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Predictive Indices in Outcome of Intracranial Hematomas: Study of 180 Cases and Review of Literature

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Abstract

Aim and objective: To investigate various prognostic factors associated and their effect on the neurological outcome among patients of post-traumatic intracranial hematomas.

Methods: This was a prospective observational study of 180 patients with a head injury, managed in the P.G. Department of surgery, S.R.N. Hospital associated with M.L.N Medical College, Allahabad from September 2015 to August 2016 a period of 12 months. The factors affecting the outcome were analysed.

Results: In this study the youngest patient was 3 year old, and oldest patient was 75 year old. Mean age of patients was 32.99 years. Most favourable outcome was in age group 0-20 year (81.35 % of patients had GOS 5 & 4). Male: Female ratio was approximately 4:1. Patients with GCS 13-15 had 100% favourable outcome. Patients which had hypoxia at admission had only 2.78% (n=5) favourable outcome. Patients with non reactive pupil (18.33%) had no favourable outcome. Patients with EDH had most favourable outcome 91.17% (n=31). Patient with midline shift >5mm on CT scan had only 9.09% (n=2) favourable outcome. Favourable outcome present in 80.85% (n=38) in operated patients and 63.15% (n=84) in conservatively managed patients. Overall 67.78% (n=122) patients had favourable outcome (GOS 4 & 5).

Conclusion: The unfavourable prognostic factors for traumatic intracranial hematoma are older age (>60), RTA, low GCS (3-8), hypoxia, nonresponsive pupil to light, presence of multiple lesion on CT scan, midline shift > 5 mm, nonoperative lesions, the time elapsed from trauma to surgery > 24 hours.

Keywords: Head injury, Glasgow coma scale, Intracranial hematoma, Glasgow outcome scale

Introduction

Head injuries (TBI) are a steadily increasing and major cause of morbidity mortality, particularly among younger age groups in the second to fourth decades of life. [1,2] Road traffic accidents (RTA) is a leading cause of head injury in teenagers and young adults [3] Head injuries can cause immediate death in 25% of acute trauma victims. More than half of the cases of head trauma are caused by RTA, leading to 70% of all deaths due to brain injury. Amongst the severely injured patients, majority survives with severe disability and few continue to be in a vegetative state. Increasing age is associated with poorer

outcome in patients with head injury [4]. CT scan detects and precisely localizes the intracranial hematomas, brain contusions, oedema.

On the basis of our experiences and other literatures, we e valuated 180 patients of isolated head injuries with diagnosis of intracranial hematomas on CT scan head with questions in mind that which factors best predict functional recovery and mortality for the patients?

Material and methods

This was a prospective observational study of 180 patients with a head injury, managed in the P.G. Department of surgery, S.R.N. Hospital associated with M.L.N Medical college, Allahabad from September 2015 to August 2016 a period of 12 months. The factors affecting the outcome were analysed.

All variables were categorized which might have been related to the functional recovery and mortality into three groups:

1. Clinical variables; gender, age, mechanism of injury, GCS scores (Table 1), pupillary abnormalities, hypoxia at admission.
2. CT variables; type of hematoma, midline shift.
3. Management variables; operated, non-operated, time elapsed from trauma to surgery.

The patients were divided in 4 age groups; < 20 years, 21-40 years, 41-60 years, >60 years. The GCS score was determined on admission and all patients were divided into three groups; GCS scores of 3 to 8, 9 to 12 and 13 to 15. On the basis of pupillary response patients divided in three groups: responsive, anisocoric, nonresponsive.

Table 1: Glasgow Coma Scale

Eye opening	Best verbal response	Best motor response
		6: obeys command
	5: oriented	5: localise pain
4: spontaneous	4: confused but converse	4: withdraws
3: to speech	3: inappropriate words	3: abnormal flexion
2: to pain	2:incomprehensible sounds	2: extension
1: none	1: none	1: none
Total GCS score : 3 - 15		

Standard treatment guidelines were followed as per requirement. Outcome evaluation was done using the Glasgow Outcome Scale (GOS) score at time of discharge and divided into good (normal, moderate disability) and poor (severe, vegetative, dead) outcome (Table 2).

Table 2: Glasgow Outcome Scale

Good recovery (able to return to work or school)	5
Moderate disability (able to live independently, unable to work or school)	4
Severe disability (able to follow commands / unable to live independently)	3
Vegetative state	2
Death	1

Results

In this study, the youngest patient with diagnosis of traumatic intracranial hematoma was 3 year old, and oldest patient was 75 year old. Mean age of patients was 32.99 years. Majority of patients (n = 61; 33.89%) were of age group 21 to 40 years followed by the patients n = 59; 32.78%) of age group 0 to 20 year. Most favourable outcome was in age group 0-20 year (81.35 % of patients

had GOS 5 & 4), followed by age group 41- 60 year (76.92 % of patients had GOS 5 & 4). Worst favourable outcome in elderly patients age > 60 years only 38.09 % of patients had GOS 5 & 4. In this study 145 (80.56 %) patients were male and only 35 (19.44%) patients were female. Male:Female ratio was 4:1. 94 (64.82%) male patients had favourable outcome (GOS 5 & 4) and 28 (80.00%) female patients had favourable outcome (GOS 5 & 4). RTA(Road Treffic Accident) was most common mode of Injury (n=109, 60.56%) followed by fall from height (n=50, 27.28%) and assault 11.66% (n=21). Assault Patients had most favourable outcome, GOS 5 and GOS 4 in 100% (n=21) of patients followed by patient of fall from height GOS 5 & 4 in 58% (n=29) Least favourable outcome in patient of RTA in which only 38.5 3% (n=42) patient have GOS 5 & 4.(Table 3)

Most of the patients (n=79, 43.89%) had mild head injury 27.78% (n=50) had moderate head injury and 28.33 (n=51) patient had severe head injury. Patients with GCS 13-15 had 100% favourable outcome. Patient with GCS 9-12 had 76% (n=38) favourable outcome and patient with GCS 3-8 had only 9.8% (n=5) favourable outcome. Hypoxia (SpO_2 <80%) was present in 29.44% (n=53) patients at time of admission and required endotracheal intubation and ventilatory support. Patients which had hypoxia at admission had only 2.78% (n=5) favourable outcome. patient in which hypoxia absent at admission had 92.21% favourable outcome. The patients with Responsive pupil were 61.11% (n=110), Anisocoric Pupil were 20.56% (n=37) and nonresponsive pupil were 18.33% (n=33). Patients with responsive pupil had most favourable outcome 96.36% (n=106). Patient with anisocoric pupil had 43.24% (n=16) favourable outcome and patient with nonresponsive pupil has no favourable outcome.

Most common hematoma on CT scan was contusion/ICH in 30% (n=54) of patient followed by multiple haemorrhages 28.89% (n=52) least common hematoma was SAH, present only in 7.78%) n=14) patients. Patients with EDH on CT scan had most favourable outcome 91.17% (n=31) followed by patients with multiple haemorrhages in which favourable outcome in 75% (n=39) patient. Patient with SDH had 73.07% (n=19) favourable outcome, opt with SAH had 57.14% (n=8) favourable outcome and patient with contusion had 46.29% (n=25) favourable outcome. The midline shift >5mm present in 12.22% (n=22) of patients. Patient with midline shift >5mm on CT scan had only 9.09% (n=2) favourable outcome. While patient with midline shift <5mm or no midline shift on CT scan had 75.94% (n=120) favourable outcome.

Most of the patients 73.89% (n=133) managed conservatively and only 26.11% (n=47) patient were operated. favourable outcome present in 80.85% (n=38) in operated patients and 63.15% (n=84) in conservatively managed patients. only 14.89% (n=7) patient operated within 24hr after head injury rest of the patients operated after 24hr. favourable outcome present in 100% (n=7) of patient which were operated within 24hr and 77.50% (n=31) patients had favourable outcome which were operated after 24hr. 27.78% (n=50) Patients had good recovery (GOS 5), 40% (n=72) had moderate disability (GOS 4). 7.22% (n=13) had severe disability (GOS 3) and 25% (n=45) were dead (GOS 1). Out of 180 patiens, 67.78% (n=122) patients had favourable outcome (GOS 4 & 5) and 33.22% (n=58) patient had unfavourable outcome (GOS 3-1).(Table 4)

Table 3: Factors Related to Outcome

Variables	No. of Patients	percentage	Outcome		Statistical test
			Favourable outcome (GOS 5 & 4)	Unfavourable outcome (GOS 3-1)	P value <0.05 (significant)
Age Distribution					
0-20	59	32.78	48	11	χ^2 = 17.09
21-40	61	33.89	36	25	P value = 0.00067
41-60	39	21.67	30	9	
>60	21	11.66	8	13	
Sex Distribution					
Male	145	80.56	94	51	χ^2 =2.9719
Female	35	19.44	28	7	P value = 0.0842
Mechanism of Injury					
RTA	109	60.56	42	67	χ^2 =27.93
Fall form height	50	27.28	29	21	P value < 0.0001
assault	21	11.66	21	0	
GCS at admission					
13-15	79	43.89	79	0	χ^2 =117.59
9-12	50	27.78	38	12	P value < 0.0001
3 - 8	51	28.33	5	46	

Table 4

Variables	No. of Patients	percentage	Outcome		Statistical test
			Favourable outcome (GOS 5 & 4)	Unfavourable outcome (GOS 3-1)	P value < 0.05 (significant)
Hypoxia (SpO_2 <80%)					
Present	53	25.44	5	48	χ^2 =117.08 P value < 0.0001
absent	127	70.56	117	10	
Pupillary response					
Responsive	110	61.11	106	4	χ^2 = 126.10 P value <0.0001
Anisocoric	37	20.16	16	21	
nonresponsive	37	18.33	0	37	
Type of haematoma					
Contusion	54	30.00	25	29	χ^2 =22.2346 P value < 0.00018
EDH	34	18.89	31	3	
SDH	26	18.89	19	7	
SAH	14	7.78	8	6	
multiple hemorrhages	52	28.89	39	13	
mid line shift (>5 mm)					
Present	22	12.22	2	20	χ^2 = 39.5255 P value <0.00001
absent	158	87.78	120	38	
Management					
Operated	47	26.11	38	9	χ^2 = 4.9779 P value < 0.0256
Non-operated	133	73.89	84	49	
time of surgery					
< 24 hr	7	14.89	7	0	χ^2 = 1.948 P value < 0.1628
> 24 hr	40	85.1	31	9	

Discussion

In this study, factors predicting the outcome of traumatic intracranial hematomas are evaluated. Outcome measured as favourable (GOS 5 & 4) and unfavourable (GOS 3-1). The following factors related to outcome were discussed.

Regarding age, this study showed that the young adult group (20-40 years) in the third decade of life were the most affected (n= 61, 33.89%) and mean age of 32.99 years. This was in agreement with many studies.[5,6,7] The possible explanation for the higher frequency of head injury in youth is that the second and third decades of human life are the most active phase in life and thus people in these decades are vulnerable to trauma.

In this study favourable outcome had statistic high significant (p value <0.00067)) relationship with age of the patient. Similar findings have been reported by other authors.[8-12] The mechanism by which age has such an effect on outcome is unknown, but suggestions include a poor regenerative capacity of the older brain and predisposition to develop a more lethal injury.[13]Some of this increased mortality in the elderly may be explained by the intrinsic properties of the ageing brain, pre-existing co-morbidities and complications. Furthermore, the adverse effects of general anaesthesia and surgery may affect the respiratory and circulatory function of the elderly, increasing the severity of brain injury. Therefore, in addition to treating pre-existing diseases to decrease the risk of complications, improved long-term care should be emphasized for elderly surgical patients.[14]

In this study, the male : female ratio were approximately 4:1. This result agreed with the CRASH study, in which 81% were males.[15] The male excess of head injury is attributed to greater exposure and more risk-taking behaviour during occupation or life and traumatic injuries among females remain under reported.[16] There was no significant difference in term of outcome between gender (p = 0.084). Similar results also present in the study done by K.P. Kithiji et al[10], and other authors.[5,11,12]

Road traffic accidents were the most common cause of head trauma, which contributed to 60.56% of the total cases. Most of the authors had similar finding.[5,8,12,17] In children, the most common cause of injury was fall from height[18].

The preoperative GCS score was another important predictor of outcome. Many authors reported that there is highly significant correlation between outcome and GCS score at admission.[7,19,20]In this study, 51 patients had a GCS score 8 or less (28.33%). 5 of those patients (9.80%) had favourable outcome (GOS 5&4). 50 patients had GCS score 9- 12 (27.78% of total), and 38 of them had favourable outcome (76.00%). 79 patients had GCS score 13 or 15 (43.89% of total) and all patients had favourable outcome (100%). This is agreement with recent studies done by, Dina Ismail Salama et al[7] and LU HY et al.[20] These findings also confirmed by other studies indicating that the severity of injury determines the outcome.[8,19,20,21]

In this study hypoxia was significantly associated with the outcome (p value <0.0001). Hypoxia, being one of the preventable secondary brain insults, greatly affected outcome in patients with severe head injury. In this study, 53 patients had hypoxia at the time of presentation of which only 5 (9.43%) patients had he favourable outcome, as compared to 123 patients (96.86%) of 127 non-hypoxic patients. This is in agreement with some studies. [7,11,22]

Patients with normal pupils had better outcome as compared to those with anisocoric pupil & worst outcome was seen in patients with fixed dilated pupils. In this study, 110 patients had reacting pupil 37 patients had anisocoric and 33 patients had fixed dilated pupils. Patients who had bilateral reactive pupils had favourable outcome of 96.37% as compared to 64.77 % and no

favourable outcome for anisocoric and bilaterally dilated pupils respectively. Many authors reported that patients with bilateral fixed pupils at surgery had a higher mortality rate.[5,8,11,12,23] Thus pupillary abnormalities were strong predictors for poor outcome in patients with traumatic intracranial hematomas (p< 0.0001). It has been postulated that pupillary dilatation is associated with decreased brainstem blood flow and that ischemia rather than mechanical compression of the third cranial nerve is an important causal factor.[24]

In this study, most common hematoma on CT scan was contusion/ICH in 30% (n=54) of Patients followed by multiple hemorrhages 28.89% (n=52) least common hematoma was SAH, present only in 7.78% n=14) patients. In this study, patients with EDH on CT scan had most favourable outcome 91.17% (n=31) followed by patients with multiple hemorrhages in which favourable outcome in 75% (n=39) patients. Patients with SDH had 73.07% (n=19) favourable outcome, patients with SAH had 57.14% (n=8) favourable outcome and Patients with contusion had 46.29% (n=25) favourable outcome. The prognostic value of CT characteristics has been well documented, in this study there is a high significant relation between CT finding and outcome of head injury p value (=<0.00018). This is in agreement with the studies done by K.P. kithiji et al [10], Gupta Prashant K et al.[25] CT scan detect and precisely localized the parenchymal damage of brain and effectively predicted the functional outcome.

In this study, midline shift >5mm present in 12.22% (n=22) of patients. The patients with midline shift >5mm on CT scan had only 9.09% (n=2) favourable outcome. While Patients with midline shift <5mm or no midline shift on CT scan had 75.94% (n=120) favourable outcome. These results are accordance with study done by Dina Ismail Salama et al.[7] Thus presence of mid line shift > 5mm is strong predictors for poor outcome in patients with traumatic intracranial hematomas (p< 0.00001).

The decision to operate on head-injured patients is based on: premorbid state, the severity of initial injury, the onset and rapidity of neurological deterioration and Patients assessment on arrival at the neurosurgical unit. Favourable outcome present in 80.85% (n=38) in operated patients and 63.15% (n=84) in medically managed patients. This is in agreement with study done by K.P. kithiji et al.[10] In their study there was a statistically significant increase in mortality in patients who did not undergo surgical intervention (26.1%) as compared to those who were operated (15.7%).

Life-saving surgery should be available within 4 hours of injury and immediately during management on the intensive care unit. Delay in surgical treatment continues to be a major preventable cause of morbidity and mortality.[26] The time from the trauma until surgical decompression also affects the mortality. Some researchers have observed that the sooner surgery is performed in cases of acute head trauma, the better the final results are.[27,28]. In this study operative time was not significantly related to outcome (p value = 0.1628).

Table 5: Comparison of Studies: Results of various studies compared below

S. N.	Parameters	Wu JJ et al (1999)[24]	Mwang'ombe et al (2001)[27]	K.P. Kithiji et al (2009)[50]	Muhammed hameed faeadh (2011)[58]	Miguel Rodriuez (2013)[77]	Dina Ismail Salama et al (2015)[93]	This study
1	No of patients	489	677	608	50	47	350	180
2	Age	-	Mortality more in older patient (26-45 years) than younger patients(< 13 years)	Mortality more in older patient (>60) than younger patients	Older patients (>60) had poor outcome	Increase in mortality as patients age increased	Older patients (>60) had poor outcome	Younger patients (0-20) have best outcome and elderly(>60) have worst
3	Sex	-	-	Not significant	Not significant	Not significant	Not significant	Male :female =4;1 but no difference in outcome
4	Mode of injury	RTA most common mode of injury	-	Assault most common mode of injury	RTA most common mode of injury	-	RTA most common mode of injury	RTA most common mode of injury, assault had good outcome
5	GCS at admission	GCS score significantly related to surgical outcome	GCS score 3-4 had 80%mortality, GCS 7-8 had 52 % mortality	Low GCS score significantly related to mortality	Low GCS score significantly related poor outcome	Low GCS score and low GCS motor score (< 3) significantly related to	Low GCS score significantly related to poor outcome	GCS at admission directly related to outcome

						mortality		
6	Hypoxia	-	-	-	-	Respiratory distress significantly related to mortality	Hypoxia at admission related to poor out come	Hypoxia at admission related to poor out come
7	Pupillary response	Nonresponsive pupil significantly related to poor outcome	Nonresponsive pupil significantly related to mortality	Nonresponsive pupil significantly related to mortality	Nonresponsive pupil significantly related to poor outcome	Nonresponsive pupil significantly related to mortality	Nonresponsive pupil significantly related to poor outcome	Nonresponsive pupil have worst outcome
8	Type of haematoma	EDH was most common	-	EDH was most common	Acute SDH and DAI had high mortality	SDH and multiple injuries significantly related to mortality	tSAH was most common, EDH had good out come	EDH had better outcome than SDH, Contusions /ICH were most common type of haematoma
9	Mid line shift	-	-	-	-	-	Mid line shift >5 mm relate to poor out come	Mid line shift >5 mm relate to poor out come
10	Management	Number of surgeries	-	Operated patient had less mortality	60 % operated	-	-	Operative lesion had better out come
11	Time of surgery	-	-	Patient operated < 24 hour had	-	-	-	Time of surgery not related to

				less mortality				out come
12	Outcome	56.25% good recovery,20.06 % moderately, 6.7% severely disabled, 4.4% vegetative, 12.1% dead	Overall mortality 56.2%	Overall mortality 18.4%	20% good recovery,16% moderately, 16% severely disabled, 14% vegetative, 34% dead	Overall mortality 34.04%	47.29% good recovery,0% moderately, 11.42% severely disabled, 13.51% vegetative, 24.28% dead	Good outcome (GOS 5 &4) 67.78% Poor outcome(GOS 3-1) 33.22%

Conclusion: Head trauma commonly affects the adult male in their productive age group (21 to 4**0**). Older age (> 60 years) group associated with the worse outcome. The unfavourable prognostic factors for traumatic intracranial hematoma are older age (>60), RTA, low GCS (3-8), hypoxia, nonresponsive pupil to light, presence of multiple lesion on CT scan, midline shift > 5 mm, nonoperative lesions, the time elapsed from trauma to surgery > 24 hours.

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