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Research Article

Indicators of Good Outcome in Patients with Severe Head Injury at the Fourth Oldest Western Medical Facility of South Asia: A Retrospective Experience of 3 Years

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ABSTRACT

Introduction: In developed countries like western world, Traumatic brain injury (TBI) is a critical health problem among public and equally being pandemic in developing countries. Among other causes, it is one of the most crucial cause for increasing the fatality rate among adults and significantly affecting people's lives. 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 December 2013 to Dec 2016 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 277 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 277 patients, 211 were male and 66 were female. Mean±SD age of patient was 34.8±13.7 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, 12% patient had post traumatic fits and half of the patients had features of base of skull fracture. 225 (81.2%) patient had abnormal CT findings. 83 (30%) patient on CT scan had closed cisterns and half of the patients has midline shift of 1.5-3 mm. More than 111 (40.1%) 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: Outcome among the severe traumatic head injury is determined by age, presenting post resuscitation GCS, mode of injury, CT findings and surgical lesions.

Keywords: severe head injury, prognosis, Glasgow outcome scale, Glasgow coma scale

INTRODUCTION

Severe head injury is described as head injury associated with 3 to 8/15 GCS (Glasgow Coma Scale).[1] Over the past 20 year much knowledge has been acquired and noteworthy progress has been done in management of severe head injury.[2,3,4] Traumatic brain injury can be divided into 2 parts; primary and secondary insult. Primary insult is the physical insult to vessels and brain matter due to traumatizing episode caused 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 admissions in hospital/100,000 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 group which sustain head injury by minor impacts.[7] The blast injuries caused by fire arms and explosives have distinguishing pathological alterations, treatment modalities associated with different prognostic pattern. [9] Those who survive head injury has low life expectancy and they die more than 3 time hastier as compared to general population. [10] Moreover, these survivals need lifelong reinstatement, have subsequent prolonged physical, psychological and cognition disabilities that may influence their autonomy, relations, and occupation.[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 for maintenance of stable and sufficient cerebral perfusion pressure (CPP), prevention of intracranial hypertension, avoiding systemic and secondary brain insults (SBI) and optimization of cerebral hemodynamic and perfusion. During the "GOLDEN HOUR", the provision and continuation of critical care since traumatic event to start of decisive care, must be assured and depend upon the guidelines and recommendations already mentioned.[12]

In a patient suffering from severe head injury and having abnormal CT scan findings ICP monitoring is necessary. Even if CT is normal in severe head injury cases patient with age above 40 years, 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. ICP monitor is mandatory for patients with abnormal CT findings. Despite normal CT in old age patients with hypotension and focal neurological deficits ICP monitoring is necessary. A systematic review showed that raised ICP had greater odds (6.9) of deaths than normal ICP.

Proper pain relief, paralysis, sedation and hemodynamic stability are basis for severe head injury management. Analgesics like fentanyl, morphine can be used as first line which has role in analgesia, mild sedation and depression of cough. [12]Adequate sedation helps in nursing care; reduction of raised ICP related to anxiety, proper control of BP, proper airway care and other desired therapies for head injury. It also improves patient comfort level. [12]Hyperventilation should not be done in first 24 hours after putting the patients in ventilator and prolonged hyperventilation should be avoided as it may cause vasoconstriction and ischemia. Hence, hyperventilation should only be used as a very temporary measure to reduce raised ICP. Hypertonic solutions like mannitol and hypertonic saline can be used to decrease raised ICP as they act as a temporary osmotic gradient by increasing the serum osmorality to nearly 350 mOsm/kg H2O. Mannitol works only when there is edema or raised ICP and its preventive role is not clear. Hence, prophylactic use of mannitol is not

recommended. Moderate induced hypothermia Reduces ICP as well as increases CPP to some extent. Patients with Severe head injury are in hypermetabolic, hypercatabolic and hyperglycemic state, with altered G.I. functions. Malnutrition causes increased mortality and morbidity in severe head injury patients. Prognosis is determined by age, presenting and post resuscitation GCS, mode of injury, CT findings and surgical lesions. [19]

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 restrospective study is to find early clinical and radiological elements that may be indicative of sequel and prognosis. It will indicate which components should be taken into account during the management plan.

MATERIAL 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 December 2013 to Dec 2016 with diagnosis of severe head injury. King Edward Medical University founded in 1860 is located in Lahore, Pakistan[20]. Until 2006 it was a medical college and was elevated to degree awarding institution then. The university is entitled after the Edward VII and its attached hospital Mayo Hospital was erected in 1870. The department of Neurosurgery where this study was conducted was 1st Neurosurgical center to open in Punjab Province of Pakistan, the most populated and developed province of Pakistan which harbors the cultural city, Lahore. King Edward Medical College was established in 1860 as the Lahore Medical College. It is the fourth oldest medical school in South Asia, after Medical College Kolkatta (January 28, 1835), Madras Medical College, Chennai (February 2, 1835) and Grant Medical College, Bombay (1845)[20].

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 277 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 polytrauma neurological examinations were performed. Proper history, mode of injury was noted and examinations relevant to head injury were performed. CT plain brain with bone window was 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. The entire patient with severe head injury was 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 datas 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 having severe head injury. The mortality and morbidity was 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 attended 321 severe head injury cases at emergency floor from December 2013 to Dec 2016 among which 44 patients had feature of brain death with straight line ECG. The remaining 277 patients after complete resuscitation were admitted to Neurosurgery for further management; either conservative or surgical.

The overall finding and outcomes in those 277 patients are summarized as follows:

Sample characteristics

Total of 277 patients of either sex were study subjects where 211 (76.2%) were male and 66 (23.8%) were female (Table 1).

Mean±SD age of patients was 34.8±13.7 years whereas median age was 32 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 70.8% (n=196) (Table 2)

Descriptive statistics

Common mode of injury was motorbike accident (either the rider or the person/s sitting) which comprised 39.7% (n=110) of total sample. Fire arm injury constituted 5.5% whereas hit by a vehicle also had a major share in the casualty (n=86, %= 31.0) (Table 3). Majority of the patient had GCS more than 8 (n=94, %=34) whereas 50 (18.1%) patient had GCS 3 after complete resuscitation. Patient with GCS 4, 5 and 6 were 33 (12.0%), 44 (16.0%) and 55 (20.0%) respectively (Table 4). Majority of the patients had bilateral equal and reactive pupils (52.0%), only 15 patients had bilateral fixed and dilated pupils (5.4%) (Table 5). Post traumatic fits was present in 33 patients (12.0%) (Table 6) and 139 (50.2.0%) patient had clinical signs of base of skull fracture (Table 7). Nasal bleed was complaints of nearly half of the patients (43.6%) whereas 37.2% (n=103) patient had periorbital ecchymosis on one side. CSF otorrhoea was present in 7 patients whereas rhinorrhoea was

present in 10 patients. Frequency of vomiting was number of episodes of vomiting after the incident until patient is admitted to Neurosurgery department. Under this criteria; 55 (20%) did vomit, 86 (31%) had multiple episodes of vomiting (>4) times (Table 8).

Among total 277 patient majority had normal scan on CT scan (n=52, %=18.8), single contusion followed the list with 10.8% (n=30) CT findings show that. Brain edema, multiple unilateral contusions, multiple bilateral contusions, traumatic subarachnoid hemorrhage (tSAH) and tSAH with other finding were respectively in 40 (14.4%), 29 (10.5%), 24 (8.7%), 24 (8.7%) and 24 (8.7%) patients were severe head injury (Table 9). In majority of patient basal cisterns were open (n=194, %=70) whereas 30.0% (n=83) cases had compressed or closed cisterns (Table 10). Midline shift of more than 3 mm was seen in 83 (30.0%) patients whereas half of the patient has midline shift in the range of 1.5 to 3 mm (Table 11). Neurosurgically 111 patients has surgical lesion accounting for 40.1% of total cases whereas 59.9% had non surgical lesions.

Out of 277 patients 140 (50.5%) 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 by 30th post admission (n=60, %=21.7) day had surgical lesions (total 111 surgical lesions). Majority of death was attributed by presenting GCS 3 (n=43 out of 140 death, 30.7% of total death, 86.0% of death among GCS 3 patients. (Table 13)

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=0.034). Bilaterally fixed and dilated pupils (5.4% had GOS <4) at presentation had poor GOS compared to bilaterally reactive pupils (52.0 % 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=0.04). 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).

Table 1: Sex

Male n (%)	Female n (%)	Total n (%)
211 (76.2)	66 (23.8)	277 (100)

Table 2: Age in years

Mean	SD	Median	Range
34.8	13.7	32.0	3-89
Age group	**Number**	**Percentage**	
<5	2	0.7	
5-15	39	14.1	
15-45	194	70.0	
>45	42	15.2	

Table 3: Mode of injury

Mode	Number	Percentage
Road Traffic Accident (Motorbike)	110	39.7
Road Traffic Accident (3or 4 wheeler)	32	11.6
Road Traffic Accident (Hit by any vehicle)	86	31.0

Blunt injury (assault, fall)	24	8.7
Penetrating injury (FAI)	16	5.8
Others	9	3.2

Table 4: Post resuscitation GCS

GCS	Number	Percentage
3	50	18.0
4	33	12.0
5	44	16.0
6	55	20.0
7-8	94	34.0

Table 5: Pupils status after resuscitation

Pupils	Number	Percentage
Both reactive	144	52.0
One reactive	118	42.6
Both dilated and fixed	15	5.4

Table 6: Post-traumatic Fits

Fits	Number	Percentage
Present	33	12
Absent	265	88

Table 7: Features of base of skull fracture

Features	Number	Percentage
Periorbital ecchymosis in 1 side	98	35.4
Periorbital ecchymosis both sides	27	9.7
CSF otorrhoea unilateral	3	1.1
CSF otorrhoea bilateral	1	0.3
Ear bleed unilateral	29	10.5
Ear bleed bilateral	13	4.7
CSF rhinorrhoea	10	3.6
Nasal bleed	121	43.6
Battle's sign unilateral	28	10.1
Battle's sign bilateral	3	1.1

Total more than 100% because some patient had mixed lesions

Table 8: Feature of raised ICP

Vomiting	Number	Percentage
No	55	20%
<4	120	50.8
≥5	83	31

Table 9: CT Scan

CT findings	Number	Percentage
Normal	52	18.8
Extra Dural Hematoma (Uni/bi lateral)	20	7.2
Sub Dural Hematoma (Uni/bi lateral)	20	7.2
Traumatic Sub Arachnoid Hemorrhage	24	8.
Brain Edema	40	14.4
Single contusion	29	10.4
Multiple unilateral contusions	29	10.5
Multiple bilateral contusions	24	8.7%
tSAH with any of above combinations	24	8.7%

Depressed skull bone fracture	18	6.5
Depressed skull bone fracture with any of above combinations	15	5.4

Table 10: Cistems

Status	Number	Percentage
Open	194	70
Close	83	30

Table 11: Midline shift

Shift (mm)	Number	Percentage
<1.5	55	19.9
1.5-3	139	50.1
>3	83	30.0

Table 12: Surgical Lesions

Surgical lesion	Number	Percentage
Yes	111	40.1
No	166	59.9

Table 13: Mortality by 30th day of admission

Total death= 140		**Number**	**Percentage**	**P value**
Surgical lesion	**Surgical (n_1=111)**	60	79.3	**0.004**
	Non Surgical (n_2=166)	67	20.7	
Presenting GCS	**3 (n=50)**	43	86	**<0.001**
	4 (n=33)	58	57	
	5 (n=44)	62	71	
	6 (n=55)	6	11	
	7-8 (n=94)	29	31	

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

Characteristics	**Categories**	**Glasgow Outcome Scale**				**P Value**
		1-3 (n=177)		**4-5(n=100)**		
		Number	**Percentage**	**Number**	**Percentage**	
Age Group	**<5 (n=2)**	2	100	0	0	**0.034**
	5-15 (n=39)	28	71.8	11	28.8	
	15-45 (n=194)	125	64.4	69	35.6	
	>45 (n=42)	21	50.0	21	50.0	
Pupils	**Both reactive (n=144)**	21	14.6	123	85.4	**<0.001**
	One reactive (n=118)	54	45.5	64	54.5	
	B/L dilated fixed (n=15)	13	84.6	2	15.4	
Mode	**RTA (Motorbike) (n=110)**	85	77.5	25	22.5	**0.04**
	RTA (3/4 wheeler) (n=32)	11	33.3	21	66.7	
	RTA (Vehicle hit) (n=86)	59	68.6	27	31.4	
	Blunt injury (n=24)	10	40.0	14	60	
	Penetrating injury (n=16)	12	77	4	23	

	Others (n=9)	4	44.4	5	55.6	
GCS	**3 (n=50)**	50	100	0	0	**<0.001**
	4 (n=33)	24	72.7	9	27.3	
	5 (n=44)	25	56.8	19	43.2	
	6 (n=55)	38	69.1	17	30.9	
	7-8 (n=94)	40	42.5	54	57.5	
CT	**Normal (n=52)**	15	28.8	37	71.2	**<0.001**
	Abnormal (n=225)	155	68.8	70	31.2	
Cisterns	**Open (n=194)**	119	61.2	75	38.8	0.19 (ns)
	Close (n=83)	58	70.1	25	29.9	
Midline shift	**<1.5 (n=55)**	20	36.7	35	63.3	**<0.001**
	1.5-3 (n=139)	90	64.8	49	35.2	
	>3 (n=83)	68	81.7	15	18.3	
Surgical lesion	**Surgical (n=111)**	79	71.1	32	28.9	0.06 (ns)
	Non Surgical (n=166)	100	60.0	66	40.0	

ns- not significant

DISCUSSION

The aim of this retrospective study was to find 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 3 year retrospective study comparing 277 cases of severe head injury, among which only 66 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 15%). Half of the patients had features of base of skull fractures; more than three-fourth patients 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. A set of reports has shown that sequele remains better in peadiatric group under 10 years old. On the other hand, fatality rate tends to be higher among children under 5yrs as indicated by other reports. A number of series of peadiatric head injury have accounted that mortality rate is lower among children as compared to adults. Meanwhile others indicate that there is no disparity in primary mortality rate between adults and children. Moreover, improved prognosis and outcome is documented by few investigations below the age group of 40-50 years. On the other hand, outcome is narrated by some studies as a constant function of age without any threshold values. This discordance tends to be associated with differences in the description 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. Customary, pupillary size and pupillary light has been used as a clinical criterion for evaluating transtentorial herniation and as index of prognosis.. The assessment of pupillary light reflex and size equality of pupils has enormous interobserver 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. The fatality rate for patients having a true (testable) Glasgow Coma Scale score of 3-5/15 was 88%, as compared to patients having equivalent GCS sum score when a verbal score of 1 was used because of endotracheal intubation, the fatality rate was 65% as found by Gale,et al. The prophecy of prognosis tends to be less precise if all three components of Glasgow Coma Scale, peculiarly eye opening, are not evaluated, as perceived by others. There is consequential correlation among prognosis and Glasgow Coma Scale score following severe TBI, both as the sum score,7/15,8/15 or as motor component.[45,46,47,48] In a prospective study by Narayan a PPV (positive predictive value) of 77% for a poor prognosis (dead, vegetative, or severely disabled) was estimated for patients with a GCS score of 3-5/15 and 26% poor predictive value for a GCS score 6-8.[49] As it is routinely done, this study assorted a comparison of GCS measurements against prognosis. In studies having large sample size, every GCS level will have its own predictive value. For example, a smeritorious inverse correlation was displayed among initial GCS score (obtained 6-48 hours after injury) and fatality in a study of series of 315 patients of traumatic brain injury obtained from Australia.[50]

CT findings: In our study, 18.8% patient had normal scan whereas 14.4% had brain edema. Only 6.5% 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 less than one-third had GOS <4 whereas patients with abnormal CT findings with <4 GCS were more than 65%.

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] A study indicated midline shift of 1-5mm and >5 mm had poor prognosis of 1.36 and 2.2 folds respectively and another study showed more than equal to 5 mm shift is 2n6 times more severe to the shift of less than 5 mm but it was statistically insignificant (P=0.499). [52] Current study showed poor outcome was significant with a preoperative midline shift on brain CT. Conventional classification on CT findings in severe head injury were classified on the basis of focal (extradural, subdural, contusion, intracerebral bleed)and diffuse injury (brain edema and diffuse axonal injury). [53] Diffuse injury are the one which has no visible mass effects but small contusion could be considered in that. Patient with diffuse injury had intermediate prognosis as compared to lesion giving mass effects like extra dural, subdural. Patient with acute subdural had poor prognosis and diffuse injuries with good presenting GCS had

good prognosis. Patient with extradural hematoma, small contusion, mild edema and normal CT had good prognosis than patent with abnormal CT findings, large hematomas, malignant brain swelling after surgery and multiple contusion had poor prognosis. [54] Absent or compressed cisterns always indicates raised ICP in CT scan[56,]

CONCLUSION:

The outcome in severe head injury is determined by age of patient, pupils, mode of injury, post resuscitation GCS, CT findings like cisterns, midline shift and 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 > 3mm 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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