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Frequency of Intracranial Hemorrhage among Patients with Skull Fractures in Blunt Head Trauma

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ABSTRACT

Background: The global incidence of fatal head injuries is greater than the number of non-fatal cases. 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.
Objective: To determine the frequency of intracranial hemorrhage and its different pattern in patients presented with skull fracture following blunt head injury in a tertiary care setting.
Material and Methods: The study employed cross sectional study design and was conducted in Neurosurgery Unit of Lady Reading Hospital, Peshawar. The study duration was six months after approval of synopsis (29-06-2019 to 29-12-2019). A sample size of 196 patients was calculated using WHO calculator. Non probability consecutive sampling was used for patient's selection. Ethical approval and consent forms were taken. Diagnosis of skull fracture and intracranial bleeding were made on the basis of CT brain and per op findings. Data was analyzed using SPSS version 17. Post stratification chi-square test was applied. P value ≤0.05 was considered significant.
Results: Total 196 patients were included in study. There were 129(65.8%) male and 67(34.2%) female. Mean age of patients was 35.7 years±9.9SD. Intracranial hemorrhage was present in 32(16.3%). Type of intracranial hemorrhage was subdural in 10(5.1%), intrcerebral 3(1.5%), subarchnoid 3(1.5%), intraventricular 4(2%), contusion 2(1%), combination 2(1%), and extradural 8(4.1%). Intracranial hemorrhage is significantly associated with GCS, Occupation, cause of injury, location of injury and type of intracranial injury ($p<0.001$).
Recommendation: According to the findings, frequency of intracranial hemorrhage was relatively high. This study recommend all patients with skull fractures due blunt head trauma be subjected to thorough brain damage check-up. The type and location of skull fracture is an indirect indicator of the severity of force of impact which leads to damage to the underlying brain and results in fatality.
Keywords: *Intracranial hemorrhage, skull fractures, Head trauma*

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INTRODUCTION

Intracranial hemorrhage refers to any bleeding within the intracranial vault, including the brain parenchyma and surrounding meningeal spaces. [1] Intracranial hemorrhage (ie, the pathological accumulation of blood within the cranial vault) may occur within brain parenchyma or the surrounding meningeal spaces.[2] Hemorrhage within the meninges or the associated potential spaces including epidural hematoma, subdural hematoma, and subarachnoid hemorrhage. Intracerebral hemorrhage (ich) and extension of parenchymal bleeding into the ventricles (ie, intraventricular hemorrhage [ivh]).[3] Literature reported that intracranial hemorrhage encompasses four broad types of hemorrhage: epidural hemorrhage, subdural hemorrhage, [4] subarachnoid emorrhage, and intraparenchymal hemorrhage as shown in figure 1 and figure 02

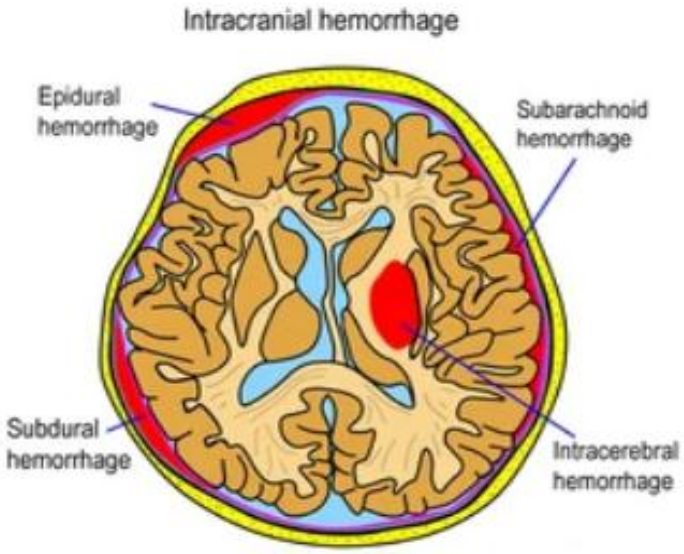

Figure 1: Intracranial hemorrhage classification

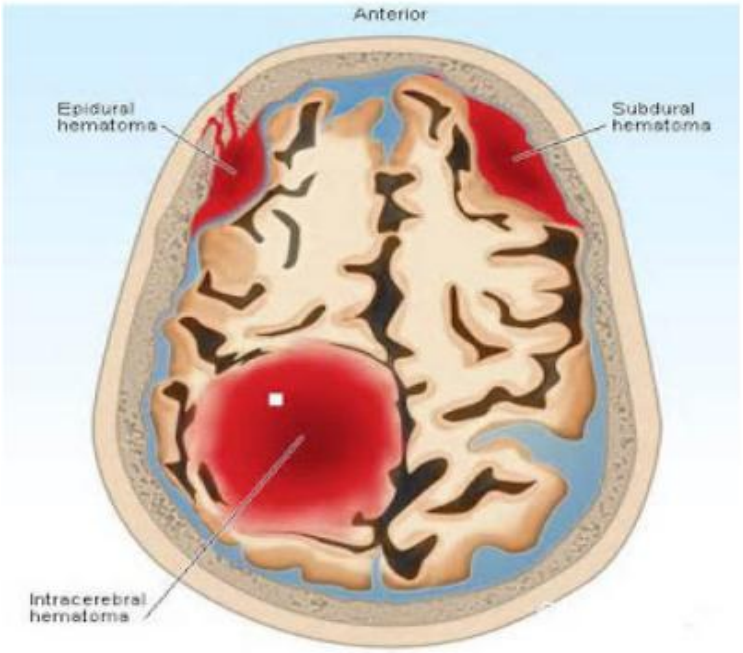

Figure 2: Intracranial hemorrhage

History and Physical examination

Epidural Hematoma patients with epidural hematoma report a history of a focal head injury such as blunt trauma from a hammer or baseball bat, fall or motor vehicle collision. [5] The classic presentation of an epidural hematoma is a loss of consciousness after the injury, followed by a lucid interval then neurologic deterioration. [6] This classic presentation only occurs in less than 20% of patients. Other symptoms which are common include a severe headache, nausea, vomiting, lethargy, and seizure.

DATA COLLECTION PROCEDURE

Permission and approval was obtained from the Ethics and Research Committee of the MTI, LRH Peshawar for conducting the study. Informed consent was taken from all patients. Those who fulfilled inclusion criteria were included in the study from Neurosurgery Unit of MTI, LRH Peshawar. These patients were further assessed through detailed history including personal particulars such as name, age, sex, address, symptoms and clinical examination, time since injury, initials score. Diagnosis of skull fracture and intracranial bleeding was made on the basis of CT brain and per-op findings. All the observation and examination was conducted by the researcher and data was recorded in a predesigned Performa attached as appendix

Statistical Analysis

The collected data in the questionnaires was recorded in a data sheet using the statistical package for social sciences software (SPSS version 17.0) and analyzed. Descriptive statistics like mean

±standard deviation was calculated for age, BMI and GCS. Frequency and percentage was calculated for categorical variables like sex, occupation, cause of head injury, location of skull fracture, type of skull fracture, intracranial hemorrhage, and type of intracranial hemorrhage and location of intracranial bleed. Effect modifiers like age, gender, BMI, GCS, occupation, cause of head injury, location of skull fracture and type of skull fracture was controlled by the stratification. Post stratification chi-square test was applied. P-value less than 0.05 considered significant. The data was presented visually in tables, pie charts, and bar graphs.

RESULTS

Total of 196 patients were included in study. There were 129(65.8%) male and 67(34.2%) female. Mean age of patients was 35.7 years±9.9SD. Intracranial hemorrhage was present in 32(16.3%). Type of intracranial hemorrhage was subdural in 10(5.1%), intracerebral 3(1.5%), subarchnoid 3(1.5%), intraventricular 4(2%), contusion 2(1%). Intracranial hemorrhage is significantly associated with GCS, occupation, cause of injury, location of injury and type of intracranial injury ($p<0.001$). Finding are summarized in table 1, 2, 3, 4, 5, and 6.

Table 1: Respondents classification according to gender

Gender	Intracranial hemorrhage		Total	P-value
	Absent	Present		
Male	107 (54.6%)	22 (11.2%)	129 (65.8%)	0.839
Female	57 (29.1%)	10 (5.1%)	67 (34.2%)	
Total	164 (83.7%)	32 (16.3%)	196 (100%)	

Table 2: Descriptive statistics

Descriptive statistics	Mean	Standard deviation
Age	35.7 years	9.9
BMI	22.9	2.6
GCS	11.6	2.4

Table 3: Summary on causes of head injury

Cause of head injury	Intracranial hemorrhage		Total	P-value
	Absent	Present		
Road traffic accident	85 (43.4%)	5 (2.6%)	90 (45.9%)	0.000
Physical assault	15 (7.7%)	14 (7.1%)	29 (14.8%)	
Sporting	26 (13.3%)	0 (0%)	26 (13.3%)	
History of fall	18 (9.2%)	4 (2%)	22 (11.2%)	
Others	20 (10.2%)	9 (4.6%)	29 (14.8%)	
Total	164 (83.7%)	32 (16.3%)	196 (100%)	

Table 4: Summary of GCS

GCS	Intracranial hemorrhage		Total	P-value
	Absent	Present		
≤8 scores (severe brain injury)	76 (38.8%)	14(7.1%)	90 (45.9%)	0.000
9-12 scores (moderate injury)	75 (38.3%)	7 (73.6%)	82 (41.8%)	
≥13 scores (mild brain injury)	13 (6.6%)	11 (5.6%)	24 (12.2%)	
Total	164 (83.7%)	32 (16.3%)	196 (100%)	

Table 5: Summary of location of injury

Location of injury	Intracranial hemorrhage		Total	P-value
	Absent	Present		
Frontal	38 (19.4%)	13 (6.6%)	51 (26%)	0.000
Parietal	40 (20.4%)	4 (2%)	44 (22.4%)	
Occipital	24 (12.2%)	3 (1.5%)	27 (13.8%)	
Temporal	14 (7.1%)	12 (6.1%)	26 (13.3%)	
Basal	24 (12.2%)	0 (0%)	24 (12.2%)	
Multiple	24 (12.2%)	0 (0%)	24 (12.2%)	
Total	164 (83.7%)	32 (16.3%)	196 (100%)	

Table 6: Summary of type of fracture

Type of skull fracture	Intracranial hemorrhage		Total	P-value
	Absent	Present		
Simple closed	61 (31.1%)	3 (1.5%)	64 (32.7%)	0.000
Linear simple closed	29 (14.8%)	13 (6.6%)	42 (21.4%)	
Depressed compound	19 (9.7%)	3 (3.5%)	22 (11.2%)	
Linear compound	16 (8.2%)	0 (0%)	16 (8.2%)	
Diastatic skull	11 (5.6%)	7 (3.6%)	18 (14.8%)	
Fracture elevated	6 (3.1%)	6 (3.1%)	12 (6.111	
Comminuted	22 (11.2%)	0 (0%)	22 (11.2%)	
Total	164 (83.7%)	32 (16.3%)	196 (100%)	

DISCUSSION

Head injury is a major cause of morbidity worldwide. [7] Traumatic head injuries represent the major cause of neurological disability. [8] Approximately 65% of traumatic patients have head injuries. [9] Approximately 52,000 US deaths per year result from traumatic brain injury. The annual rate of head injuries in Pakistan is 81 per 100,000 with a mortality rate of 15%. Intracranial hemorrhage is a common and serious consequence of head injury. [10] In present study, intracranial hemorrhage was present in 32(16.3%) and absent in 164(83.7%).The results were

compared with multiple studies. In a study performed by Racadio et al, it was found that 46% of patients had intracranial hemorrhage. [11] Whereas a study conducted at Shifa International hospital in 2008 showed only 0.6% of cases of head injury had intracranial hemorrhage. In the crash trial which was the largest trial conducted among traumatic head injury patients, 56% of the patients had some type of intracranial hemorrhage and 27% had subdural haemorrhage which is higher to the incidence reported in this study49. [12] Our study showed about 16 % patients with intracranial hemorrhage which is higher than the study conducted in Shifa but lower than studies performed by Racadio et al. Rosenthal and colleagues scanned head trauma patients at hospital admission and found that 16% of patients had intracranial hematomas. [13]

These results are comparable to this study because the incidence is 16%. Similarly, Ruiz et al found that traumatic intracranial hemorrhages were found in 23% of 160 head injury patients50. More recently Russo and colleagues reported a study in which they included patients with traumatic brain injury and showed that 51% patients had intracranial hematomas.[14] These studies show a higher incidence of intracranial hemorrhages as compared to this study In present study, type of intracranial hemorrhage was subdural in 10(5.1%), intracerebral 3(1.5%), subarchnoid 3(1.5%), intraventricular 4(2%), contusion 2(1%), combination 2(1%) and extradural 8(4.1%). Location of intracranial bleeding was parietal 10(5.1%), occipital 4(2%), temporal 3(1.5%), combination 4(2%) and frontal 11(5.6%).[15-16]

These results are comparable to multiple studies which show the higher incidence of subdural hematomas in trauma patients as compared to other types of intracranial bleeds. A study performed by Ravindran et al showed 20% of patients with subdural hematomas. [17] In another study conducted in 2010, which included 9 randomized clinical trials in trauma head patients, the range of frequency for EPH and SDH was 7-8% and 8-9% respectively, which is comparable to the frequency reported in this study53. These results are consistent, but more precise, than those of previous studies showing that intracranial hemorrhage is associated with increased mortality.[18] In another study it was shown that subdural hemorrhage was present in 30% of the patients and epidural and intraparenchymal bleeds in approximately 22% each respectively55. In a study conducted at Radiology Department, Dow University of Health Sciences in 2009, it was seen that the incidence of extradural hematoma was 48 % and the highest as compared to other types of hemorrhage56. This was against the results of my study which showed the highest incidence of subdural hematomas.

In another study conducted by Rashid et al, it was seen that the incidence of subdural hematomas was higher i.e. 22 out of 38 patients (58%) with intraparenchymal bleed being 39%57. In a study conducting analysis of over 13,000 patients with traumatic brain injury, it was shown that patients with a large EDH, SDH or IPH have a substantially higher mortality than patients with either no bleeding or a small bleed. [19] Even after adjusting for other CT findings, such as contusions and brain swelling, and other potential confounding variables, such as age, large bleeds substantially increase the probability of death. Small intracranial hemorrhage is not associated with an increase in mortality after adjustment for other potentially confounding variables.[20] Out of all head trauma cases 65.4% were males and 34.6% were females. The reason behind this can be that males are on the road in major part of the day for work or other purpose.

This is in keeping with the general life-styles, occupational and social interaction. In Peshawar, due to dominance of Islamic law and observation of pardah, females are seldom seen on roads. This predominance of males in trauma head patients was compared to a study performed in Dow University Karachi which showed that of all the patients presenting with head trauma 90% were males and 10% were females. In our study, out of 165 patients with head trauma, largest number of people was in the age group 16-30 years. [21] This age group people are mostly students, young laborers or conductors on buses. The higher incidence of trauma in these patients indicates that this age group is prone to more traumas as compared to other age groups. This is comparable to a study showing higher incidence of head trauma in age group 18-40 years. The commonest cause of head trauma in our study was road traffic accidents. Because of increasing incidence of road traffic accidents, risk of head trauma is being increased in our population.[22] Road traffic accidents are seen commonly in urban areas due to congestion and heavy traffic in cities. This high incidence of head trauma with road traffic accidents is also proven in multiple studies. A study showed that the commonest mechanism of head injury was road traffic crashes.

In present study, type of skull fractures were simple (closed) linear 64(32.7%), simple (closed) depressed 42(21.4%), compound linear 22(11.2%), compound depressed 16(8.2%), diastatic skull fractures 18(9.2%), elevated 12(6.1%) and comminuted 22(11.2%). [23] Out of 165 patients with head trauma, 17% had skull fractures without any evidence of intracranial bleed. This was comparable to a study showing frequency of fractures in head trauma patients to be 21%. Bleeding size was taken into account to recommend surgical evacuation. However, the evidence presented in the guideline is very limited. For EDH the guideline reported only seven studies that evaluated the effect of size on outcome. [24-25] It is found that only large intracranial bleed, wherever the location (EDH, SDH or IPH) are associated with worse outcome and that large bleeds are associated with an increased risk of death in comparison with small volume intracranial bleeds.

RECOMMENDATION

According to the findings, frequency of intracranial hemorrhage was relatively high. This study recommend all patients with skull fractures due blunt head trauma be subjected to thorough brain damage check-up. The type and location of skull fracture involved is an indirect indicator of the severity of force of impact which leads to damage to the underlying brain and results in fatality.

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