, Skull fracture, Intracranial haemorrhage, Autopsy, Assault, weapons.

Corresponding Author:**Dr. Kishore R,**

Email:

ravichandrankishore1993@gmail.com

DOI: 10.47009/jamp.2025.7.5.167

Source of Support: Nil,

Conflict of Interest: None declared

Int J Acad Med Pharm
 2025; 7 (5); 877-881

**ABSTRACT**

Background: Homicidal head injury is a major contributor to violent mortality in India, yet contemporary data from Eastern India remain limited. The objective is to describe the demographic profile, injury patterns and survival following homicidal head injury among medico-legal autopsies at a tertiary centre in Jharkhand. **Materials and Methods:** We conducted a cross-sectional analysis of 91 alleged homicidal head-injury cases autopsied at the Department of Forensic Medicine, Rajendra Institute of Medical Sciences, Ranchi. Variables included age, sex, place of assault, pre-death management, weapon category, skull-fracture pattern, intracranial haemorrhage and brain-injury characteristics, and survival time. **Result:** Males comprised 81.3% (n=74). The most affected age group was 01–40 years (74.7%). Assaults occurred most often outside the home (49.5%). Hard/blunt weapons predominated (72.5%), followed by sharp weapons (15.4%) and firearms (8.8%). Among cases with skull fractures, fissure fractures were most frequent (53.5%). Right-sided intracranial haemorrhage (40.5% of those with side recorded) and cerebral contusions (63.1% of brain injuries) were common findings. Mean survival was 18.9±42.7 hours. **Conclusion:** Young adult males are disproportionately affected, with blunt-force trauma and fissure-type fractures as the signature pattern. The findings can inform forensic interpretation, targeted violence-prevention strategies and resource planning for trauma and policing.

INTRODUCTION

Homicide represents the most severe expression of interpersonal violence and continues to impose a substantial burden on public health systems and criminal justice worldwide. Head injury—now widely framed as traumatic brain injury (TBI)—is a common terminal pathway in homicidal assaults and carries a high risk of rapid death given the centrality of cranio-cerebral structures to vital functions. Although comprehensive national estimates for TBI in India remain challenging, prior syntheses and programmatic reports underscore its growing contribution to mortality and disability across low- and middle-income settings and within India's diverse states.^[1–5] Forensic medicine plays a critical role in characterising the manner, mechanism and pattern of fatal injuries. Descriptions of the injury complex in homicidal head trauma—weapon category, skull-fracture morphology, intracranial haemorrhage, and brain parenchymal damage—are essential to reconstruct events, guide legal proceedings and inform prevention. Published Indian autopsy studies and regional case series consistently report a predominance of young adult males among victims of homicidal head injury

and a high share of blunt-force mechanisms.^[6–8] Blunt instruments are inexpensive, ubiquitous and often repurposed household or occupational objects, which may partly explain their frequent use. At the same time, the specific patterns of fracture and intracranial bleeding vary by setting, weapon, and impact dynamics. Fissure (linear) fractures are commonly documented, whereas comminuted and base-of-skull fractures have been linked to higher lethality in some cohorts.^[6,7] Beyond conventional autopsy, advances in post-mortem radiology including computed tomography (CT) and magnetic resonance imaging (MRI) have strengthened documentation of fracture lines, fracture distribution across cranial fossae, pneumocephalus and haemorrhagic patterns, and can complement internal examination in complex cases.^[9,10] Jharkhand, a state in Eastern India with a mix of urban and rural communities, has seen social change and internal migration that may shape the epidemiology of violent crime. However, data on homicidal head injury from this region are sparse. We therefore undertook a cross-sectional study of alleged homicidal head-injury cases subjected to medico-legal autopsy at a tertiary referral centre in Ranchi, Jharkhand. Our aims were to describe the

demographic profile, scene context, treatment received prior to death, weapon category, skull-fracture and intracranial patterns, brain-injury characteristics and survival time, and to compare salient findings with the published literature from India and abroad.^[6–13] We anticipated that, consistent with prior reports, blunt-force trauma would predominate and fissure fractures would be the single most frequent skull-fracture pattern, with short survival intervals reflecting the severity of cranio-cerebral injuries.

MATERIALS AND METHODS

Study design and setting: We performed a cross-sectional observational study at the Autopsy Centre of the Department of Forensic Medicine, Rajendra Institute of Medical Sciences (RIMS), Ranchi, Jharkhand, India. RIMS is a tertiary care government teaching hospital that receives medico-legal cases from Ranchi and adjoining districts.

Study population: The sampling frame comprised consecutive medico-legal autopsies with an allegation of homicide where head injury was present during the study period. A total of 91 cases met inclusion criteria. Inclusion criteria were: (i) medico-legal autopsy performed at RIMS; (ii) death certified as due to head injury with alleged homicidal manner based on police inquest/magisterial requisition; and (iii) availability of essential autopsy data fields. Exclusion criteria were: deaths certified as non-homicidal (accidental/suicidal/natural), decomposed bodies with unassessable cranial findings, and records with missing core variables.

Variables and data sources: From autopsy proformas, inquest papers and available hospital records, we abstracted age, sex, place of assault (outside, residence, unknown), pre-death management (none, conservative, operative), presumed weapon category (hard/blunt, sharp/cutting, firearm, other/unspecified), skull-fracture type (fissure, depressed, comminuted, depressed–comminuted, suture, cut), laterality of

skull fracture when recorded, intracranial haemorrhage (type and side where documented), brain-injury type (e.g., contusion) and side, and survival time (hours). Because documentation completeness varied, denominators for some injury sub-analyses differed from the total sample and are stated in the tables.

Statistical analysis: We present descriptive statistics as counts and percentages. Where applicable, Z-tests for proportions supplied in the source thesis are reported with p-values, with statistical significance defined as $p \leq 0.05$. No imputation was performed; ‘unknown’ was retained as a category where necessary to preserve data integrity.

Ethical considerations: The analysis used de-identified autopsy data collected as part of routine medico-legal work following police/magisterial inquest in accordance with Indian law. Institutional permissions for data use were obtained; individual consent is not applicable for autopsy-based record reviews.

RESULTS

Demographics and scene context: Of 91 cases, 74 (81.3%) were male and 17 (18.7%) were female. Victims aged 01–40 years comprised 68 (74.7%) cases, whereas those aged 41–70 years comprised 23 (25.3%) [Table 1]. Males comprised 74 (81.3%) cases and females 17 (18.7%) which is illustrated in [Figure 1].

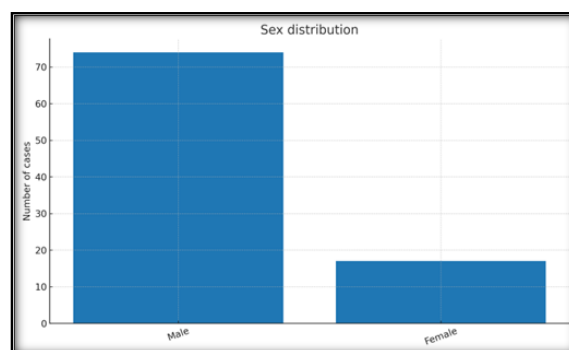


Figure 1: Sex distribution of victims. (n=91)

Table 1: Age group distribution of victims (n=91)

Age group (years)	n	%
01–40	68	74.7
41–70	23	25.3

Assaults most commonly occurred outside the home in streets, grounds, roadsides or fields (45, 49.5%), followed by inside the victim’s residence (33,

36.3%); the scene was unknown in 13 (14.3%) [Table 2].

Table 2: Place of assault (n=91)

Place of assault	n	%
Outside (street/ground/roadside/field)	45	49.5
Residence (inside own house)	33	36.3
Unknown	13	14.3

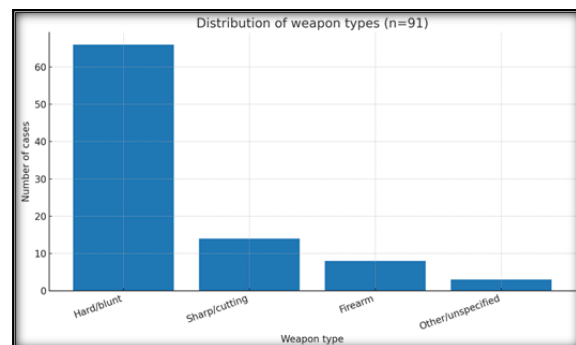
Most victims received no active medical care prior to death (53, 58.2%); conservative management was

recorded in 35 (38.5%) and operative intervention in 3 (3.3%) [Table 3].

Table 3: Clinical management prior to death (n=91)

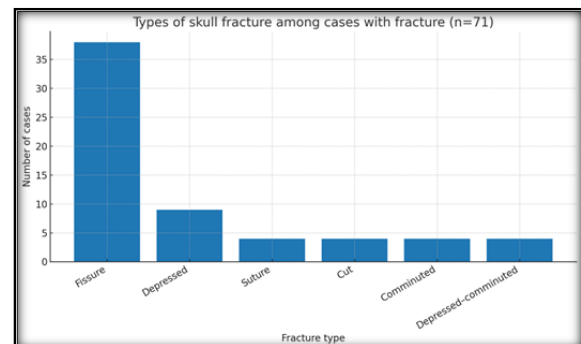
Management prior to death	n	%
No treatment	53	58.2
Conservative	35	38.5
Operative	3	3.3

Weapons and external force: Hard/blunt instruments were the predominant weapon category (66, 72.5%), with sharp/cutting weapons in 14 (15.4%) and firearms in 8 (8.8%); three cases were classified as other/unspecified [Figure 2]. This pattern was statistically significant in favour of blunt force in the source analysis ($p<0.00001$).

**Figure 2: Distribution of weapon types among homicidal head-injury cases (n=91).**

Skull-fracture morphology: Among cases with skull fractures (n=71), fissure (linear) fractures were most frequent (38, 53.5%). Depressed fractures were noted in 9 (12.7%), while suture, cut, comminuted and

depressed–comminuted fractures each accounted for 4 cases (5.6%) (Figure 3). Left-sided skull fractures were more common than right-sided in the source tallies (42.0% left among cases with side recorded).

**Figure 3: Distribution of skull-fracture types among cases with fracture (n=71).**

Intracranial haemorrhage and brain injury: Of those with typed intracranial haemorrhage recorded (n=37), intracerebral haemorrhage alone accounted for 3 (8.1%); the remainder reflected subdural and/or subarachnoid haemorrhage patterns. Right-sided intracranial haemorrhage was more frequent than left (32 of 79, 40.5%). [Table 4]

Table 4: Intracranial haemorrhage

Type of intracranial haemorrhage (n=37)	n	%
Intracerebral	3	8.1
Other types (SDH/SAH/EDH or combinations)	34	92
Side of intracranial haemorrhage (n=79)	n	%
Right	32	41
Left/other sides	47	60

Contusions were the commonest brain parenchymal injury (53 of 84, 63.1%), and left-sided brain injuries

slightly predominated among cases with side documented (36 of 83, 43.4%). [Table 5]

Table 5: Brain injury

Type of brain injury (n=84)	n	%
Contusion	53	63
Other types	31	37
Side of brain injury (n=83)	n	%
Left	36	43
Other sides	47	57

Survival: Mean survival time was 18.9 ± 42.7 hours. Many victims died at the scene or before definitive care could be provided.

DISCUSSION

In this tertiary-centre autopsy series from Jharkhand, alleged homicidal head injuries were concentrated among young adult males, with nearly three-quarters of victims aged 01–40 years and more than four-fifths male. This demographic profile mirrors prior Indian series and international forensic datasets, which attribute male predominance to differential exposure

to interpersonal violence and higher participation in risk-laden social settings.^[6–8,11] The locus of assault was most often outside the home, again in keeping with studies that emphasise public or semi-public spaces as frequent scenes of lethal interpersonal conflict.

Blunt-force trauma emerged as the signature mechanism (72.5%), far outstripping sharp-force and firearm injuries. Comparable dominance of blunt

instruments has been reported in several Indian jurisdictions and in settings with strict firearm regulation.^[6-8] Pragmatically, blunt implements are ubiquitous, easily wielded and amenable to multiple blows; such characteristics likely explain their disproportionate representation in lethal outcomes. By contrast, firearm fatalities cluster where access is liberal and among organised criminal activity, whereas sharp-weapon homicide dominates in some locales with cultural or situational determinants.^[8]

The skull-fracture pattern in our series showed fissure (linear) fractures as the single most frequent morphology among cases with fractures (53.5%), with smaller shares of depressed and comminuted variants. This aligns with medico-legal expectations for single or repeated strikes with hard, broad-surface objects. Other autopsy cohorts, including those centred on blunt head injury irrespective of manner of death, have similarly highlighted the prevalence of linear fractures, with hinge fractures at the cranial base and comminution associated with higher-energy impacts.^[7] Notably, left-sided skull fractures were more common—a finding plausibly linked to right-handed assailants delivering blows from the front or side, although this inference is speculative and cannot be confirmed without scene reconstruction. Among intracranial lesions, the tally of typed haemorrhages available in the records suggested a predominance of subdural and/or subarachnoid haemorrhage patterns, while right-sided haemorrhage was more frequent than left in cases with documented laterality. Cerebral contusions were the dominant parenchymal injury (63.1%). This constellation—linear fractures, SDH/SAH combinations, and contusions—is consistent with rotational-translational cranial loading and coup-contrecoup dynamics well described in the forensic literature.^[6,7]

The short mean survival (18.9 hours) underscores the lethality of the cranio-cerebral injury complex in homicidal assaults. Several victims likely died at the scene or during transport; only 3.3% underwent operative intervention. This echoes prior Indian autopsy reports in which limited access to timely neurosurgical care, delays in transfer, and the severity of injury at presentation constrain opportunities for survival.^[6-8] From a systems standpoint, the data argue for sustained investments in pre-hospital response, rapid triage and transfer pathways, and strengthening of neurosurgical capacity in regional hubs.

Comparison with other regions and modalities enriches interpretation. The Bhopal series of homicidal head-injury deaths reported by Mishra and Singh similarly identified blunt weapons as the leading cause, with most victims dying at the scene and a high frequency of combined subdural and subarachnoid haemorrhages.^[8] Patil and Vaz, in a two-year Mumbai autopsy series of fatal blunt head injuries, also found fissure fractures to be prevalent and combined SDH+SAH patterns common.^[7] Post-mortem imaging can augment autopsy by

delineating fracture lines and pneumocephalus and by detecting radiologic correlates of intracranial bleeding; case reports and series have documented hatchet-specific fracture signatures and variable congruence between CT and autopsy for cranial and cerebral lesions.^[9,10] Contemporary forensic cohorts from high-income settings continue to show male predominance and age-dependent differences in fatal head trauma, while focused studies of cranial base fractures highlight their frequency in lethal trauma and their diagnostic significance at autopsy.^[11,12] Beyond gross and radiologic pathology, immunohistochemical staining for β -amyloid precursor protein (β -APP) may support the diagnosis of axonal injury in selected paediatric deaths, especially when survival intervals are brief and conventional stains are insensitive.^[14-17]

Several findings warrant cautious interpretation. First, denominators varied for certain sub-analyses because documentation was incomplete for a subset of variables (e.g., typed intracranial haemorrhage, side). We therefore reported explicit denominators to preserve transparency. Second, although left-sided skull or parenchymal injury predominance is enticing from a reconstruction perspective, side alone is an imperfect proxy for assailant handedness or stance, and scene-level evidence is indispensable. Third, while weapon category is recorded, many blunt instruments lack distinctive wound signatures and the specific object may not be identifiable without corroborative investigative findings.

Implications for practice and policy include: (i) sharpening forensic documentation of laterality, fracture mapping and haemorrhage patterns, ideally with routine integration of post-mortem CT in complex cases; (ii) continued training for standardised autopsy proformas to minimise missingness for key variables; and (iii) violence-prevention efforts that address situational antecedents of public-space assaults among young men. At a research level, multi-centre collaborations with harmonised definitions would enable comparative analyses across Indian regions and improve precision around risk profiles, while linkage with police and judicial outcomes could illuminate the evidentiary value of specific forensic findings.

Strengths of the present analysis include the focus on a relatively under-reported region and the preservation of numeric integrity from the primary autopsy records. Limitations include its single-centre nature, modest sample size, variation in documentation completeness, and the inherent constraints of retrospective autopsy abstraction. Nonetheless, the observed patterns align with established forensic expectations and add to the national evidence base on homicidal head injury.

CONCLUSION

In this autopsy series of alleged homicidal head injuries from a tertiary centre in Jharkhand, India,

victims were predominantly young adult males. Blunt instruments were the leading weapon category, with fissure-type skull fractures, combinations of subdural/subarachnoid haemorrhage and cerebral contusions forming the characteristic injury complex. Most deaths occurred rapidly, reflected in a mean survival under 24 hours and minimal operative intervention before death. These findings reinforce established forensic patterns and underscore the need for improved pre-hospital and neurosurgical systems, rigorous and standardised autopsy documentation (including laterality), and targeted violence-prevention strategies for at-risk populations. Future multi-centre studies integrating post-mortem imaging and uniform data standards would further clarify the mechanistic underpinnings and enhance the evidentiary value of cranio-cerebral injury patterns in homicidal deaths.

REFERENCES

1. Abelson-Mitchell N. Epidemiology and prevention of head injuries: literature review. *J Clin Nurs*. 2008;17:46–57.
2. Gururaj G, Kolluri SV, Chandramouli BA, Subbakrishna DK, Kraus JF. Traumatic brain injury. Publication No. 61. Bangalore: National Institute of Mental Health & Neuro Sciences; 2005.
3. Langlois JA, Sattin RW. Traumatic brain injury in the United States: research and programs of the Centers for Disease Control and Prevention (CDC). *J Head Trauma Rehabil*. 2005;20:187–188.
4. Indrayan A, Wysocki MJ, Kumar R, Chawla A, Singh N. Estimates of years of life lost due to the top nine causes of death in rural areas of major states in India in 1995. *Natl Med J India*. 2002;15:7–13.
5. De Silva MJ, Roberts I, Perel P, Edwards P, Kenward MG, Fernandes J, et al. Patient outcome after traumatic brain injury in high-, middle- and low-income countries: analysis of 8927 patients in 46 countries. *Int J Epidemiol*. 2009;38:452–458.
6. Chattopadhyay S, Tripathi CB. Skull fracture and haemorrhage pattern among fatal and non-fatal head-injury assault victims: a critical analysis. *J Injury Violence Res*. 2010;2(2):99–106.
7. Patil AM, Vaz WF. Pattern of fatal blunt head injury: a two-year retrospective/prospective medicolegal autopsy study. *J Indian Acad Forensic Med*. 2010;32(2):144–149.
8. Mishra PK, Singh S. Fatal head injury in homicidal deaths in Bhopal region of Central India. *Int J Pharm Bio Sci*. 2012;3(4):1103–1108.
9. Amparozi G, Ruder TD, Preiss U, Aschenbroich K, Germerott T, Filograna L, et al. Virtopsy: CT and MR imaging of a fatal head injury caused by a hatchet: a case report. *Legal Med*. 2010;12(5):238–241.
10. Jacobsen C, Lynnerup N. Craniocerebral trauma—congruence between post-mortem computed tomography diagnoses and autopsy results: a 2-year retrospective study. *Forensic Sci Int*. 2010;194(1-3):9–14.
11. Kronsbein K, Karger B, Budczies J, Pfeiffer H, Wittschieber D. Updating the risk profile of fatal head trauma: an autopsy study with focus on age- and sex-dependent differences. *Int J Legal Med*. 2020;134(1):295–307.
12. Crudele GD, Merelli VG, Vener C, Milani S, Cattaneo C. The frequency of cranial base fractures in lethal head trauma. *J Forensic Sci*. 2020;65(1):193–195.
13. Nelson LD, Temkin NR, Dikmen S, Barber J, Giacino JT, Yuh E, et al. Recovery after mild traumatic brain injury in patients presenting to US level I trauma centres: a TRACK-TBI study. *JAMA Neurol*. 2019;76(9):1049–1059.
14. Johnson MW, Stoll L, Rubio A, Troncoso J, Pletnikova O, Fowler DR, Li L. Axonal injury in young paediatric head trauma: β -APP immunohistochemistry in traumatic vs non-traumatic deaths. *J Forensic Sci*. 2011;56(5):1198–1205.
15. Dixit PC, Dogra TD, Chandra J. Comprehensive study of homicides in South Delhi, 1969–1979. *Med Sci Law*. 1986;26(3):230–234.
16. Gupta S, Prajapati P. Homicide trends at Surat region of Gujarat, India. *J Forensic Med Toxicol*. 2009;26(1):45–48.
17. Blennow K, Brody DL, Kochanek PM, Levin H, McKee A, Ribbers GM, Yaffe K, Zetterberg H. Traumatic brain injuries. *Nat Rev Dis Primers*. 2016;2:16084.