__Original Research Article__

Risk Factors Predicting Prognosis in Moderate and Severe Traumatic Brain Injury in Pediatrics in Tanta University Hospital

Abstract

Background: Traumatic brain injury (TBI) is well recognized as the primary cause of mortality and impairment in cases of pediatric trauma. TBI is the prevailing cause of both disability and mortality associated with trauma in children within industrialized nations. The objective of this research was to identify radiological and clinical criteria indicators that might serve as prognostic factors for pediatric patients with severe and moderate TBI.

Methods: This prospective observational study was conducted on hundred fifty pediatric individuals younger than eighteen years old with severe and moderate TBI within twenty-four hours. The obtained computerized tomography (CT) and clinical data findings were compared with outcome and the outcome categorized into unfavourable and favourable. Unfavourable defined as death, deterioration in Glasgow coma scale (GCS) and discharge with severe disability. Favourable defined as discharging without complications.

Results: GSC, hypotension, hypoxia, unequal pupil, WBCs ,and some of the CT findings were demonstrated to be statistically important linked with unfavourable findings.

Conclusions: Low initial GCS score, Hypotension, hypoxia, unequal pupil, hemiplegia, and the presence of midline shift or subdural haemorrhage of five mm or more in the initial CT were found to be poor prognostic factors

Keywords: Traumatic brain injury, GSC, outcome, severe, moderate, pediatric injury

Introduction:

Traumatic brain injury (TBI) is well recognized as the primary cause of mortality and impairment in cases of paediatric trauma [1].TBI represents as the prevailing cause of both disability and mortality associated with trauma during children in wealthy nations [2].

Although children with TBI have a better chance of surviving, it is important to note that impairment remains a serious concern. The functional long-term result of these children is closely linked to the severity of the original damage. Several causes might lead to TBI of such severity that hospitalization is necessary. In general, the majority of injuries are attributed to falls and car crashes [3].

The Centers for Disease Control and Prevention (CDC) states that the assessment of TBI severity is often based on the first Glasgow Coma Scale (GCS) or Pediatric Glasgow Coma Scale score. TBI severity is categorized into three levels: mild (GCS score Thirteen to Fifteen), moderate (GCS score Nine to Twelve), and severe (GCS score less than nine).

There are specific variations in the prognosis and pathogenesis between adult and pediatric traumatic brain injury (TBI) [4]. Children under the age of four years have the greatest incidence of death and morbidity in the paediatrics field. This is particularly true for those who come with hypotension, poor GCS scores upon first evaluation, coagulopathy, or hyperglycaemia [5].

Research findings have shown that there are many characteristics that are correlated with worse outcomes in juvenile TBI. Various research published data on the parameters of age GCS scores, clinical symptoms such as vomiting and pupil size, as well as damage causes [6, 7].

Furthermore, there have been efforts in radiological research to investigate the correlation between and patient outcomes and computed tomography (CT) results. Previous researches have shown that the subarachnoid haemorrhage (SAH) occurrence, brain swelling diffuse and axonal damage, are associated with unfavourable prognoses in cases of TBI in children [8] .

Nevertheless, the limited number of research that have examined the predictive variables of TBI outcomes has presented inconsistent findings. For example, the size of the pupils was shown to be a significant predictor in certain investigations [8]. Similar concerns arise about age, length of unconsciousness, the occurrence of hypothermia, and the existence of injury severity ratings [9].

While certain physicians tend to adopt a cautious approach to care, there is an increasing body of data suggesting that decompressed surgery may enhance the prognosis of young patients with TBI [10, 11].

The objective of the present research was to identify radiological indicators and clinical criteria that may serve as prognostic factors for paediatric patients with moderate and severe TBI.

Methods and Patients:

The present research is an observational prospective include one hundred and fifty pediatric patients, all of whom were under the age of Eighteen and diagnosed with moderate to severe TBI. These patients were hospitalized to Tanta University Emergency Hospital during a period spanning from the first of September 2020 to the end of September 2022. Prior to the research commencement, each child's relative was required to provide an informed written permission, after a thorough description of the research. Additionally, approval from the ethics committee was obtained. The confidentiality of all patient data was ensured. Each patient file was assigned a unique code number that included all investigations conducted.

Participants with serious abdominal trauma, substantial burns, inadequate information regarding the incident, major chest trauma, and patients with accompanying chronic debilitating disorders were excluded.

The following information were obtained:

A complete history is obtained from the patient, his or her family, or a witness: This included age, sex mechanism of trauma e.g., road traffic accident, falling from height, animal kick, prehospital medications run over, duration of transfer, local head trauma, and mode of transfer.

symptoms of Patient in older children: e.g vomiting, seizures, disturbed conscious level.

increase intracranial tension Signs: e.g unequal pupil, sudden drop of GCS, projectile vomiting, and severe headache, and indications of a skull fracture (especially a depressed or basilar fracture) e.g bleeding per nose, raccoon eye, presence of scalp hematoma, bleeding per ear and pupil size, reactivity and equality.

Laboratory investigations data: complete blood picture, serum electrolytes, coagulation profile and random blood sugar.

Brain CT results included fracture (fissure, base and depressed fractures), hemorrhage (brain contusion, extradural, subdural, Pneumocephalus, subarachnoid, and intraventricular), brain edema, and mass effect (compression or effacement presence of basal cisterns with a 0.5 cm midline shift). A midline shift is defined as a perpendicular distance more than five mm between the midline and septum pellucidum.

There are two primary approaches for treating this condition: surgical interventions, such conservative treatments and evacuation or decompressive craniotomy, such as dehydration measures. The aforementioned data were subjected to a comparative analysis with the outcome, which was afterwards categorized into two distinct groups: favorable and unfavorable. The term "favorable" is commonly used to describe a patient's condition when they are discharged without experiencing any difficulties. Conversely, the term "unfavorable" is typically used to denote outcomes such as death, a deterioration in Glasgow Coma Scale (GCS), or discharge with severe disability.

Statistical analysis:

The data were subjected to analysis using the Statistical Program for Social Science (SPSS) version 24. The quantitative data were presented as the mean plus or minus the standard deviation (SD). The qualitative data were represented in terms of frequency and percentage. The mean, sometimes referred to as the average, is a measure of central tendency used to determine the center value of a discrete collection of numbers. It is calculated by dividing the sum of all values in the set by the total number of values. The SD is a statistical metric used to quantify the extent of dispersion within a given collection of data. A smaller SD suggests that the values in the dataset are often clustered around the mean, whereas a larger SD indicates that the values are more widely dispersed throughout a broader range.

A series of experiments were conducted. The independent samples t-test (T-test) is used for comparing two means when the data follows a normal distribution. On the other hand, the Mann-Whitney U test (MW) is utilized for comparing two means when the data is not normally distributed. Lastly, the chi-square test is employed for comparing non-parametric data. A p-value less than 0.05 was deemed statistically significant.

Results:

Regarding the research subjects demographic data, our patients' age ranged between two months and eighteen years and the averge age of all studied patients was 7.8 ± 5.4 years. There were forty nine females (32.7%) and one hundred and one males (67.3%) . The predominant form of trauma observed in the patient population was road traffic accidents, accounting for 48.7% of cases. Falling from height was the second most common cause, affecting 45.3% of patients, while local head trauma accounted for 6% of cases. In terms of the transfer route , it was determined that 62.7% of the patients were received by ambulance referrals from another healthcare facility. Additionally, twenty four% of the cases were brought in by ambulances directly from the accident scene, while 13.3% of the cases were given by either witnesses or family . The average duration from the accident occurrence to the patients' arrival, as shown in the research, was found to be 63.03 ± 81.3 minutes. The shortest recorded time was fifteen minutes, while the longest recorded time was nine hundred and sixty minutes. As regard GCS on arrival, we had sixty one patients with moderate TBI with GCS (nine-twelve) and eighty nine patients with severe TBI with GCS < nine. The GCS the maximum eleven and minimum was three . In relation to clinical data, our investigation unveiled that eighteen people exhibited hypotension, thirty-four patients had seizures, eleven individuals displayed vomiting, six individuals presented with hemiplegia, and Six patients manifested unequal pupil size. A total of seventy six individuals exhibited periorbital ecchymosis, fifty-five individuals experienced epistaxis, and thirty-six individuals presented with otorrhagia. A total of eighty-seven patients presented with scalp hematoma. (Table 1)

Table 1: Description of clinical data , mode of trauma and transfer, GCS, and demographic features on arrival in all studied individuals.

		Studied individuals (N = one hundred fifty)	
Gender	**Male**	Hundred and one	67.3%
	Female	Forty and nine	32.7%
Age (years)	**Average±SD**	7.8 ± 5.4	
	Min – Max	0.16 – 18	
Trauma tmode	**Road traffic accident**	Seventy three	48.7%
	Falling from height	Sixty eight	45.3%
	Local head trauma	nine	6%
Transfer mode	**Ambulance from accident site**	Thirty six	24%
	Ambulance transfer from another hospital	Ninty four	62.7%
	Private car from accident site	twenty	13.3%

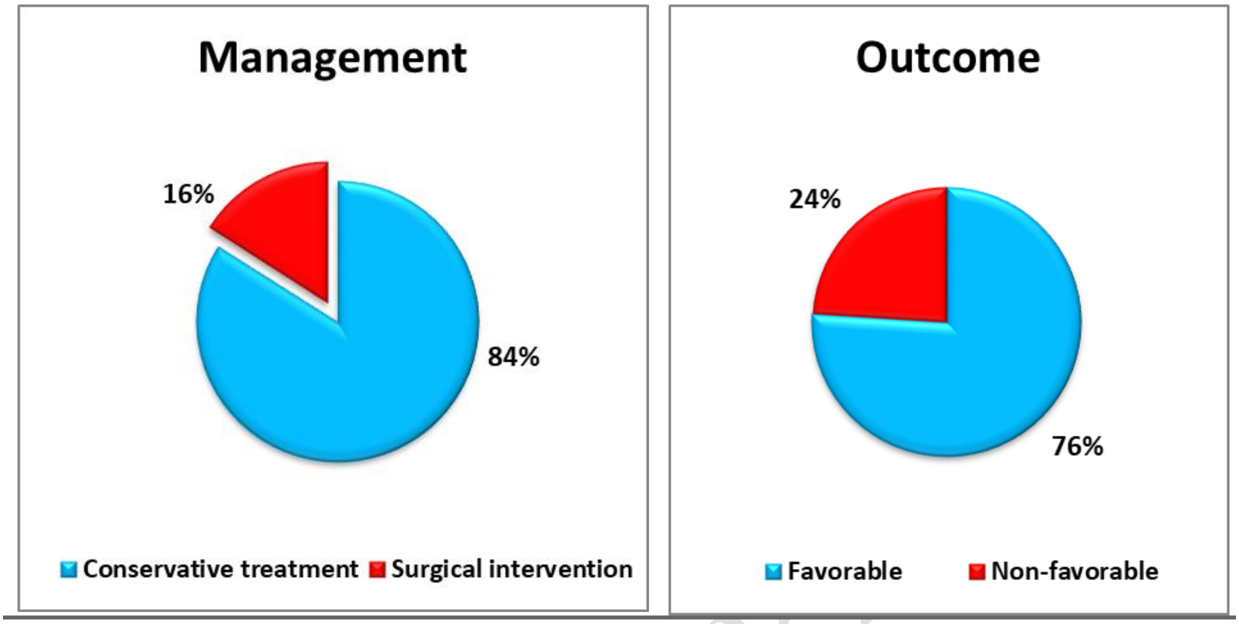
Time from accident to arrival (min)	**Average ±SD**	63.03 ± 81.3	
	Min – Max	fifteen– nine hundred and sixty	
GCS	**Moderate (9 - 12)**	Sixty one	40.7%
	Severe (< 9)	Eighty nine	59.3%
Signsand Symptoms	**Hypotension**	eighteen	12%
	Vomiting	eleven	7.3%
	Seizures	Thirty four	22.7%
	Hemiplegia	six	4%
	Unequal pupil	six	4%
	Raccoon eye	Seventy six	84.4%
	Bleeding per-nose	Fifty five	61.1%
	Bleeding per-ear	Thirty six	40%
	Scalp hematoma	Eighty seven	58%

According to saturation of oxygen, the table of following revealed that oxygen minimum sat forty%. Hypoxia in TBI patients caused by either: declined GCS less than eight with subsequently elevate aspiration risk and airway protection lack. Respiratory center depression is occurred because of brain injury. Endotracheal intubation (ETT) was performed in eighty nine patients. ETT in TBI is not only serve as the airway protection but avoids hypercapnia and hypoxia. Our research also revealed that maximum of WBCs on arrival 25 x 10^3μl. This can be explained by acute rise in level of cortisol and serum catecholaminesearly in trauma. CT brain show fissure fracture in 48.3% of patients, fracture base in 50.3% of patients, depressed fracture in 15.4% of patients,subarachnoid hemorrhage in 23.8% patients, extradural hemorrhage in 9.8% of patients, subdural hemorrhage in twenty one% patients, brain contusion in 37.1% patients, Pneumocephalus in twenty eight % patients, no abnormal finding in seven patients, brain edema in 24.5% of patients, Intraventricular hemorrhage in fourteen % of patients, midline shift ≥ fivr mm in 4.9% of patients. (Table 2)

Table 2: CT findings and Laboratory parameters of the included individuals

(n = Hundred and fifty)	Average	±SD	
O_2 Sat (%)	92.6	7.7	
RBS (mg/dl)	105.4	16.9	
HB (g/dl)	11.7	1.4	
PLTs (10^3/µl)	363.0	60.6	
WBCs (10^3/µl)	12.8	4.6	
Na (mEq/L)	139.0	3.4	
K(mmol/L)	3.8	0.4	
PT(sec)	13.1	1.1	
Prothrombin activity (%)	87.2	5.4	
INR	1.3	0.2	
Result of CT brain	**Abnormal**	Hundred and forty three	95.3%
	Normal	seven	4.7%
Findings of CT brain	**Fissure fracture**	Sixty and nine	48.3%
	Fracture base	Seventy two	50.3%
	Depressed fracture	Twenty two	15.4%
	Extradural bleeding	fourteen	9.8%
	Subdural bleeding	Thirty four	23.8%
	Subarachnoid bleeding	thirty	21%
	Brain contusion	Fifty three	37.1%
	Intraventricular bleeding	twenty	14%
	Pneumocephalus	forty	28%
	Brain edema	Thirty five	24.5%
	Midline shift ≥ five mm	seven	4.9%

According to the management, a total of hundred and twenty six patients had conservative treatment. A total of twenty-four patients had surgical intervention based on the following criteria:The assessment of neurological status is commonly determined by GCS. The CT scan findings indicate significant intracranial hemorrhage in the form of a massive hematoma, as well as signs of mass impact such as midline shift. With respect to the outcome, a good result was observed in hundred and fourteen patients, whereas a non-favorable outcome was observed in thirty-six individuals. (Figure 1)



(a) (b)

Figure 1: Outcome and Management of the studied patients

Our research demonstrated that there was no statistically important correlation (p-value more than 0.05) between the studied demographic data and finding (age and gender) in all studied patients. There was no statistically important correlation (p-value more than 0.05) between (mode of transfer,mode of trauma & time of arrival) and outcome in all studied patients. Highly statistically significant declined GCS on arrival in patients with non-favorable finding (4.1 ± 1.4) when compared with favorable outcome patients (8.5 ± 1.9).

Our investigation revealed that highly statistically important (p-value less than 0.001) elevated non-favorable finding percentage in patients with hypotension (sixteen patients, 44.4%) when compared with patients with non-favorable outcome in patients with no hypotension (two patients, 1.8%). There was a highly statistically importantt (p-value less than 0.001) elevated non-favorable outcome percentage in patients with abnormal pupillary reaction (six patients, 16.7%) when compared with patients with favorable finding in patients with reaction normal pupil . About hemiplegia our research demonstrated that statistical significant elevated non-favorable outcome percentage in patients with hemiplegia (five patients, 13.8 %) when compared with non -favorable finding in patients with no hemiplegia (one patient, 0.8%). There was statistically important correlation (p-value more than 0.05) between finding and bleeding per ear in all studied patients. There was no statistically important correlation (p-value more than 0.05) between scalp , seizures, raccoon eye and hematoma and vomiting and outcome in all studied patients.

There was a statistically important (p-value = 0.003) non-favorable finding in patients with declined oxygen saturation, oxygen saturation average in non-favorable finding eighy nine% while in favorable finding average was ninety three%. Our research demonstrated that statistically important (p-value = 0.044) elevated WBCs in patients with non-favorable finding (14.3 ± 5.1) when compared with patients of favorable finding (12.3 ± 4.3). There was no statistically important correlation (p-value more than 0.05) between studied laboratory investigation data (RBS, Hb, PLTs, Na, K, PT, PC and INR) and outcome on admission in all studied patients.

Regarding CT brain outcomes, there was no statistically important correlationship between (normal CT, fracture base,fissure fracture,pneumocephalus and brain contusion) and outcome. There was a statistically important (p-value = 0.044) elevated non-favorable result in patients with depressed fracture presented in twenty two patients, nine patients have unfavorable finding, a statistically important (p-value = 0.017) elevated non-favorable outcome in patients with extradural hemorrhage when compared with non-favorable finding in patients without epidural hemorrhage, a highly statistical important (p-value less than 0.001) elevated percentage of subdural hemorrhage as a CT brain finding in patients with non-favorable finding (sixteen patients, 44.4%) when compared with patients with non-favorable finding in patients with no subarachnoid hemorrhage (eighteen patients, 15.8%), a statistically important (p-value = 0.001) elevated subarachnoid hemorrhage percentage as a CT brain outcome in patients with non-favorable outcome (fourteen patients, 38.9%) when compared with patients with non-favorable outcome in patients with no subdural hemorrhage (sixteen patients, 14%), a statistically significant (p-value = 0.018) elevated Intraventricular hemorrhage percentage as a CT brain outcome in patients with non-favorable outcome (nine patients, 25%) when compared with patients with non-favorable finding in patients with no intraventricular hemorrhage (eleven patients, 9.6%), a statistically significant (p-value = 0.011) elevated brain edema percentage as a CT brain outcome in patients with non-favorable finding , thirty five patients have brain edema in the CT brain twenty one patients have favorable outcome, and a highly statistical important (p-value < 0.001) elevated non-favorable result in patients midline shift of five mm or more, seven patients has mass impact in their CT brain only one case has favorable outcome.

There was a statistically important (p-value = 0.027) increased non-favorable outcome percentage in patients with intervention of surgical, twenty four patients have undergo management of surgical ten patients have unfavorable result. (Table 3)

Table 3: Relation between (management,cause and mode of trauma, GCS, clinical data, laboratory data, CT findings, and demographic data)and outcome in all studied patient.

		Finding				**P-value**
		Favorable (N = hundred and fourteen)		**Non-favorable (N = thirty six)**		
Age (years)	**Average±SD**	7.6±5.2		8.2±5.9		0.907
Dender	**Male**	73	64%	28	77.8%	0.125
	Female	41	36%	8	22.5%	
Mode of trauma	**Road traffic accident**	59	51.8%	14	38.9%	0.200
	Falling from height	50	43.9%	18	50%	
	Local head trauma	5	4.4%	4	11.1%	

Mode of transfer	**Ambulance from accident site**		25	21.9%	11	30.6%	0.184
	Ambulance transfer from another hospital		76	66.7%	18	50%	
	Private car from accident site		13	11.4%	7	19.4%	
Time from accident to arrival (min)	**Average**		84.8		47.5		0.051
	±SD		266.5		25.3		
GCS (on arrival)	**Mean**		8.5		4.1		**< 0.001**
	±SD		1.9		1.4		
Signs and symptoms	**Vomiting**		8	7%	3	8.3%	0.792
	Seizures		28	24.6%	6	16.7%	0.324
	Raccoon eye		54	47.4%	22	61.1%	0.150
	Bleeding per-nose		35	30.7%	20	55.6%	**0.007**
	Bleeding per-ear		19	16.7%	17	47.2%	**< 0.001**
	Scalp hematoma		68	59.6%	19	52.8%	**0.466**
	Hypotension	**No** **Yes**	112 2	98.2% 1.8%	20 16	55.6% 44.4%	**< 0.001**
	hemiplegia	**No** **Yes**	111 1	97.4% 0.8%	33 5	91.7% 13.8%	**0.007**
	Unequal pupil	**No** **Yes**	114 0	100% 0%	30 6	83.3% 16.7%	**< 0.001**
O2 saturation (%)	**Average±SD**		93.6±7.5		89.3±7.8		**0.003**
RBS (mg/dl)	**Average±SD**		103.8±15.8		110.4±19.3		0.083
HB (g/dl)	**Average±SD**		11.7±1.4		11.6±1.4		0.651
PLTs (10^3/μL)	**Average±SD**		364.7±62.9		357.7±66.5		0.608
WBCs (10^3/μL)	**Average±SD**		12.3±4.3		14.3±5.1		**0.044**
Na (mEq/L)	**Average±SD**		138.8±3.0		139.6±4.4		0.557
K (mmol/L)	**Average±SD**		3.9±0.4		3.7±0.4		0.151
PT (sec)	**Average±SD**		13.1±1.1		12.9±1.1		0.356
PC	**Average±SD**		87.3±5.4		86.9±5.5		0.855
INR	**Average±SD**		1.26±0.16		1.29±0.16		0.429
CT brain results	**Abnormal**		107	93.9%	36	100%	0.128
	Normal		7	6.1%	0	0%	
CT brain findings	**Fissure fracture**		50	43.9%	19	52.8%	0.349
	Fracture base		50	43.9%	22	61.1%	0.071
	Depressed fracture		13	11.4%	9	25%	**0.044**
	Extradural hemorrhage		7	6.1%	7	19.4%	**0.017**
	Subdural hemorrhage		18	15.8%	16	44.4%	**< 0.001**
	Subarachnoid		16	14%	14	38.9%	**0.001**

	Bleeding					
	Brain contusion	37	32.5%	16	44.4%	0.190
	Intraventricular hemorrhage	11	9.6%	9	25%	**0.018**
	Pneumocephalus	33	28.9%	7	19.4%	0.261
	Brain edema	21	18.4%	14	38.9%	**0.011**
	Midline shift of 5 mm or more	1	0.9%	6	16.7%	**< 0.001**
Management	**Conservative**	100	87.7%	26	72.2%	**0.027**
	Surgical	14	12.3%	10	27.8%	
	±SD	8.5		7.3		

Our research demonstrated no statistically important correlationship between hemiplegia in patients in both groups severe and moderate TBI. Hemiplegia in TBI patients is not only caused by ICP but also due to direct brain cell injury. So, its presence does not indicate severity of TBI . About hypoxia on arrival our research demonstrated that statistically important declined saturation of oxygen on arrival in patients with severe TBI when compared with patients with moderate TBI. Aspiration was common in patients with GCS 8 or less due to lack of airway protection that leads to elevated of aspiration risk . Our research also revealed that a statistically important elevated unequal pupil percentage in patients with severe TBI compared with patients with moderate TBI. WBCs were higher in patients with severe TBI (13.7 ± 5.1) when compared with patients with moderate TBI (11.3 ± 3.2) and there was statistically important correlation between severe and moderate TBI. Our research also showed a highly statistically important elevated percentage of hemodynamic instability in patients with severe TBI when compared with patients with moderate TBI. Highly statistically important elevated unfavorable outcome (33.7%) in pediatrics with sever TBI when compared with unfavorable outcome (9.8%) in pediatrics with moderate TBI. Our researcg showed no statistically important correlationship between the following CT brain outcomes (fissure fracture,extradural hemorrhage, fracture base, depressed fracture, brain contusion,brain edema and Pneumocephalus)and GCS in both severe and moderate TBI. There was a statistically important elevated subdural hemorrhage percentage, subarachnoid hemorrhage, intraventricular hemorrhage and midline shift more than 5 mm in their CT brain of patients with severe TBI when compared with patients with moderate TBI. (Table 4)

Table 4: Relation between (important CT brain and clinical data on arrival) in severe and moderate TBI

		GCS				**P-value**
		Moderate (N = sixty one)		**Severe (N = eighty nine)**		
saturation oxygen on arrival	**Average±SD**	94.9±7.4		91.03±7.6		**0.006**
Hemodynamic stability	**Stable**	Sixty one	100%	71	79.8%	< **0.001**
	Unstable	0	0%	18	20.2%	
Neurological sings	**Hemiplegia**	1	1.6%	5	5.6%	0.222
	Unequal pupil	0	0%	6	6.7%	**0.038**
WBCs	**Mean±SD**	11.3±3.2		13.7±5.1		**0.003**
Hospital stay	**Mean±SD**	8.1±5.5		11.9±9.5		**0.016**
Management	**Conservative**	55	90.2 %	71	79.8%	0.088
	Surgical	6	9.8%	18	20.2%	
Finding	**Favorable**	55	90.2 %	59	66.3%	< **0.001**
Fissure fracture	24	39.3 %	45	50.6 %	1.83	0.176
Fracture base	26	42.6 %	46	51.7 %	1.19	0.275
Depressed fracture	6	9.8%	16	18%	1.91	0.166
Extradural hemorrhage	3	4.9%	11	12.4 %	2.3	0.124
Subdural hemorrhage	7	11.5 %	27	30.3 %	**7.3%**	**0.007**
Subarachnoid hemorrhage	6	9.8%	24	27%	**6.6**	**0.01**
Brain	16	26.2	37	41.6	3.7	0.053

contusion		%		%		
Intraventricular hemorrhage	3	4.9%	17	19.1 %	**6.3%**	**0.012**
Pneumocephalus	15	24.6 %	25	28.1 %	0.22	0.634
Brain edema	12	19.7 %	23	25.8 %	0.77	0.380
Midline shift ≥ 5 mm	0	0%	7	7.9%	**5.03**	**0.025**

Discussion

Our research revealed that no important correlationship between outcome and age. Kan et al. [12] Wells et al. [13] and Barcenas, et al. [14] were in line with our finding and reported that age at injury was not a good factor of result in pediatric TBI patients.

In a study conducted by Prigatano and Gray [15], the objective was to identify factors that could predict performance on neuropsychological tests in children with and without TBI. The findings of their research indicated that age emerged as the most influential predictor of post-TBI performance on neuropsychological tests among school-aged children. In our research there was no importance between result and gender. In agreement with our findings, Hernandez et al. [16] reported ninty eight children,thirty eight (38.8%) girls and sixty (61.2%) boys. Jochems et al. [17] research on children with sever and moderate TBI conducted on thousand and four hundred and ninteen cases,five hundred and fifty girls (38%) and eight hundred and eighty boys (62%).

In our research, ninty four cases (62.7%) were presented to our department of emergency by ambulance referred from other hospitals as the ambulance transferred all cases at first to the insurance sector hospitals where cases are triaged and transferred to Emergency Tanta Hospital when needed. Also, thirty six cases (twenty four%) presented by the ambulance directly from the accident site, twenty cases (13.3%) presented to us by private cars by relatives or witnesses.

In our research there was no statistically important (p-value > 0.05) between transfer mode and outcome in all studied patients, however in a research by Hernandez et al. [16] twenty six % Of the patients transferred in a private vehicle (15/98), had an unfavorable prognosis, compared to 21.6% of the patients treated by the extra-hospital emergency services (18/83).

In our research, the time of average from the accident to arrival to Emergency Tanta Hospital sixty three minutes with the minimum fifteen minutes and the maximum sixteen hours. This delay might be shown by the fact that most of our cases were referred from another hospital which take time for first aid, retransfer and triage . Also, there were some cases that were stable at the trauma time and deteriorated later and mostly were brought by their parents or relatives.

On arrival, from one hundred and fifty cases, eighteen cases (twelve%) had hypo tension. Highly statistically important elevated percentage of non-favorable ofinding in hypotensive patients (sixteen patients) also our research showed highly statistically important correlationship hemodynamic instability percentage in patients with severe TBI when compared with patients with moderate TBI. Similar findings were found in Tunthanathip and Oearsakul [18] hypotension presented in thirty four cases (4.1%) and reported that hypotension is one of the prognostic indicators for unfavorable finding.

In our research we found statistically important non-favorable finding in patients with declined saturation of oxygen less than 92%, Saturation of oxygen average in non-favorable outcome ninty eight% while in favorable outcome average was ninty three%. Our research demonstrated that statistically important correlation saturation of oxygen on arrival in patients with severe TBI when compared with patients with moderate TBI. Aspiration was common in patients with GCS eight or less due to lack of airway protection that leads to elevated aspiration risk. In line with our outcomes, Barcenas, et al. [14] Hypoxia presented in fifty six patients, unfavorable result presented in fouty six cases (76.8%) of them.

Hukkelhoven et al. [19, 20] carried out a research on 2269 cases with moderate and sever TBI and reported that hypoxia one of the prognostic factors that predict unfavorable outcome.

In our research , seizures presented in patients thirty four cases (22.6%) and no statistically significant relation between outcome and seizures. Similarly, in Barcenas, et al. [14] and Tunthanathip and Oearsakul [18] were in line with our results and concluded that no significant statistical relation between seizures and outcome. Our research revealed that statistically significant increased percentage of bleeding per-nose and ear in patients with un-favorable outcome. On contrary, a study by Tunthanathip and Oearsakul [18] showed that there was twenty two patients with bleeding per ear and nose (2.7%) and reported that bleeding per ear and nose not predictor factor for unfavorable outcome unlike previous study showed that bleeding per ear and nose is one of prognostic factors significantly associated with unfavorable outcomes. In our study, vomiting presented in eleven patients (7.3%) and no statistically important correlation between outcome and vomiting. On contrary, Lee et al. [21] showed that vomiting was seen in thirteen patients (30.2%). None of the patients who vomited had unfavorable outcomes. About hemiplegia, we found significant relation between outcome and hemiplegia. Our research also showed no statistically significant relation between hemiplegia in patients in both groups moderate and severe TBI. Hemiplegia in TBI patients is not only caused by ICP but also due to direct brain cell injury. So, its presence doesn’t indicate severity of TBI.

Our research revealed a highly statistically significant increased percentage of unequal pupil in patients with non-favorable outcome. Also, Hernandez et al. [16] were in line with our results, In the prehospital pupillary examination, 72.4% presented a normal pupillary reaction, the 27.5% had abnormal reactive pupils. A statistical association was found between abnormal pupillary examination and unfavorable prognosis.

Our research revealed that as regard GCS on arrival, moderate TBI presented in sixty one patients (40.6%) and sever TBI in eighty nine patients (59.3%). The mean GCS of all studied patients was seven with minimum GCS of three and maximum GCS of eleven. There was highly statistically significant decreased GCS on arrival and after six hours in patients with non-favorable outcome.

In line with our results Kamal et al. [22] who reported that GCS score was significant predictors of outcome in the pediatric population younger than twelve years old.

In our research, CT brain showed no abnormal finding in seven patients, There was fissure fracture in 48.3% of patients , fracture base in 50.3% of patients , depressed fracture in 15.4% of patients, extradural hemorrhage in 9.8% of patients, subarachnoid hemorrhage in 23.8% patients, subdural hemorrhage in twenty one% patients, brain contusion in 37.1% patients , intraventricular hemorrhage in fourteen% of patients, Pneumocephalus in twenty eight% patients , brain edema in 24.5% of patients , midline shift of five mm or more in 4.9% of patients. Highly statistically significant increased percentage of subdural hemorrhage and presence midline shift of five mm or more as a CT brain finding in patients with un-favorable outcome. Statistically significant increased un-favorable outcome in patients with depressed fracture, extradural hemorrhage, subarachnoid hemorrhage, Intraventricular hemorrhage and brain edema.

No statistically significant difference between favorable and un-favorable patients as regard the following CT brain findings (normal CT, fissure fracture, fracture base, brain contusion and Pneumocephalus).

According to Hernandez et al. [16], it has been found that in the adult population, a significant proportion of patients, ranging from ninety percent to ninety-three have detectable cerebral disease during initial head CT examination.

Our research revealed that twenty four children (sixteen%) have been underwent intervention of surgical (decompressive craniotomy, craniotomy and evacuation,external ventricular drain and burr hole drainage and we found statistically important (p-value = 0.027) elevated un-favorable outcome percentage in patients with surgical intervention, twenty four patients have undergo management of surgical ten patients have unfavorable outcome. In contrary, a study by Lee et al [21] a study to identify important clinical parameters predictive of outcomes in pediatric TBI patients who underwent surgery. They reported that the majority of pediatric TBI patients who required intervention of neurosurgical have favorable findings.

From this research, we recommend the following: Treatment and Diagnosis of pediatrics with severe and moderate TBI should follow ATLS protocol with the main goal is to reduce or prevent of secondary brain insults that are known to worsen outcome after TBI. Hypotension and hypoxia are known to be main reasons of secondary brain injury and are poor prognostic risk indicators should be managed probably. Early emergency surgery after head injury should be considered and are based upon neurologic findings and status in head CT such as large hematoma volume or evidence of mass impact including midline shift. There is a lag in the improper triagingand transfer of patients . The referral systems need counseling and revision with administrative health authorities to improve these parameters and subsequently improve patient outcomes. Patients with TBI should be transferred to tertiary hospitals directly which have the facilities to deal with patients of head trauma.

Conclusions:

Hypotension, hypoxia, unequal pupil, low initial GCS score, hemiplegia, and the presence of midline shift or subdural haemorrhage of five mm or more in the initial CT were found to be poor prognostic factors

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