ORIGINAL ARTICLE

Prognostic Indicators in Patients with Severe Head Injury: A 2 Year Retrospective Experience at Mayo Hospital, Lahore

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ABSTRACT

Introduction: *Traumatic brain injury (TBI) is an important public health care problem in the western world and equally being pandemic in the developing world. It is one of the most common causes of death in young adults and it can affect people's lives enormously. Since many years the prognostic indicators of severe head injury had been field of research. Knowing the factors responsible for poor prognosis and preventing them outcome of severe head injury can be improved.*

Material and Methods: *A retrospective study was conducted analyzing past records of the patients in department of Neurosurgery, Mayo Hospital from Nov 2011 to Nov 2013 with diagnosis of severe head injury (Glasgow Come Scale < 9). All patients except the patients with brain death, associated poly trauma, spinal injuries were excluded from the study. Total sample of 236 either managed conservatively or surgical and observed in Intensive care unit were study population. Prognosis was assessed with Glasgow Outcome Score (GOS) on or before (if patient expired before 30 days) 30 post admission day. Age, GCS, CT findings, Pupils were compared with GOS to find probable predictors of prognosis. GOS of less than 4 was regarded as poor prognosis. Categorical variables like GCS, pupils, CT findings were presented in the form of frequency (percentage) whereas continuous variables like age were presented in the form of mean ± SD and median (range). Association between GOS and probable prognostic indictors was seen by chi square test.*

Results: *Out of 236 patients, 188 were male and 48 were female. Mean ± SD age of patient was 32.8 ± 14.6 years. Age group 15 – 45 years had maximum number of patients. Road traffic accident was major cause of severe head injury and majority had GCS 3 after resuscitation. More than half of the patient had bilaterally reactive pupils, 10% patient had post traumatic fits and half of the patients had features of base of skull fracture. 208 (8%) patient had abnormal CT findings. 30% patient on CT scan had closed cisterns and half of the patients has midline shift of 1.5 – 3 mm. More than 35% cases had surgical lesions over CT scan. Patients with age group < 15 years, GCS < 4, with closed cisterns, with surgical lesions and with midline shift of more than 3 mm had 30 day GOS < 4, which is regarded as poor prognostic marker.*

Conclusion: *Prognosis in patient with severe head injury is determined by age, presenting post resuscitation GCS, mode of injury, CT findings and surgical lesions.*

Key Words: *Severe head injury, prognosis, Glasgow outcome scale, Glasgow coma scale.*

INTRODUCTION

Severe head injury is defined as head trauma associated with Glasgow Coma Scale (GCS) score of 3 to 8.[1] Over the past 20 year much has been learned and remarkable progress has been done in management of severe head injury.[2-4] Traumatic brain injury can be divided into 2 parts; primary and secondary insult. Primary insult is the physical damage to brain matter, vessels during the traumatic event by compression and sheering force whereas secondary brain injury occurs ranging from hours to days which could be cerebral edema, hematomas, hydrocephalus, raised intracranial pressure, infection, seizures etc.[5,6]

Traumatic head injury is a serious global problem with global incidence ranging from 108 to 332 admitted to hospital per 100000 population per year.[7] The incidence is more propound in low and middle income countries and major cause being transport related injuries.[8] Total death accounts for 39% and total GOS unfavorable outcomes account for 60% of total traumatic brain injury.[7] The ageing population in most countries has created a new groups which sustain head injury by minor impacts.[7] The blast injuries caused by fire arms and explosives have distinctive pathological changes, treatment modality and different prognosis pattern.[9] Those who survive head injury has low life expectancy and they die more than 3 times faster than the general population.[10] Furthermore these survivals needs lifelong rehabilitation, and have consequent long-term physical, cognitive, and psychological disorders that affect their independence, relationships, and employment.[10] Estimated life time cost of severe head injury per case was almost US$ 400000 which included lose due to costs for disability and low productivity.[11]

After resuscitation and stabilization in emergency or in operating room patient are further treated in ICU to prevent intracranial hypertension, maintain adequate and stable cerebral perfusion pressure (CPP), avoid systemic and secondary brain insults (SBI) and optimization of cerebral hemodynamic and oxygenation.[12] The continuum of acute care, during the "GOLDEN HOUR", from the time of injury through the start of definitive care, should be ensured and based on the guidelines and recommendations previously mentioned.[12]

In a patient with severe head injury with abnormal CT scan findings ICP monitoring is necessary. Even if CT is normal in severe head injury cases patient with age over 40, unilateral or bilateral motor posturing, or systolic blood pressure < 90 mm Hg is indicative of ICP monitoring.[3] Refractory ICP and response to treatment of raised ICP are better predictors of neurological outcomes than ICP values alone. A systematic review revealed that relative to normal ICP, raised ICP was associated with elevated odds ratio (OR) of death: 3.5 (95% CI: 1.7, 7.3) for ICP 20 – 40, and 6.9 (95% CI: 3.9, 12.4) for ICP > 40 mm Hg.[13]

Analgesics, sedation, paralysis and hemodynamic support are principles of management for severe head injury. Narcotics such as morphine, fentanyl should be considered first line therapy as they provide analgesia, mild sedation and depression of airway reflexes (cough).[12]Adequate sedation potentiates analgesics; provides anxiolysis; limits elevations of ICP related to agitation, discomfort, cough or pain; facilitates nursing care and mechanical ventilation; decrease O_2 consumption, $CMRO_2$, and CO_2 production; improves patient comfort; and prevents harmful movements.[12] Patients with severe TBI are usually intubated and mechanically ventilated. Within the first 24 hours following severe TBI, hyperventilation should be avoided, as it can further compromise an already critically reduced cerebral perfusion.[12] Excessive and prolonged hyperventilation results in cerebral vasoconstriction and ischemia. Thus, hyperventilation is recommended only as a temporizing measure to reduce an elevated ICP. Hypotension is significantly associated with increased mortality following TBI.[14-16] Mannitol administration is an effective method to decrease raised ICP after severe TBI.[17] Mannitol creates a temporary osmotic gradient and it increases the serum osmolarity to 310 to 320 mOsm/kg H_2O. The prophylactic administration of mannitol is not recommended.[4] Moderate systemic hypothermia at 32°C to 34°C, reduces cerebral metabolism and CBV, decreases ICP, and increases CPP.[18] Severe TBI patients are usually in hypermetabolic, hypercatabolic and hyperglycemic state, with altered G.I. functions. There is evidence suggesting that malnutrition increases mortality rate in TBI patients.[19]

Rationale

Like other countries there is burden of head trauma in Pakistan. Pakistan is a developing country which is still fighting for infectious disease. The slow epidemiological transition has led the country to double burden of disease, i.e. communicable and non communicable disease at the same time. Head injury being a non-communicable disease is rampant in Pakistan due to road traffic accidents, suicides, homicidal attempts etc. Mayo hospital is a tertiary center in capital of Pakistani state of Punjab, Lahore. Many severe head injury cases come to this hospital. Being a tertiary care center lots of referred cases from periphery are also dealt here.

The purpose of this retrospective study is to find early clinical and radiological factors that may be prognostic for outcome. This will suggest which factors should be focused during the management plan. Besides pointing out the prognostic factors this study serves as an audit of severe head injury patient over past 2 years at one of the tertiary clinical setting of urban Punjab.

MATERIALS AND METHODS

A retrospective study was conducted analyzing the past records of the patients admitted in department of Neurosurgery, Mayo Hospital/ King Edward Medical University, Lahore from Nov 2011 to Nov 2013 with diagnosis of severe head injury. All patient with severe head injury as defined Glasgow Coma Scale with intact brain stem reflexes admitted to Neurosurgery depart of the hospital through emergency floor during the study period were sample population. Excluding patients with brain death, associated poly-trauma, spinal injuries total of 236 severe head injury cases were managed either conservatively or surgically which was the sample population. Since it was a retrospective study that analyzed the data from the past records of the patients and the study was not active when the patients were getting treatment, therefore there is no issue of consent. Approval from concerned department and hospital was enough which was taken before commencement of the study.

After surgical floor completed resuscitated the patients call was attended from Neurosurgery department to assess Neurological status. After ensuring intact brain stem reflexes and ruling out poly trauma neurological examinations were performed. Proper history, mode of injury were noted and examinations relevant to head injury was performed. CT plain brain with bone window were advised in patient with GCS less than 9. Other associated spinal injuries with severe head injury were excluded from the study but were managed by department of Neurosurgery department. As the CT film arrived all baseline investigation were performed. After arrival of the CT scan, the decision was made weather to operate or not. The surgical candidates were immediately shifted to emergency operation theatre where General Anesthesia (GA) fitness was obtained from department of anesthesia whereas non surgical candidates were managed conservatively in Neurosurgical ICU. The surgical candidates joined the conservative subjects in the Neurosurgical ICU after neurosurgical intervention was done. All the patient with severe head injury were kept in elective ventilation for 48 hours and then weaning was tried after that with the help of department of Anesthesia. If patient still needed intubation after 7 days, tracheotomy was performed. All patients were followed till 30 post admission / operative day. The outcome was measured with the help of presenting complaints, Glasgow Coma Scale (GCS) on presentation, CT findings and management against Glasgow Outcome Scale (GOS). If a person survived 30th post admission day GOS of 30th day will be regarded as outcome of the patient and if patient expired before 30th post operative day it will either be regarded as death of GOS 1.

Standard proforma was designed to collect all relevant information of the patient from patient record books. These data were transferred to SPSS 20 version. Possible mistakes in data entry were corrected then analysis was performed. Data were represented in the form of either mean (SD), median (Range) for continuous variables like age or frequency (percentage) for categorical variables like pupils status, GCS, CT findings etc. Association between GOS and independent variables were done were the help of chi square test and level of significance for all statistical test was set as < 0.05. All tests were 2 tailed.

RESULTS

The aim of this retrospective descriptive study was find out the factors that determine mortality and morbidity in patient with severe head injury. The mortality and morbidity were determined with the help of Glasgow Outcome Scale at the end of 30th post admission day.

GOS status on or before 30th post admission day was analyzed as a factor of age, pupils status, mode of injury, GCS, CT findings (lesion, cisterns, midline shift) and surgical intervention. If a person died before 30 post admission day it will be regarded as death or GOS 1.

Department of Neurosurgery, Mayo Hospital atended 259 severe head injury cases at emergency floor from Nov 2011 to Nov 2013 among which 23 patients had feature of brain death with straight line ECG. The remaining 236 patients after complete resuscitation were admitted to Neurosurgery for further management; either conservative or surgical.

The overall finding and outcomes in those 236 patients are summarized as follows:

Sample Characteristics

Total of 236 patients of either sex were study subjects where 188(80%) were male and 48 (20%) were female (Table 1).

Table 1: *Sex.*

Male	Female	Total
188	48	236

Mean ± SD age of patients was 32.8 ± 14.6 years whereas median age was 31 years and patient ranged from age group 3 to 89. Age group stratification showed; 2 patients below 5 years of age, 33 (14.0%) patients in between 5 to 15 years and 38 (15.0%) belonged to age group more than 45 years. Major chunk was taken by people between 15 to 45 years which constituted 69.1% (n = 163) (Table 2).

Table 2: *Age.*

Mean	SD	Median	Range
32.8	14.6	31.0	3 – 89
Age Group	**Number**	**Percentage**	
< 5	2	0.8	
5 – 15	33	14.0	
15 – 45	163	69.1	
> 45	38	15.2	

Descriptive Statistics

Common mode of injury was motorbike accident (either the rider or the person/s sitting) which comprised 37.7% (n = 89) of total sample. Fire arm injury constituted 5.5% whereas hit by a vehicle also had a major share in the casualty (n = 72, % = 30.5) (Table 3). Majority of the patient had GCS more than 7 (n = 80, % = 33.8) whereas 43 (18.2%) patient had GCS 3 after complete resuscitation. Patient with GCS 4, 5 and 6 were 28 (11.9%), 38 (16.1%) and 47(20.0%) respectively (Table 4). Majority of the patients had bilateral equal and reactive pupils (51.7%), only 13 patients had bilateral fixed and dilated pupils (5.5%) (Table 5). Post traumatic fits was present in 23 patients (9.8%) (Table 6) and 198 (84.0%) patient had clinical signs of base of skull fracture (Table 7). Nasal bleed was complaints of nearly half of the patients (43.6%) whereas 35.2% (n = 83) patient had periorbital ecchymosis on one side. CSF otorrhoea was present in 4 patient whereas rhinorrhoea was present in 7 patients. Frequency of vomiting was number of episodes of vomiting after the incident until patient is admitted to Neurosurgery department. Under this criteria; 43 (18.2%) did vomit, 120 patient had less than 4 episodes of vomiting and 73 (31%) had multiple episodes of vomiting (> 4) times (Table 8).

Table 3: *Mode of Injury.*

Mode	Number	Percentage
Road Traffic Accident (Motorbike)	89	37.7
Road Traffic Accident (3or 4 wheeler)	33	14.0
Road Traffic Accident (Hit by any vehicle)	72	30.5
Blunt injury (assault, fall)	20	8.5
Penetrating injury (FAI)	13	5.5
Others	9	3.8

Table 4: *Post resuscitation GCS.*

GCS	Number	Percentage
3	43	18.2
4	28	11.9
5	38	16.1
6	47	20.0
7 – 8	80	33.8

Table 5: *Pupils status after resuscitation.*

Pupils	Number	Percentage
Both reactive	122	51.7
One reactive	101	42.8
Both dilated and fixed	13	5.5

Table 6: *Post-traumatic Fits.*

Fits	Number	Percentage
Present	23	9.8
Absent	213	90.2

Table 7: *Features of base of skull fracture.*

Features	Number	Percentage
Periorbital ecchymosis in 1 side	83	35.2
Periorbital ecchymosis both sides	21	8.9
CSF otorrhoea unilateral	3	1.3
CSF otorrhoea bilateral	1	0.4
Ear bleed unilateral	25	10.6
Ear bleed bilateral	11	4.7
CSF rhinorrhoea	7	3.0
Nasal bleed	103	43.6
Battle's sign unilateral	8	3.4
Battle's sign bilateral	2	0.8

Total more than 100% because some patient had mixed lesions

Table 8: *Feature of raised ICP.*

Vomiting	Number	Percentage
No	43	18.2
< 4	120	50.8
≥ 5	73	31

Among total 236 patient majority had normal scan on CT scan (n = 28, % = 11.9), single contusion followed the list with 10.6% (n = 25) CT findings show that. Brain edema, multiple unilateral contusions, multiple bilateral contusions, traumatic subarachnoid hemorrhage (tSAH) and tSAH with other finding were respectively in 32 (13.6%), 24 (10.2%), 20 (8.4%), 20 (8.4%) and 25 (10.6%) patients were severe head injury (Table 9). In majority of patient basal cisterns were open (n = 165, % = 69.9) whereas 30.1% (n = 71) cases had compressed or closed cisterns (Table 10). Midline shift of more than 3 mm was seen in 71 (30.0%) patients whereas half of the patient has midline shift in the range of 1.5 to 3 mm (Table 11). Neurosurgically 83 patients has surgical lesion accounting for 35.2 of total cases whereas 64.8% has non surgical lesions.

Out of 236 patients 120 patients died on or before 30th day of admission. Mortality at the end of 30 day was predicted by 2 characteristics viz; surgical lesion and presenting GCS. Majority of patient who died

Table 9: CT Scan.

CT findings	Number	Percentage
Normal	28	11.9
Extra Dural Hematoma (Uni/bi lateral)	17	7.2
Sub Dural Hematoma (Uni/bi lateral)	17	7.2
Traumatic Sub Arachnoid Hemorrhage	20	8.4
Brain Edema	32	13.6
Single contusion	25	10.6
Multiple unilateral contusions	24	10.2
Multiple bilateral contusions	20	8.4
tSAH with any of above combinations	25	10.6
Depressed skull bone fracture	15	6.4
Depressed skull bone fracture with any of above combinations	13	5.5

Table 10: Cisterns.

Status	Number	Percentage
Open	165	69.9
Close	71	30.1

Table 11: *Midline shift.*

Shift (mm)	Number	Percentage
< 1.5	47	20.0
1.5 – 3	118	50.0
> 3	71	30.0

Table 12: *Surgical Lesions.*

Surgical lesion	Number	Percentage
Yes	83	35.2
No	153	64.8

by 30th post admission (n = 53, % = 64.0) day had surgical lesions (total 83 surgical lesions) and 67 patients who died by 30th post admission day had non surgical lesions. Majority of death was attributed by presenting GCS 3 (n = 33 out of 120 death, 27.5% of total death, 76.7% of death among GCS 3 patients) followed by patient with GCS 5 (n = 27 out of 120 death, 22.5% of total death, 71.1% of death among GCS 5 patients) (Table 13).

Table 13: *Mortality by 30th day of admission.*

Total Death = 120		Number	Percentage	P value
Surgical Lesion	Surgical (n_1 = 83)	53	64.0	0.004
	Non Surgical (n_2 = 153)	67	41.2	
Presenting GCS	3 (n = 43)	33	27.5	< 0.001
	4 (n = 28)	25	20.8	
	5 (n = 38)	27	22.5	
	6 (n = 47)	25	2	
	7 – 8 (n = 80)	10	8.3	

Table 14: *Glasgow Outcome scale (before or on 30th day of admission).*

Characteristics	Categories	Glasgow Outcome Scale				P-value
		1 – 3 (n = 151)		4 – 5 (n = 85)		
		Number	Percentage	Number	Percentage	
Age Group	< 5 (n = 2)	2	100	-	-	0.043
	5 – 15 (n = 33)	24	72.7	9	27.3	
	15 – 45 (n = 163)	105	64.4	58	35.6	
	> 45 (n = 38)	20	52.6	18	47.4	
Pupils	Both reactive (n = 122)	54	14.6	68	85.4	< 0.001
	One reactive (n = 101)	86	45.5	15	54.5	
	B/L dilated fixed (n = 13)	11	84.6	2	15.4	
Mode	RTA (Motorbike) (n = 89)	69	77.5	20	22.5	0.05
	RTA (3/4 wheeler) (n = 38)	11	33.3	22	66.7	
	RTA (Vehicle hit) (n = 72)	49	68.1	23	31.9	
	Blunt injury (n = 20)	8	40.0	12	60.0	
	Penetrating injury (n = 13)	10	77	3	23.0	
	Others (n = 9)	4	44.4	5	55.6	
GCS	3 (n = 43)	43	100	-	-	< 0.001
	4 (n = 28)	20	71.4	8	28.6	
	5 (n = 38)	22	57.9	16	42.1	
	6 (n = 47)	32	68.1	15	31.9	
	7 – 8 (n = 80)	34	42.5	46	57.7	
CT	Normal (n = 28)	8	28.6	20	71.4	< 0.001
	Abnormal (n = 208)	143	68.8	65	31.2	
Cisterns	Open (n = 165)	101	61.2	64	38.8	0.19 (ns)
	Close (n = 71)	50	70.4	21	29.6	

Midline shift	< 1.5 (n = 47)	17	36.2	30	63.8	< 0.001
	1.5 – 3 (n = 118)	76	64.4	42	35.6	
	> 3 (n = 71)	58	81.7	13	18.3	
Surgical lesion	Surgical (n = 83)	59	71.1	24	28.9	0.06(ns)
	Non Surgical (n = 153)	92	60.0	61	40.0	

ns- not significant

Analytical Statistics

The association between all categorical variables was seen with GOS at or before 30th post admission day. Person with age group 5 – 15 years had poor GOS (1 – 3 score) whereas persons with more than 45 years had favorable outcomes (GOS > 3). The test was statistically significant (p = 0.043). Bilaterally fixed and dilated pupils (84.6% had GOS < 4) at presentation had poor GOS compared to bilaterally reactive pupils (85.4% had GOS > 3). The association was statistically significant with p < 0.001. The poorest GOS had that of patient sustaining motorbike accident and hit by 3/4 wheeler had favorable GOS (> 3). The association between GOS and mode of injury was also highly significant (p = 0.05). Presenting GCS had significant association with GOS (p < 0001). Patients with GCS had GOS < 4 whereas GOS of patients with GCS > 7 was > 3. Abnormal CT scan favored poor GOS with significant association (p < 0.001) and midline shift of > 3 mm had poor GOS (< 4). Variables like status of cisterns and surgical lesion had no association with GOS (Table 14).

DISCUSSION

The aim of this retrospective study was to find the prognostic indicators of severe head injury. In the discussion part more than sample characteristics we will discuss about the association between clinical, radiological features and management that was adopted with mortality and morbidity. Then we will try to compare our study finding with published literatures and try to rationalize our findings. Literature review will range from as old as 1950s until 2000s so that prognostic factors at different eras of Neurosurgery can be summarized with our findings.

Current study was a 2 year retrospective study comparing 236 cases of severe head injury, among which only 48 were female. Age group of 15 – 45 years had highest number of casualties which is similar to other studies.[4,8,10] Road traffic accident either the rider or hit by the vehicle topped the list of etiology with is similar to other studies conducted.[10,12,13]

In our study highest number of patient after resuscitation had GCS 3, majority had both the pupils equal and reactive and only few had post traumatic fits (less than 10%). Half of the patients had features of base of skull fractures, more than 80% had features of raised ICP on clinical examination.

Now, we will discuss individually on association between mortality and morbidity (Glasgow Outcome Scale) with important features like age, pupils, GCS, CT findings.

Age

In current study there is a significant association between age group of patient and prognostic outcome; measured with the help of Glasgow Outcome Scale (GOS). There was poor prognosis in age group 5 – 15 years after age group < 5 than other age groups. In terms of prognosis; age group > 45 years seemed to have GOS more than 3. Our study is comparable with past studies. One group of reports has indicated that outcome tends to be better in children under ten years of age[20-22] while others report that children under five have a higher mortality rate.[23-26] Several large pediatric head injury series have reported that children have a lower mortality than adults, while others report that the primary mortality rate does not differ between children and adults. Additionally, some investigations reported better outcomes below the age range of 40 – 50 years[27-30] while other studies reported outcome as a continuous function of age without threshold values.[31-35] These discrepancies appear to be related to variations in the definitions of age groups.

Pupils

Patients with anisocoria had poor prognosis but bilateral fixed and dilated pupils had poorer GOS. The association between pupils reaction and GOS scale was highly significant (p < 0.001). Many past studies favored our findings.[36-38] This pupillary light reflex and the size of the pupil has traditionally been used as a clinical parameter in assessing transtentorial herniation and as a prognostic indicator. The pupillary light reflex and size equality of pupils has a high inter-observer reliability.[39]

Mode

Mode of injury had significant association with GOS (p < 005) in current study. Patient sustaining road traffic accident had poorer prognosis compared to other modality of injuries. Our result is comparable with other studies as well.[40,41]

Post Resuscitation GCS

Majority of patients in our study had post resuscitation GCS 3 followed by 7 – 8 GCS. The association between prognosis was significantly associated with post resuscitation GCS. All patient having GCS 3 had GOS < 4. Many of them died and remaining ended up in vegetative states. GCS of 5 had good prognosis than GCS of 6 which is surprising. This association can be a new field for research in neurosurgery. Association between GOS and GCS were seen in other studies as well. Gale, et al., found that the mortality rate for those with a true (testable) GCS score of 3 – 5 was 88%, while it was only 65% for those with the same GCS sum score when a verbal score of 1 was used because of endotracheal intubation.[42] Others also have found that prediction of outcome is less accurate if all three components of the GCS, and particularly eye opening, are not assessed.[43,44] GCS score has been shown to have a significant correlation with outcome following severe TBI, both as the sum score, 7, 8 or as just the motor component.[45-48] In a prospective study by Narayan a positive predictive value of 77% for a poor outcome (dead, vegetative, or severely disabled) was measured for patients with a GCS score of 3-5 and 26% poor predictive value for a GCS score 6-8.[49] As is commonly done, this study grouped GCS measurements versus outcome. In a larger study each GCS level would have its own predictive value. For example, in a series of 315 TBI patients from Australia, a significant inverse correlation was demonstrated between the initial GCS score (obtained 6 – 48 hours after injury) and mortality.[50]

CT Findings

In our study, 12% patient had normal scan whereas 13.6% had brain edema. Only 6.4% patient had depressed skull fracture either needing surgical intervention or those can be non-surgically managed. Total patients with contusions comprised more than 20% of cases and combining of extra dural and sub dural hematomas the total percentage was more than 14%.

There was significant association between CT finding and prognosis of the patient. Patients with normal CT findings has good prognosis whereas patients with abnormal CT scan had poorer prognosis. Among normal CT findings only 28% had GOS < 4 whereas patients with abnormal CT findings with < 4 GCS were 68.8%.

The distance of brain CT midline shift is generally considered to indicate the severity of injury and has a risk factor with poor outcome. [51] Mass et al showed midline shift (1 – 5 mm, OR 1.36; CI 1.09-1.68; > 5 mm, OR 2.20; CI 1.64 – 2.96) were strongly related to poor outcome. However, Lin et al contradicted it with results of (distance of midline shift ≧ 5 Vs < 5 mm, OR 2.63; CI 6.0 – 43.67, P = 0.499).[52] In the present study, the results revealing poor outcome was significant with a preoperative midline shift on brain CT. Conventional classification of CT findings in severely head – injured patients differentiates between focal (extradural and subdural hematomas, as well as intracerebral hematomas and space occupying contusions) and diffuse head injuries (Gennarelli, et al., 1982).[53] Diffuse injuries according to this classification are defined by the absence of mass lesions, although small contusions without mass effect may be present. In terms of outcome, patients with diffuse injuries were found to have an intermediate prognosis when compared to patients with epidural or subdural hematomas. While acute subdural hematomas with low GCS scores had a high mortality, diffuse injuries with higher GCS scores showed a low mortality and a high incidence of good recovery. Patients with pure extra-cerebral hematoma, single brain contusion, generalized brain swelling, and normal CT scans had a significantly better outcome than patients developing acute hemispheric swelling after operation for a large extra-cerebral hematoma or patients with multiple brain contusion, either unilateral or bilateral, and patients with diffuse axonal injury.[54] Marshall, et al. (1991), in the publication on the Traumatic Coma Data Bank, propose a new classification in which the category of diffuse injury is further expanded, taking into account signs of raised ICP (i.e., compressed or absent basal cisterns), midline shift, and the presence of mass lesions apart from hematomas (intra/extra cerebral), contusions, brain edema, diffuse axonal injury.[55] Compression or absence of the basal cisterns on CT scan is considered one of the indicators of raised intracranial pressure (ICP).[56,57]

CONCLUSION

The prognosis in severe head injury is determined by age of patient, pupils, mode of injury, post resuscitation GCS, CT findings like cisterns, midline shift, surgical lesions. Poor Glasgow Outcome Score (< 4) is seen in patient of age group < 15 years, GCS < 4, with closed basal cisterns, with midline shift of > 3 mm and patient with surgical issues.

RECOMMENDATION

While dealing with cases of severe head injury; patient with age < 15 years, with low GCS and with abnormal CT findings should be dealt carefully to prevent poor prognosis.

Conflict of Interest

Authors declare no competing financial or non financial conflict of interest.

The study is not funded by any pharmaceutical company directly or indirectly involved in production of medication, instruments used for the management of this condition.

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