PATTERN OF HEAD INJURIES IN CASES OF FATAL HEAD TRAUMA ADMITTED AT TERTIARY CARE CENTRE IN EASTERN NEPAL

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ABSTRACT

A head injury describes a vast array of injuries that occur to the scalp, skull and brain. Among all regional injuries, those of the head are the most common and important ones in forensic practice as head injuries are one of the leading causes of death and disability worldwide. The present study aims to establish this fact by means of examining the pattern of head injuries which are an indirect indicator of severity of trauma. This hospital - based descriptive, cross-sectional study was carried out in Nobel Medical College Teaching Hospital in 210 cases of head trauma Including patients with head injuries (scalp injury, skull fracture, intracranial hemorrhage and brain injury) while excluding dead on arrival cases. Road traffic accidents (RTA) account for more than half of all cases 51.9% compared to 26.7% cases fall from height, 10.5% assault and 11.0% due to other reasons. Males are more frequently affected across all types of incidences, 72.5% male, 27.5% female involved in RTA, 55.4% male and 44.6% female in fall from height and 63.6% male, 36.4% female in assault cases. 109 RTAs cases were the most common among young and middle-aged adults, 56 falls from height cases showed a bimodal distribution, mainly affecting children and elderly people while assault was most common in the economically active adult age group. Alcohol abuse cases (18 out of 210) were relatively low compared to some global trauma statistics. In this study most common cause of head injury was found to be RTA followed by fall from height where males were more prone to injuries. The study showed a statistically significant relationship between age group of victims and type of incidence. Thus preventive measures focusing on age group should be implemented for safety and security purpose.

KEYWORDS

Assault, head injury, road traffic accident, Nepal

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INTRODUCTION

A head injury describes a vast array of injuries that occur to the scalp, skull and brain. It is one of the most common causes of disability and death in adults. The injury can be as mild as a bump, bruise (contusion), or cut on the head, or can be moderate to severe in nature due to a concussion, deep cut or open wound, fractured skull bone(s), or from internal bleeding and damage to the brain.[1] As defined by the National Advisory Neurological Diseases and Stroke Council, 'Head injury is a morbid state resulting from gross or subtle structural changes in the scalp, skull, and/or the contents of the skull, which is produced by mechanical forces'.[2]

Among all regional injuries, those of the head are the most common and important ones in forensic practice as head injuries are one of the leading causes of death and disability worldwide.[3-5] The thickness of the cranium is not uniform throughout as there are thin plates of bones such as the frontal and temporal plates and the thickness is greater along the sutures.[6] The dominance of head injuries in road traffic accidents is due to the fact that, when the victim is pushed or knocked to the ground, he/she often strikes the head and also, that the brain and its coverings are vulnerable to blunt trauma that would not so frequently be lethal if applied to other body parts.[7] The global incidence of fatal head injuries as the result of assault is greater than the number of non-fatal cases. The important factors that determine the outcome in terms of survival of such head injury cases include the type of weapon used, type and site of skull fracture, intracranial hemorrhage and the brain injury. The greater the force of impact, the greater will be the damage and the more lethal the outcome.

The presence or absence of a skull fracture, its type and site along with the type of intracranial hemorrhage has immense significance in the final outcome in cases of head injuries. The type and the extent of the intra cranial hemorrhage also play a vital role in determining the ultimate result. Hence the chances of survival for a victim of these head injuries will be determined to a large extent, apart from other factors, on the intensity and effect of the injury on the skull and the brain itself. The present study aims to establish this fact by means of examining pattern of head injuries which are an indirect indicator of severity of trauma. Beside, this study also aims to find out the prevalence of head injuries and find association with respect to type of incidence, age, gender and alcohol or substance abuse to establish an epidemiologic data bank which might be essential for designing preventive strategies for head injuries in the Eastern Region of Nepal.

MATERIALS AND METHODS

This hospital - based descriptive, cross-sectional study was carried out in Nobel Medical College Teaching Hospital (NMCTH) in 210 cases of head trauma who visited OPD, emergency, or neurosurgery department for a period of one year from December 2024 till December 2025, after obtaining ethical approval from Research and Institutional Review Committee (IRC) of NMCTH Ref. No. 48/2025.

Inclusion and exclusion criteria: All patients with head injuries (scalp injury, skull fracture, intracranial hemorrhage and brain injury) were included. Dead on arrival cases were excluded.

Data collection and statistical analysis: Data were collected through a proforma with detail about the incident, clinical investigations and findings. All clinical records, investigations and treatment charts, age, gender, etiology and pattern of injuries were noted and analyzed. All collected data were compiled and entered into SPSS-16 and was used for descriptive analysis to calculate frequency distribution.

RESULTS

Road traffic accidents (RTA) account for more than half of all cases 51.9% in compare to other causes such as 26.7% cases fall from height, 10.5% assault and 11.0% other cases. Males are more frequently affected across all types of incidences, the percentage being 72.5% males, 27.5% female involved in RTA, 55.4% male and 44.6% female in case of fall from height and 63.6% male, 36.4% female in assault cases. The analysis shows that males are significantly more prone to injuries, particularly from road traffic accidents. Applying chi-square test, there is no statistically significant association

Table 1: Frequency table of type of incidence in male and female

Types of incidence	Gender		Total n (%)
	Female	Male	
Road traffic accident	30	79	109 (51.9)
Fall from height	25	31	56 (26.7)
Assault	8	14	22 (10.4)
Others	8	15	23 (11.0)
Total	**71**	**139**	**210 (100.0)**

Table 2: Frequency table of type of incidence different age group

Types of incidence	Age group						
	0-10	11-20	21-30	31-40	41-50	51-60	≥61
Road traffic accident	9	21	19	24	18	10	8
Fall from height	14	2	5	4	10	7	14
Assault	0	1	5	10	4	1	1
Others	0	1	2	3	7	4	6
Total	**23 (11.0%)**	**25 (12.0%)**	**31 (14.8%)**	**41 (19.5%)**	**39 (18.6%)**	**22 (10.4%)**	**29 (13.7%)**

Table 3: Frequency table of type of incidence and its association with alcohol abuse

Types of incidence	Alcohol abuse				Total
	Female (71)		Male (139)		
	Yes	No	Yes	No	
Road traffic accident	0	30	10	69	109
Fall from height	1	24	6	25	56
Assault	0	8	1	13	22
Others	0	8	0	15	23
Total	**1 (1.4%)**	**70 (98.6%)**	**17 (12.2%)**	**122 (87.8%)**	**210**

between gender and type of incidence at the 5% level of significance.

The age of the victim was found to range from minimum 8-months old child to maximum 86 years old. These age ranges were categorized into seven groups inclusive of 10 years in each group with the last one having individuals of more than 60 years. 31-40 years age group is the most affected one, followed by 41-50 years and 21-30 years.

Out of 109 cases of RTAs, it was most common among young and middle-aged adults, highest cases being 24 in age group 31-40 years, next common 21 in age group 11-20 years followed by 19 cases in the age group 21-30 years, likely due to higher road exposure. While the least affected one was the age group 0-10 years having 9 cases.

In case of 56 patients due to fall from height, highest cases were recorded in age group 0-10 years (14 cases) and age group 61 and above (14). Moderate cases were recorded in age group 41-50 (10 cases) and 51-60 (7 cases), while least record was found in age group 11-20 years (2 cases). Fall cases show a bimodal distribution, mainly affecting children and elderly people.

Twenty two cases of assault were recorded where highest cases of assault were found in age group 31-40 years (10) followed by 21-30 years (5) and no cases at all in age group 0-10 years. This showed assault was most common in the economically active adult age group.

Beside RTAs, fall from height and assault, some cases were of non traumatic brain injury which was categorized into others. Twenty three cases were recorded in this category with highest cases admitted were of age group 41-50 years (n =7) and 61 and above (n =6). Moderate cases were admitted of age group 51-60 (n =4) and 31-40 (n =3) while no cases at all in the age group 0-10 years. These types of non traumatic brain injuries were more frequent in older age groups.

The chi-square test (age group vs. types of incidence) revealed a significant association between age group and type of incidence (χ^2 =43.26, df =18, p <0.05), indicating that the pattern of incidence varies significantly with age.

The overall involvement of alcohol abuse was found to be 8.6%. The lowest age 19 and highest age 74, found to have alcoholic influence during the incident. Falls from height had a higher percentage of abuse (12.5%) compared to assaults (4.5%) and RTAs (9.2%). The total number of alcohol abuse cases 18 out of 210 was too small for these differences to be considered scientifically reliable. Whether the type of incident was dependent on alcohol

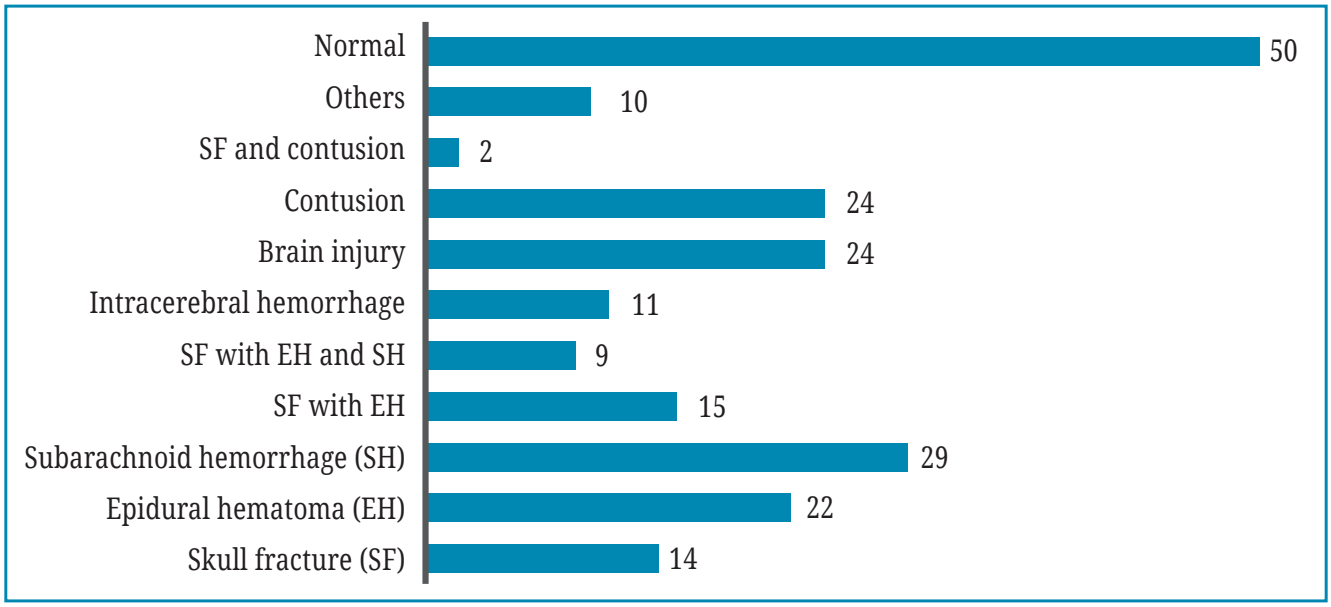

Fig. 1: Baseline pattern of injuries: Radiological findings

or substances abuse was no statistically significant.

The chart illustrates the radiological findings for a baseline pattern of injuries, totaling 210 cases. Approximately 24.0%, occurring in 50 cases were normal while 160 cases (approx. 76.0%) showed some form of radiological abnormality. Categorizing the injuries by their type and severity; isolated skull fractures (SF) were seen in 14 cases; however SF were frequently associated with other injuries. Fifteen cases of SF were associated with epidural hematoma (EH) 9 cases with both EH and Subarachnoid hemorrhage (SH), and 2 cases with contusions. Regarding hemorrhages and hematomas, SH was the most frequent abnormal finding with 29 cases, EH in 22 cases and intra-cerebral hemorrhage in 11 cases. Reportedly 24 cases were of brain injury, majority of which were mild traumatic brain injury requiring only few days of hospital stay for the treatment. Out of total cases, contusions over the scalp were found in 24 cases and 2 of the scalp contusion were associated with SF.

A significant portion of the data shows complex trauma where multiple findings (like SF with EH and SH) occur simultaneously, often indicates high-impact trauma, such as the Road Traffic Accidents. When including combined cases, EH appears in 46 instances, making it a primary concern for the patient group. Similar to EH, when combined with other categories, SH is highly prevalent (38 cases), which is a critical finding in head trauma management. The radiological findings showed that 76.0% of the total patients suffered physical intracranial or extra-cranial damage.

Among the total cases, 10 of the patient were categorized into 'others' which include the cases of diffused axonal injury, parasagittal meningoma, complicated cases of scalp flap osteomyelitis, brain stem injury and cervical vertebra injuries which could not be fitted in any of the previous categories.

DISCUSSION

The present study included 210 patients of head injury who visited OPD, emergency or neurosurgery department. Data regarding detail about the incident, age, gender, etiology and pattern of injuries were noted and analyzed.

In the present study, among different modes of injuries RTAs were the primary mode accounting for 51.9% cause of head injuries followed by fall from height 26.7% and physical assault 10.4%. The results revealed by Sah *et al*[8] 49.6%, Kumar *et al*[9] and Kremer *et al*[10] were in accordance with the findings of this study. So above mentioned facts point out road traffic accidents and fall from height to be the common causes of unintentional head injuries.

Gender of the patients found to have head injuries; 66.2% of patients were male and 33.6% female representing the ratio of 2:1. A Similar trends was observed in many studies where vast majority of head injuries were experienced by male representing male –to-female ratio as 2:1 by Sah *et al*[8] and Marker *et al*.[11] While the male female ratio was slightly higher in studies carries out by Moosa *et al*[12] being 4.1:1 and Ahmed *et al*[13] being 4.4:1. Males are significantly more prone to injuries,

particularly from road traffic accidents the reason might be because men typically drive more miles than women and are more likely to engage in risky driving practices, including not using seat belts, speeding and driving while impaired by alcohol.[14]

In this study, the age of the victim was found to range from minimum 8 month old child to maximum 86 years old. The majority of overall victims were in age group of 31-40 years with 19.5%, followed by 41-50 years with 18.6% and 21-30 years with 14.8%. Out of 109 cases of RTAs, it was most common among young and middle-aged adults, highest cases being 24 in age group 31-40 years, next common 21 in age group 11-20 years followed by 19 cases in the age group 21-30 years, likely due to higher road exposure. The finding was very much similar to Khare *et al*[15] reported 16-31 years and Solanki *et al*[16] reported majorities were below 15 years. The younger age groups in this study found more liable for RTA as they might have lack of knowledge of road traffic safety precautions, have to use frequent public transport or walk and their activities require them to travel more than the older demographics.

The prevalence of driving under the influence of alcohol in this study was 17 (12.2%) in male patient, similar to the finding by Joshi *et al*[17] 12.2% and Pokhrel *et al*[18] 15%. While some studies in Indian setting reported a varying prevalence of alcohol-related RTA ranging from 14-23%.[19] Despite the strict traffic regulations, a study conducted in Kathmandu, the capital city of Nepal, found an increase of 1.5-fold RTAs during a fiscal year.[20] In present study, the alcohol influence RTAs was 9.17% while the effect of alcohol was found higher in case of fall from height 12.5%.

In this study fracture of skull was found in 38 (18.1%) subjects Similar to the findings presented by Sah *et al*,[8] showing the prevalence of skull fracture to be 20.2%. In contrast to our study some authors have reported very high percentage of skull fracture as 51.47% by Thube *et al*[21] and 57.0% by Soni *et al*.[22]

Regarding intracranial hemorrhage in our study, EH was the most common 21.9% followed by SH 18.1% and intra-cerebral hemorrhage being least common 5.2%. Beside isolated intracranial hemorrhage, most of the intracranial hemorrhage occurred in association. Isolated epidural hemorrhage occurred in 10.47% cases which was in accordance with the isolated epidural hemorrhage percentage shown by Sah *et al*[8] 15.7%. On the contrary, a study conducted by Jha *et al*[23] found that 50.6% of the cases had subdural haemorrhage which was very high in comparison to present study. Chandra *et al*[24] stated subarachnoid haemorrhage was noticed as the most common intracranial hemorrhage (66.9%), followed by subdural haemorrhage (58.2%) and extradural haemorrhage (14.2%). which also was contradictory to our case where epidural was the most common.

In conclusion, head injuries were found to be mostly caused by road traffic accidents followed by fall from height. The analysis shows that males are more prone to injuries, particularly from road traffic accidents. Preventive measures such as road safety awareness could reduce the overall incidence, especially among males. The study showed a statistically significant relationship between the age group of victims and type of incidence. Thus, preventive measures focusing on age group should be implemented, such as; 'Road safety programs' for young and middle-aged adults, 'Childproofing and supervision' to prevent fall related injuries in case of children and elderly people. The overall involvement of alcohol is relatively low compared to some global trauma statistics. This might suggest a specific demographic or a geographic region where substance-related trauma is less prevalent, or it could indicate under-reporting of such cases.

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