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Study of Traumatic brain injury cases with special reference to predictors of its outcome

[1] S.S. Vhora, [2] R.S. Vhora, [3] C. Gandoke, [4] M.M. Pardasani, [4] R. Panday, [5] P.S. Vhora

[1] MCh (Neurosurgery), Professor & HOD Neurosurgery, B. J. Medical college & Sasoon General Hospital, Pune, Maharashtra.

[2] Professor Emergency Medicine, Dr DY Patil Medical College & Hospital, Pune.

[3] Senior Resident, Neurosurgery, G.B. Pant Hospital, New Delhi

[4] JR-III M. S. General Surgery, B.J. Medical college & Sasoon General Hospital, Pune, Maharashtra

[5] 3rd MBBS student, B.J. Medical College & Sasoon General, Hospital, Pune, Maharashtra

Abstract

Introduction: The term "Traumatic Brain Injury" is synonymous with Head Injury. Brain function is temporarily or permanently impaired and structural damage may or may not be detectable with current technology. We studied cases of Traumatic brain injury (TBI) with special reference to factors associated with severity and outcome.

Objectives: To Study TBI with special reference to parameters that must be considered in analyzing a patients prognosis, which will in turn help in managing patients on admission with necessary precautions, & interventions.

Material & Methods: We selected 45 patients admitted in general surgery wards of Sassoon General Hospitals, Pune. These patients were diagnosed to have traumatic brain injury with surgery as the primary line of management. The study design was a prospective non randomized trial.

Observation: Out of 45 patients, 36 were under the age of 50 years and 9 were above the age of 50 yrs Out of the 45 patients that were included in the study, 7 patients had a GCS score between 3-5. 12 patients out of 45 patients had a score between 6-9. 26 patients out of 45 patients had a score between 10-15.

Conclusion: Traumatic brain injury is more common in the younger age group. Survival at one year was 71.1%. There was significant association between age in years, pupil findings, GCS score and survival at 1 year.

Keywords: Traumatic brain injury, predictors.

Introduction

TBI is a major cause of death and disability worldwide, especially in children and young adults. Causes include falls, vehicle accidents, and violence. Prevention measures include use of technology to protect those people who can get involved in accidents, such as use of seat belts and motorcycle helmets, as well as efforts to reduce the number of accidents, such as safety education programs and enforcement of traffic laws.

All traumatic brain injuries are head injuries, but the latter term may also refer to injury to other parts of the head [1-3].

Traumatic brain injury means damage to the brain resulting from external mechanical force such as rapid acceleration or deceleration [4], impact, blast waves or penetration by a projectile [5]. The term "Traumatic Brain Injury" is synonymous with Head Injury. Brain injuries can be classified into mild, moderate, and severe categories [6].

A common method used to measure the severity of a traumatic brain injury is the Glasgow Coma Scale (GCS) score. It is generally agreed that a TBI with a GCS of 13 or above is mild, 9-12 is moderate, and 8 or below is severe [7, 3, 8]. By definition a GCS score of 8 or below reflects a severe TBI,

A current model developed by the Department of Defense and Department of Veterans Affairs uses all three criteria of GCS after resuscitation, duration of post-traumatic amnesia (PTA), and loss of consciousness (LOC) [9].

The goal of the treatment team in the hospital is to prevent any further or secondary injury to the brain. One example of secondary injury is hypoxia or not getting sufficient oxygen to the brain. This can occur when the person is not breathing or their blood pressure is too low. The end result is further brain injury.

Another problem leading to secondary brain injury can be increased intracranial pressure which can come from significant swelling of the brain, often referred to as edema Cushing's triad, a slow heart rate with high blood pressure and respiratory depression is a classic manifestation of significantly raised ICP [7]. Anisocoria, unequal pupil size, is another sign of serious TBI [10].

Aims: To study Traumatic brain injury.

Objectives

The objective was to study TBI with special reference to factors associated with outcome. To Study the injury parameters that must be considered in analyzing a patients prognosis which include Glasgow coma scale (GCS scores collected at the time of admission & GCS scores collected 4 hours after resuscitation), Hemodynamic stability of the patient (hypotension, tachycardia etc., Neuro deficits like hemiplegia / hemiparesis, Pupillary Status, To refine current knowledge of what prognostic parameters are most helpful in analyzing outcomes in traumatic brain injury cases.

Material & Methods

We selected 45 patients of TBI coming to the casualty of a Tertiary care teaching hospital. All patients requiring surgery as the primary line of treatment were included.

Patient having minimal head injury (Mild cerebral edema etc.) were excluded.

All patients records with respect to their name, age, sex, address, contact number, time & place of injury, psycho social background, history of alcohol abuse, prior brain injury, GCS scores at the time of admission pupillary status, Neuro deficits, time lag in shifting the patient to the hospital and all associated injuries were recorded.

All patients coming to the casualty with head injury and positive symptoms like vomiting, convulsions, history of loss of consciousness and ENT bleed were provisionally included in the study. Detailed clinical history of each patient was taken. This was followed by blood tests, chest x-ray, USG abd+ pelvis & CT scan. Only patients having positive CT Scan findings which needed surgery as the primary line of management were included in the study. Some patients had positive CT scan findings but had a GCS score of 3/15 and pupils were fixed and dilated. Surgery was not advised to such patients due to poor prognosis. Thus, these patients were excluded from the study.

Post-op, patients were evaluated everyday till they were discharged from the hospital or death occurred. Patients once discharged were followed up every month for a period of one year.

All the collected data was tabulated and a master chart was prepared. Data was analyzed by using SPSS (Statistical package for social sciences) version 17:0. We used chi-square test, fisher's exact test to find association between survival at one year and the various parameters.

P value of less than 0.05 is considered as significant association. After analysis of the data results were put forth.

Results

Observation & Results

Table 1: Distribution of patients with respect to age (years)

Age group	Number of patients	Percentage (%)
≤ 50	36	80.0
> 50	9	20.0
Total	45	100.0

This table explains that 36 patients out of 45 patients are ≤ 50 years of age i.e. 80% of the sample size. 9 patients out of 45 patients are > 50 years of age i.e. 20 % of the sample size.

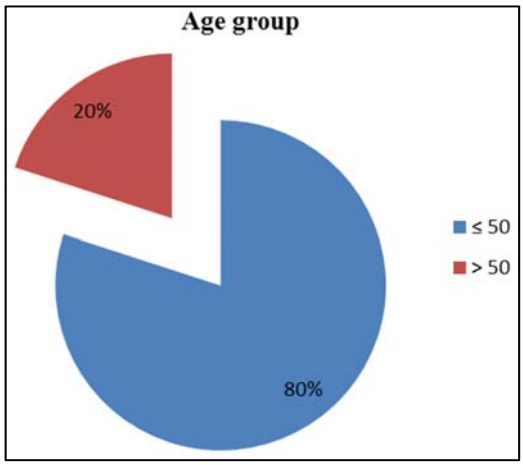

Fig 1

Table 2: Distribution of patients with respect to GCS score.

GCS score	Number of patients	Percentage (%)
3 - 5	7	15.6
6 – 9	12	26.7
> 9	26	57.8
Total	45	100.0

Table 2 explains that in our study 15.6% of the patients belong to the GCS score of 3-5. 26.7% of the patients belong to the GCS score of 6-9 & 57.8 % of the patients belong to the GCS score of 10-15.

In our study only those patients requiring surgery as the primary line of treatment are included. Patients with a poor GCS score of 3/15, pupils fixed and dilated are usually not operated due to poor prognosis & hence excluded from our study. As a result GCS score group of 3-5 has decreased in our study. Hence no conclusion can be made.

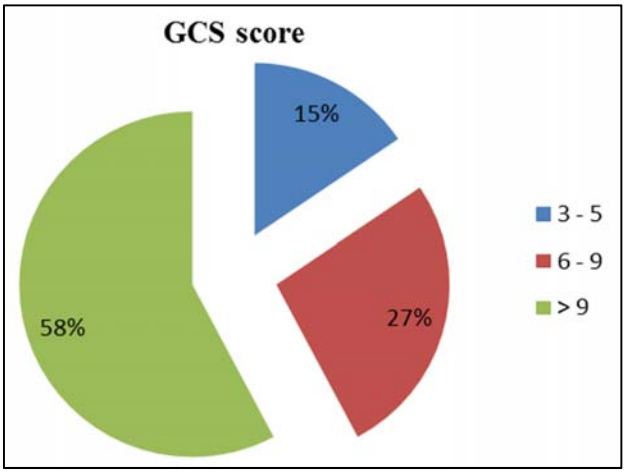

Fig 2

Table 3: Distribution of patients with respect to pupil findings

Pupil	Number of patients	Percentage (%)
Pupils equal reactive to light	14	31.1
Pupils equal sluggishly reactive to light	13	28.9
pupils unequal reacting to light	7	15.6
pupils unequal not reacting to light	7	15.6
Pupils fixed dilated	2	4.4
Pupils cannot be Assessed	2	4.4
Total	45	100.0

Table 3 explains that in our study 60% of the pupils are equal & fully or sluggishly reactive to light. 15.6% of the pupils are unequal but reacting to light. 20% of the pupils are either not reacting to light or fixed and dilated. In our study only those patients requiring surgery as the primary line of treatment are included. Patients with a poor GCS score of 3/15, pupils fixed and dilated are usually not operated due to poor prognosis & hence excluded from our study. As a result pupil fixed & dilated group has decreased in our study. Hence no conclusion can be made.

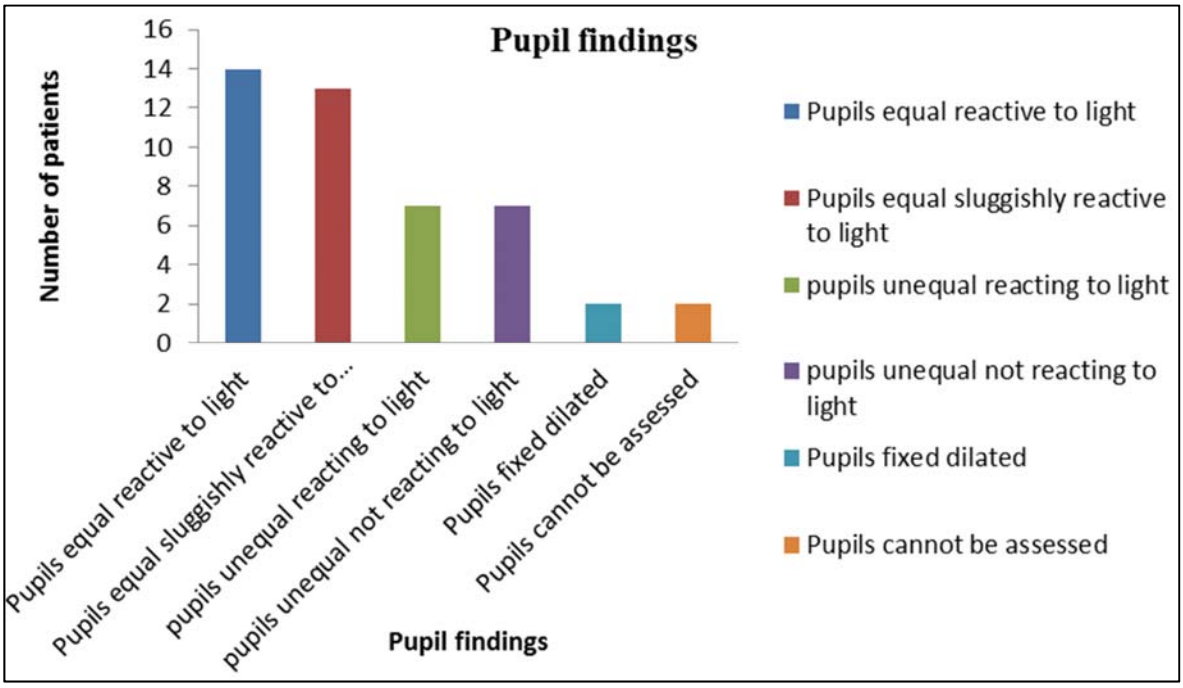

Fig 3

Table 4: Distribution of patients with respect to CT scan findings

CT scan findings	Number of patients	Percentage (%)
Depressed fracture	11	24.44
Chronic SDH	3	6.67
EDH	10	22.22
Hemorrhagic contusions	9	20.00
Acute SDH	15	33.33
Retro orbital hematoma	1	2.22

Table 4 explains that depressed fracture as a CT Scan finding was seen in 24.44 % of the patients, chronic SDH was seen in 6.67%, EDH in 22.22%, hemorrhagic contusions in 20%, acute SDH in 33.33% & retro orbital hematoma in 2.22% of the patients.

Conclusion: In our study acute SDH was the most common CT Scan finding followed by depressed fractures and EDH. Chronic SDH and retro orbital hematoma were the least common.

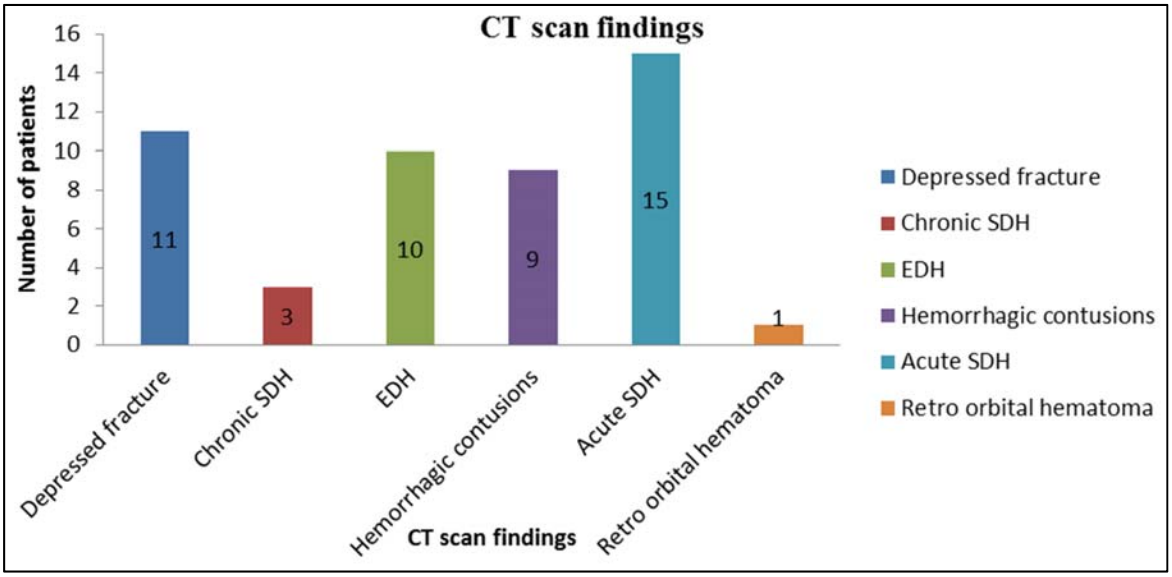

Fig 4

Table 5: Distribution of patients with respect to survival at 1 year

Survival at 1 year	Number of patients	Percentage (%)
Yes	32	71.1
No	13	28.9
Total	45	100.0

Table 5 explains that in our study 71.1 % of the patients were alive at the end of 1 year and 28.9 % of the patients died by the end of 1 year.

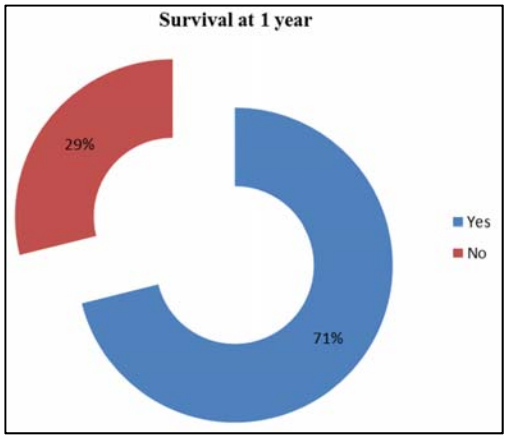

Fig 5

Table 6: Distribution of patients with respect to age (years) and survival at 1 year

Age group	Survival at one year		Total	p-value
	Yes	No		
≤ 50	29	7	36	0.011
> 50	3	6	9	

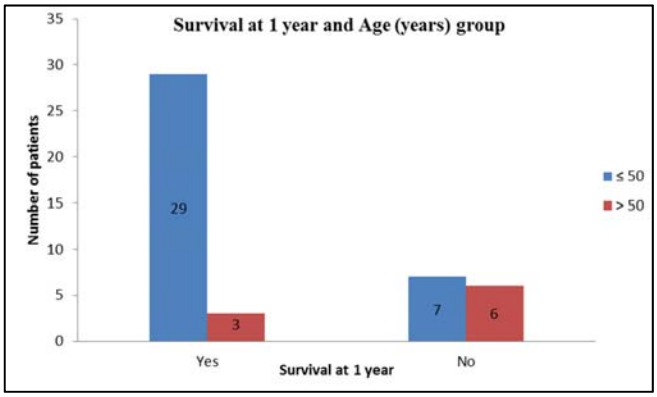

Fig 6

Table 7: Distribution of patients with respect to GCS score and survival at 1 year

GCS score	Survival at one year		Total	p-value
	Yes	No		
3 – 5	0	7	7	< 0.001
6 – 9	8	4	12	
> 9	24	2	26	

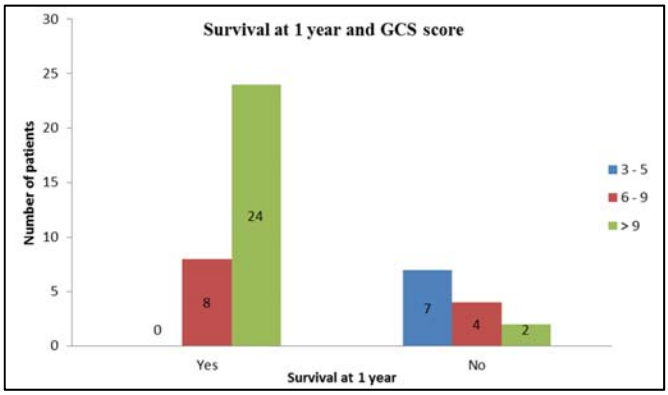

Fig 7

Table 8: Distribution of patients with respect to pupil findings and survival at 1 year

Pupil findings	Survival at one year		Total	p-value
	Yes	No		
Pupils equal reactive to light	14	0	14	< 0.001
Pupils equal sluggishly reactive to light	11	2	13	
pupils unequal reacting to light	5	2	7	
pupils unequal not reacting to light	0	7	7	
Pupils fixed dilated	0	2	2	
Pupils cannot be assessed	2	0	2	

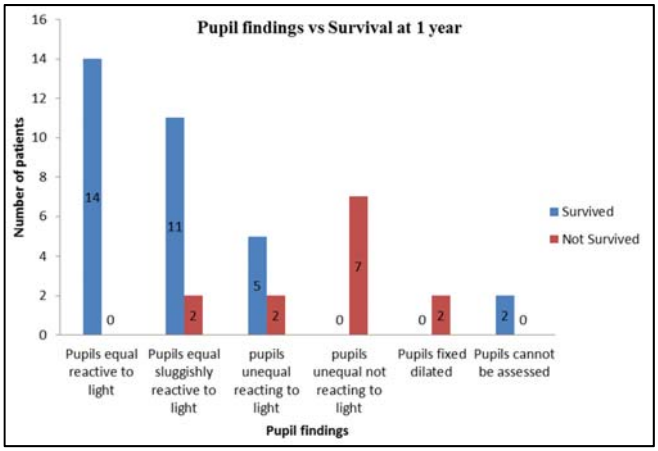

Fig 8

Discussion

Age as a prognostic indicator: In our study we took a sample size of 45 patients. Out of these 45 patients, 36 were under the age of 50 years and 9 were above the age of 50 yrs. this means that 80% of patients were <50 years and 20% of patients were >50 years.

Out of the 36 patients that were under the age of 50 years, 29 patients survived at one year and 7 patients did not survive at one year. That means 80 % of the patients <50 years who came to the casualty of Sassoon general hospitals and were diagnosed as having traumatic brain injury that needed surgery survived at one year. 20% of patients < 50 years did not survive at one year.

Out of the 9 patients that were above the age of 50 years, 3 patients survived at one year and 6 patients did not survive at one year. That means 33.33% of the patients >50 years of age who came to the casualty of Sassoon general hospitals and were diagnosed as having traumatic brain injury that needed surgery survived at one year. 66.67% of patients did not survive at one year.

By using chi-square test there is a significant association between age and survival at one year.

Age < 50 years has a good prognosis and age >50 years has a poor prognosis.

Pupillary reaction and size as a prognostic indicator: In our study pupillary findings were divided into 6 groups.14 patients out of 45 had pupils equal and reactive to light. Out of these 14 patients, all patients survived at 1 year.13 patients out of 45 had pupils equal and sluggishly reacting to light. Out of these 13 patients, 11 patients survived at 1 year. 7

patients out of 45 had pupils unequal but reacting to light. Out of these 7 patients, 5 patients survived at one year. 7 patients out of 45 had pupils unequal and not reacting to light. All of these 7 patients did not survive by the end of one year. 2 patients out of 45 had pupils fixed and dilated. Both of them did not survive at one year. 2 patients out of 45 could not be assessed for pupil size and reaction due to upper lid edema. Both of them survived at one year.
By using chi-square test there is a significant association between pupillary findings and survival at one year.
Equal and reacting pupils have a good prognosis. On the other hand, unequal and non-reacting pupils / fixed and dilated pupils have a poor prognosis.

Glasgow Coma Score at the time of admission as a prognostic indicator: Glasgow Coma Score was divided into 3 groups 3-5, 6-9 and 10-15. Out of the 45 patients that were included in the study, 7 patients had a score between 3-5. None of these 7 patients survived by the end of one year.12 patients out of 45 patients had a score between 6-9. 8 patients out of these 12 patients survived at the end of one year. 4 patients died in this group. 26 patients out of 45 patients had a score between 10-15. Out of these 26 patients, 24 patients survived at one year.
By using chi-square test, there is significant association between Glasgow Coma Score and survival at one year.
More the Glasgow Coma Score, better the prognosis. That means a score of 3-5 has poor prognosis and a score of 10-15 is associated with good prognosis.

Functional and Cognitive Recovery of Patients with Traumatic Brain Injury - Prediction Tree Model Versus General Model [11]: This case study evaluated functional disability and cognitive ability at the end of 1 month & 6 months after admission of the patient to the ICU in Traumatic Brain Injury patients. In this study the significant predictors of 1-month functional disability were GCS score, pupillary reflex, age, and the presence of subarachnoid hemorrhage. Thus poor 1-month functional recovery appears to be associated with a lower GCS score, abnormal pupillary reflex, older age,
The significant predictors of 6-month functional disability were GCS score, systolic blood pressure, age, and pupillary reflex. Thus poor 6-month functional recovery appears to be associated with a lower GCS score, a lower systolic blood pressure, older age, and an abnormal pupillary reflex on admission

Prognosis after Acute Subdural or Epidural Hemorrhage [12] - In comatose patients, the duration of the time interval between onset of coma and surgical decompression is very important. When this interval exceeded two hours, mortality from SDH rose from 47 to 80% (good outcomes 32 and 4%, respectively). In acute EDH an interval under two hours lead to 17% mortality and 67% of good recoveries compared to 65% mortality and 13 % of good recoveries after an interval of more than two hours. Among 567 cases of severe closed head injury in the present series the number of acute subdural haematomas (111, 21%) was more than twice that of acute epidural haematomas (60, 10%). Outcome was significantly better in EDH ($p < 0.001$) regarding both mortality rate and quality of life.

- **Predicting survival using simple clinical variables: a case study in traumatic brain injury [13]** - 372 patients were included in the study, of whom 365 (98%) were followed up for survival at 1 year. Multiple logistic regression resulted in a model containing age ($p<0.001$), Glasgow coma scale score ($p<0.001$), injury severity score ($p<0.001$), pupil reactivity (p=0.004), and presence of haematoma on CT (p=0.004) as independently significant predictors of survival.
- **Pupil evaluation in addition to Glasgow Coma Scale components in prediction of traumatic brain injury and mortality [14]** - Some 24 115 patients fulfilled the study inclusion criteria. Best accuracy for outcome prediction was found for pupil reactivity (AUROC 0·770, 95 per cent confidence interval 0·761 to 0·779) and GCS motor component (AUROC 0·797, 0·788 to 0·805), with less accuracy for GCS eye and verbal components. The combination of pupil reactivity and GCS motor component (AUROC 0·822, 0·814 to 0·830) outmatched the predictive accuracy of GCS alone (AUROC 0·808, 0·800 to 0·815). Pupil reactivity and size were significantly correlated (r= 0·56, P < 0·001).

Summary and Conclusion
Traumatic brain injury is more common in the younger age group. Most likely reason is that this younger age group is maximally involved in road traffic accidents. Survival at one year was 71.1%. Due to advances in an aesthetic and neuro-surgical techniques, survival at one year is on the rise. There was significant association between age in years and survival at 1 year. Traumatic brain injury in older patients has poorer survival. There is significant association between GCS score group and survival at one year. More the GCS score better the prognosis. There is significant association between pupil findings and survival at one year. Pupils fixed and dilated/ unequal and not reacting to light has poor prognosis whereas pupils equal and fully or sluggishly reactive to light has good prognosis.
Thus we conclude that all 3 parameters that were included in the study that is age in years, pupil size and reactivity, GCS score are independent predictors of survival in patients of Traumatic Brain Injury (TBI).

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