Retrospective study of Gunshot Head Injury patients in Najran, Saudi Arabia between 2015-2017

Marshad H. Alyami [a], Abdullah A. Alyazidi [b], Ahmed M. Al-Aljam [c].

Abstract— Retrospective study is conducted to analyze the Gunshot Head injury in Najran, Saudi Arabia, of period May 2015 to June 2017. the Najran region is very closely to Yemen, where the war and the hospitals of Najran is receive a lot of the gunfire patients. The overall number of cases was 71, with mean age (29.6 years) ranged between 11-75. The mean time of admission under care of neurosurgery is 36.2 days with maximum 294 days.
The Computed Tomography (CT) which is the investigation of choice was done for (95.8%) which revealed that Brain contusions represent the mostly of the findings by 38%, followed by Brain edema. The (CT) showed that Parietal region is the most affected site by brain hematoma, and the right frontal lobe take the majority of lobes fractured by 22.5%.
a 32.4% involving in neurological deficits where 6 patients of them have brain death, 5 patients have left side hemiparesis, 4 patients with right side hemiplegia and 4 patients for the left side hemiplegia.
The deaths are 28.2%, the Glasgow Coma Score (GCS) of deaths was 3 scores for 70% of them, and most of the death causes are contributed to interventricular hemorrhage, brain edema, and infections. 80% of deaths happened within 1 month of admission, There are 30 patients who have undergone surgery where 23 of them were survived and 7 was died.

Index Terms— Gunshot head injury , penetrating head wounds , traumatic brain injury , Gunshot head injury, Saudi Arabia.

INTRODUCTION

The Traumatic brain injury (TBI) is an insult to the brain from an external mechanical force, which may lead to permanent or temporary impairment of cognitive, physical, and psychosocial functions, with an associated diminished or altered state of consciousness, its often an acute event similar to other injuries, where the similarity between traumatic brain injury and other injuries ends. One moment the person is normal and the next moment life has abruptly changed.(1)(2)

The most important problem of (TBI) it is the consequences of the injury that can affect on all the aspects of our lives, including our personality.(1)

The (TBI) happens when a bump, blow, jolt, or other head injury causes damage to the brain. The worst injuries can lead to permanent brain damage or death. Half of all (TBIs) are from motor vehicle accidents (MVA). Military personnel in combat zones are also at risk.(3)
The (TBIs) is classified to primary and secondary in which the primary Induced by mechanical force and occurs at the moment of injury (eg, an object striking the head or the brain striking the inside of the skull) and acceleration-deceleration. the Secondary injury is not mechanically induced; it may be delayed from the moment of impact, and it may superimpose injury on a brain already affected by a mechanical injury.(4)

Review of United State (US) mortality data from 1979 to 1986 identified 315,328 deaths associated with head injury, which represented 2% of all deaths, and an annualized head injury-associated death rate of 16.9 per 100,000. Motor vehicle Accidents (MVA) represents 57%, Gunshot 14%, and falls 12% were the most frequent causes, the younger group most affected by (MVA) 77% and the older group by falls 43%.(5)

in (US) approximately 2.5 million are (TBI) related emergency department visits, hospitalizations, or deaths occurred in 2010. where there are 50,000 deaths due to (TBI),
Approximately 475,000 (TBIs) occur among infants, children, and adolescents aged 0-14 years, and about 80,000-90,000 people experience the onset of a long-term disability due to a (TBI).(6)(7)

The open head injury is one of the mechanisms of brain injury which occurred due to bullet, that lead to penetrates of the skull, focal damage.(8)
Annually, 20000 Americans are involved in Gunshot Head Injury (GSHI). Over 90% of the victims of (GSHI) eventually fail to survive and only a meager 5% of the patients have a chance to continue with a useful life.(9)

The analysis of the trauma literature has shown that 50% of all trauma deaths are secondary to (TBI), and (GSHI) caused 35% of these. The current increase in firearm-related violence and subsequent increase in penetrating head injury remains of concern to neurosurgeons in particular and to as a whole, (GSHI) is fatal about 90% of the time, with many victims dying before arriving at the hospital, For victims who survive the initial trauma, about 50 % die in the Emergency Department (ED), and about 50% of surviving patients will suffer from seizures and require anti-epilepsy medication. (10)

a. Medical Student, IbnSina National College, Saudi Arabia, First Author.

b. Neurosurgery Consultant, The chief of Neurosurgery Departement, King Khaled Hospital, Najran, Saudi Arabia, Co-author.

c. Orthopedic Resident, King Khaled Hospital, Najran, Saudi Arabia, Data-Collector.

The earliest reported series of head injuries and their management appears in the Edwin Smith papyrus around 1700 BC, reporting 4 depressed skull fractures treated by the Egyptians by leaving the wound unbandaged, providing free drainage of the intracranial cavity.(11)

A dramatic increase in the incidence of penetrating injuries to the brain has occurred, with gunshot wounds to the head becoming the leading or second leading cause of head injury in many cities in the (US). These injuries are devastating to the patient, family, and society.(12)(13)(14)

In Kingdom of Saud Arabia (KSA) the studies show that a causes of Gunshot head injury (GSHI) is due to homicide, suicide, and accidentally, while the homicide is the most common cause of this injury according to the studies following by suicidal then, accidental causes.(15)(16)

one study in Dammam city, (KSA) which composed 64 fatalities cases, the homicide is the first reason in firearms (55 cases) follow by suicide (7 cases), the study showed that 45 cases out 64 of fatalities was Gunshot to the head.(15)

an another study in Eastern regions, (KSA) which composed 71 firearms fatalities revealed that 48% of the cases due to homicide, 28% is suicide, and the study showed that 34% of 71 victims was due to Gunshot to the head.(16)

an another study in the Abha city, (KSA) which composed 42 victims of gunshot injuries, its reveled the gunshot to the head is 2% of the cases.(17)

in Najran region, (KSA) and since the war started in March 2015, against Houthis terrorist in Yemen, the south regions of (KSA) are offered to many of helps to those victims coming, and in King Khaled Hospital of Najran city, where the study are conducted they received a lot of Gunshot Head Injury victims, which they representing the majority cases in the study.

RESULTS :

-The study are composed 71 patients which they admitted in King Khaled Hospital(KKH) of Najran region, (KSA) ,male and female, the mean age (29.6 years) ranged between 11-75 years with a standard deviation (9.4), the 69 patients of them are males (97.2%), and 2 females (2.8%), and (69.6%) of them they're between 18-30 years of age.

- The data showed that 22 patients (31%) have 3 score out 15 of Glasgow Coma Score (GCS) when they arrived at Emergency Department (ED), and from 3 score to 8 there are 13 patients (18.3%), while there is 21 patients (29.6%) comes to (ED) with 14-15 score, finally, a 15 patients (21.1%) have a score 9-13.

		Frequency	Percent
Valid	3.00	22	31.0
	5.00	4	5.6
	6.00	6	8.5
	8.00	3	4.2
	9.00	2	2.8
	10.00	3	4.2
	11.00	3	4.2
	12.00	3	4.2
	13.00	4	5.6
	14.00	7	9.9
	15.00	14	19.7
	Total	71	100.0

Glasgow Coma Score distribution (Table 1-1)

- from all those 71 patients, only (80.3%) of them comes to (KKH) immediately after the injury, while the other victims they are either referred to (KKH) from another hospitals for further evaluations or they are very far away from (KKH), a (8.5%) of them comes within one week of injury, (2.8%) comes within 2 weeks, (2.8%) comes within 3 weeks, and 4 patients (5.6%) comes to (KKH) within 4 weeks of injury.

- The Computed Tomography (CT) was done for (95.8%) to those patients, and the other (4.2%) they're unfit for (CT) due to massive injuries and brain tissue out.

-The Brain contusions represent a mostly of the findings where there are 27 patients have contusion in the initial (CT) at arrival, followed by Brain edema and foreign bodies where the results indicates 23 patients for each one. (Table 1-2).

-in term of brain hemorrhage, there are only 1 out 71 patient his (CT) was free from brain hemorrhage and the other findings show that the interventricular hemorrhage (IVH) was found in 17 patients, followed by left parietal subarachnoid hemorrhage (SAH), followed by Subgaleal hematoma that presents in 12 patients.(Table 1-3)

-in term of (SAH) the parietal regions of the brain take a majority where there are 27 patients have parietal (SAH) either in the left or the right or both, following by the frontal regions, where the (CT) findings showed that 16 patients have frontal (SAH) either in the left or the right or both, following by 13 patients for temporal (SAH) either in the left or the right or both, and finally, the (CT) findings showed that 7 patients have occipital (SAH) either in the left or the right or both.(Table 1-3)

-in term of SubDural Hemorrhage (SDH) the parietal regions also take the majority where there are 13 patients have (SDH) either in the left or the right or both, following by frontal regions where the (CT) findings showed that 9 patients have frontal (SDH) either in the left or the right or both, following by 8 patients for temporal (SDH) either in the left or the right or both, and finally, the (CT) findings showed that occipital regions also take the less findings for (SDH) where there are 2 patients only have occipital (SAH) either in the left or the right or both.(Table 1-3).

-in term of EpiDural Hemorrhage (EDH) the frontal regions take the majority where there are 8 patients have (EDH) either in the left or the right or both, following by parietal regions where the (CT) findings showed that 6 patients have frontal (EDH) either in the left or the right or both, following by 5 patients for temporal (EDH) either in the left or the right or both, and finally, the (CT) findings showed that occipital regions again take the less findings for (EDH) where there are no patients records for occipital (SAH).(Table 1-3).

-the result showed that only one patient has brainsetm hemorrhage.

- For skull fractures there are 26 out 71 patients whose (CT) was free from skull fractures and the other results show that the right frontal lobe take

the majority of lobes fractured compared to the other where there are 16 patients recorded with right frontal fracture, the right occipital lobe was the less one get fractures where the result show only 3 patients recorded.(Table 1-2).

- The (CT) of the brain show that 12 patients have a parietal bone fragments, 7 patients have frontal bone fragments, 3 bone fragments for the temporal and 3 for the occipital regions . (Table 1-2)
- There are 11 patients recorded with midline shift to right side, and 8 patients for midline shift to the left side. (Table 1-2)
- For eye globe rupture there are 4 patients recorded for the right and 4 patients for the left eyes. (Table 1-2)
- There are 6 patients whose brain (CT) results show they have Pneumocephalus, 2 patients they recorded for superior sagittal sinus injury, and one patient with optic nerve injury. (Table 1-2)

		Responses	
		N	Percent
Finding:	Brain contusion	27	11.5%
	Foreign Bodies	23	9.8%
	Brain Edema	23	9.8%
	RT. Frontal bone fracture	16	6.8%
	LT. Temporal bone fracture	13	5.6%
	LT. Parietal Fracture	13	5.6%
	RT. Parietal Fracture	12	5.1%
	Parital Bone Fragments	12	5.1%
	Midline shift to Right	11	4.7%
	RT. Temporal bone fracture	9	3.8%
	Midline shift to Left	8	3.4%
	Frontal Bone Fragments	7	3.0%
	LT. Frontal bone fracture	6	2.6%
	Skull base fracture	6	2.6%
	Depressed fracture	6	2.6%
	Pneumoccephalus	6	2.6%
	Brain tissue out	6	2.6%
	LT. Occipital Fracture	5	2.1%
	RT . eye globe rupture	4	1.7%
	LT . eye globe rupture	4	1.7%
	RT. Occipital Fracture	3	1.3%
	Brain Abscess	3	1.3%
	Temporal Bone Fragments	3	1.3%
	Occipital Bone Fragments	2	0.9%
	Superior Sagittal sinus injury	2	0.9%
	optic nerve injury	1	0.4%
	Ischemic change	1	0.4%
	Hydrocephalus	1	0.4%
	Diffuse Ischemia	1	0.4%
Total		234	100.0%

CT Findings (Table 1-2)

		Responses	
		N	Percent
Finding	Interventricular Hemorrhage IVH	17	11.1%
	LT. Parietal SAH	16	10.5%
	SubGaleal hematoma	12	7.8%
	RT. Parietal SAH	11	7.2%
	RT. Frontal SAH	9	5.9%
	LT. Temporal SAH	8	5.2%
	LT. Frontal SAH	7	4.6%
	RT. Parietal SDH	7	4.6%
	LT. Parietal SDH	6	3.9%
	Left ICH	6	3.9%
	RT. Temporal SAH	5	3.3%
	RT. Frontal EDH	5	3.3%
	LT. Frontal SDH	5	3.3%
	LT. Temporal SDH	5	3.3%
	RT. Parietal EDH	5	3.3%
	LT. Occipital SAH	4	2.6%
	RT. Frontal SDH	4	2.6%
	RT. Occipital SAH	3	2.0%
	LT. Temporal EDH	3	2.0%
	LT. Frontal EDH	3	2.0%
	RT. Temporal SDH	3	2.0%
	Right ICH	3	2.0%
	RT. Temporal EDH	2	1.3%
	LT. Parietal EDH	1	0.7%
	LT. Occipital SDH	1	0.7%
	RT. Occipital SDH	1	0.7%
	Brainstem Hemorrhage	1	0.7%
Total		153	100.0%

Hemorrhagic CT findings (Table 1-3)

- In term of the operations that was done for those patients while they admitted under care of neurosurgery, there are 30 patients go through surgery by neurosurgeons, the 14 surgeries was a Debridment surgery, 9 surgeries for craniotomy with debridment, 3 surgeries for debridment with

pus evacuation, 3 surgeries for decompressive craniotomy, and the other as show in (Table 1-4).

Surgery table

		Frequency	Percent
Valid	YES	30	42.3
	NO	41	57.7
	Total	71	100.0

Distribution of the surgery (Table 1-4)

- In term of Neurological deficits there are 23 patients involved in this deficits, 6 of them have brain death, 5 patients have left side hemiparesis, 4 patients with right side hemiplegia and 4 patients for the left side hemiplegia, the other neurological deficit findings show in (Table 1-5).

		Responses	
		N	Percent
find-	Brain death	6	20.0%
ings	LT. side Hemiparesis	5	16.7%
	RT. side Hemiparesis	4	13.3%
	RT. side hemiplegia	4	13.3%
	Vegetative State	3	10.0%
	Aphasia	3	10.0%
	Hearing loss	2	6.7%
	LT. side hemiplegia	1	3.3%
	RT. leg monoparesis	1	3.3%
	Uogaze Palsy	1	3.3%
Total		30	100.0%

Distribution of the Neurological deficits (Table 1-5)

- In term of prognosis of those patients while they admitted in the hospital thare are 17 patients out 71 whose involved in systemic problems, where there are 5 patients complained of brain abscess, 5 patients whose complain of Klebsiella infection, 5 patients complained of bedsores, 1 patient who involved in suicidal attempt, and the other results show in (Table 1-6).

		Responses	
		N	Percent
Findings	klebsilla infection	5	16.1%
	Brain Abscess	5	16.1%
	Enterococcus infection	4	12.9%
	Sacral region bedsore	4	12.9%
	Meningitis	2	6.5%
	Pseudococcus infection	2	6.5%
	MRSA	2	6.5%
	DVT	1	3.2%
	Occipital bedsore	1	3.2%
	Ischemic Hypoxia	1	3.2%
	LT. Femoral bedsore	1	3.2%
	Suicidal Attempt	1	3.2%
	Acinetobacter infection	1	3.2%
	Hydrocephalus	1	3.2%
Total		31	100.0%

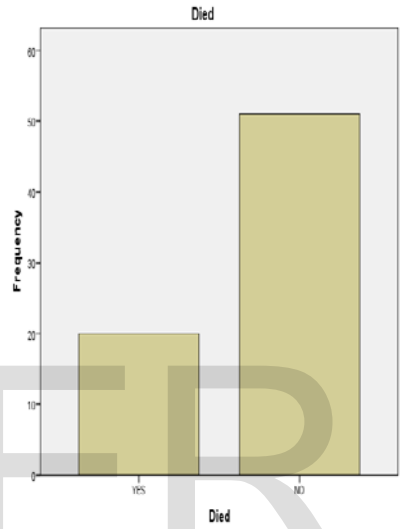
Distribution of the systemic problems during admission (Table 1-6)

- For referred concern, there are 6 patients out 71 whose referral, 1 of them referred to the psychiatric hospital, and the others referral due to either against medical advice or to higher centers.
- Under issues how many medical departments involved to manage those patients, the results showed that 12 patients out 71 whose still under neurosurgery care only, the others was with neurosurgery and the different specialist, where the general surgery is involved to consultation for 30 patients, ophthalmologist were consulted for 24 patients, and the others findings show in (Table 1-7).

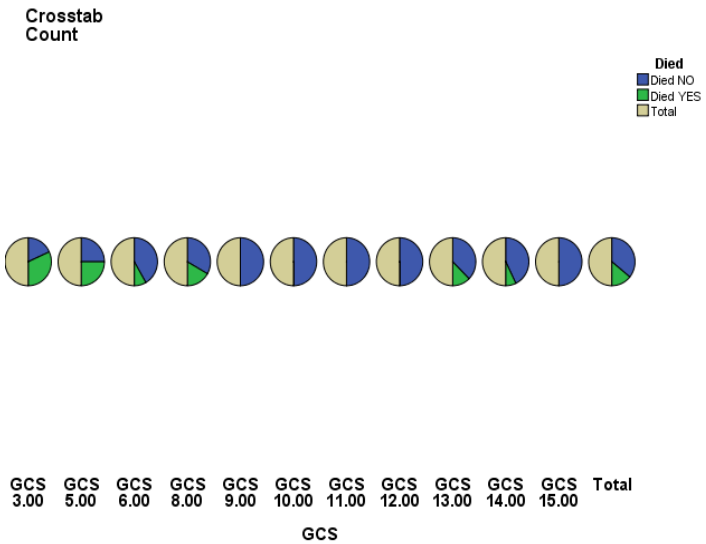
70% was 3 score on (GCS), and 10% was 5, and 80% of the them died within 1 month of admission.(Graph 1-2)
from 20 patients that died, a 7 of them undergoes through surgical intervention, compared to 13 patients who didn't go through surgery and they also died. (Table 1-8)
9 of deaths developing a neurological deficits, while the other 11 didn't, and 5 of them developing systemic problems while they admitted. (Table 1-8)
there are 28 patients who didn't go through surgical intervention and they survive, compared to 23 patients who go through surgery and survived.
the (Table 1-9) show the most characteristic findings in the death patients from (CT), prognosis while they in the hospital to identify the acceleration factors for death among (GSHI).

	Responses	
	N	Percent
General Surgery	30	12.5%
Ophthalmology	24	10.0%
ENT	21	8.8%
Medical	20	8.3%
Physiotherapy	14	5.8%
Plastic	14	5.8%
Maxillofacial Surgery	12	5.0%
Orthopedics	9	3.8%
Cardiology	6	2.5%
Derma	5	2.1%
Nephrology	4	1.7%
Gstrology	4	1.7%
Psychiatric	4	1.7%
Vascular Surgery	3	1.3%
Urology	3	1.3%
Thoracic Surgery	3	1.3%
NeuroMedical	2	0.8%
Interventional Radiology	1	0.4%
Endocrinology	1	0.4%
Hematology	1	0.4%
Total	240	100.0%

Distribution of the medical department that involved to manage the patient (Table 1-7)



Distribution of death (Graph 1-1)



Distribution of (GCS) among deaths .(Graph 1-2)

- For duration of admission concerns, the mean time of admission is 36.2 days, maximum 294 days, and the minimum is only 1 day.
- For survival rate and deaths, the 28.2% patients out 71 whose died, the mean of (GCS) of them was 8.8 out 15 at arrival, the results showed that

have Neurological Deficits?			Patient undergo to surgery		Total
			YES	NO	
NO	Died	NO	15	22	37
		YES	3	8	11
	Total		18	30	48
YES	Died	NO	8	6	14
		YES	4	5	9
	Total		12	11	23
Total	Died	NO	23	28	51
		YES	7	13	20
	Total		30	41	71

Distribution of the deaths according to surgery that done by neurosurgeons and Neurological deficits (Table 1-8)

Death patients	Sepsis	Brain edema	Brain contusion	IVH	Midline shift	EDH	SDH	SAH	Cerebral ischemia
1									
2									
3			Yes	Yes	Yes	Yes		Yes	
4		Yes						Yes	Yes
5		Yes		Yes	Yes		Yes	Yes	
6		Yes	Yes		Yes				
7				Yes				Yes	
8		Yes				Yes			
9	Yes	Yes	Yes		Yes				
10			Yes		Yes		Yes	Yes	
11	Yes	Yes		Yes	Yes				
12		Yes	Yes		Yes				
13	Yes		Yes			Yes			
14			Yes	Yes					
15				Yes	Yes			Yes	
16				Yes		Yes		Yes	
17		Yes		Yes				Yes	
18		Yes		Yes					
19	Yes							Yes	
20		Yes	Yes	Yes	Yes			Yes	
Total	4	10	8	10	9	4	1	10	1

The moat characteristic findings in death patients from arrival until died (Table 1-9)

DISCUSSION

The Trauma Brain Injury (TBI) is a heterogeneous disorder with different forms of presentation. it's defined as “brain damage resulting from external forces, as a consequence of direct impact, rapid acceleration or dece-

leration, a penetrating object (e.g., gunshot) or blast waves from an explosion.

The main causes of (TBIs) are transport incidents, falls, and gunshot wounds. These injuries, caused by misadventure, violence, or carelessness, all reflect societal behavior.

the Saudi Arabia statistical in 2015 indictate that Saudi red crescent ambulance dilvered more than 98,000 victims of Road Traffic Accidents (RTA), more than 16,000 due to fall, and 9,497 delivered due to assaults.(18)(4)

The (TBI) is affects all societies around the world, More than 10 million people world-wide suffer (TBI) serious enough to result in death or hospitalization each year.(19) there are a different approaches used in the classification of (TBI). From a mechanistic perspective, closed, penetrating, crush, and blast injuries are distinguished. the Blast injuries have been identified as a separate entity and are frequently caused by improvised explosive devices, used during armed conflicts or terrorist activities.

The Clinical severity of intracranial injuries is commonly assessed by the Glasgow Coma Score (GCS), where from 3-8 consider a severe, 9-13 is moderate, and 14-15 is mild.(4)

The assessment of the structural damage is from the initial (CT) according to the Marshall (CT) classification, which focusing on the mesencephalic cisterns, the degree of midline shift in millimeters, and the presence or absence of one or more surgical masses.

this assessment is divided the "diffuse head injury " to four subgroups, There is a direct relationship between these four diagnostic categories and the mortality rate. Patients suffering of diffuse injury with no visible pathology (Diffuse Injury I) have the lowest mortality rate (10%), while the mortality rate in patients suffering of diffuse injury with a midline shift (Diffuse Injury IV) is greater than 50%. When used in conjunction with the traditional division of intracranial hemorrhages (extradural, subdural, or intracerebral), this categorization allows a much better assessment of the risk of intracranial hypertension and of a fatal or nonfatal outcome. (20)

in a clinical term , the brain injuries can be classified into three categories: skull fracture, focal injury, and diffuse brain injury. while the skull fracture requires significant biomechanical loading, and often not a direct cause of neurological disability. the focal injuries are defined as visible damage to the parenchyma which represents the half of all patients with severe brain injuries ; (e.g., contusion, SAH, SDH, and EDH). the focal injuries are responsible for approximately two thirds of brain injury-related-deaths.(21)

(TBI) can cause cerebral edema, contusions, or intracranial hemorrhage, which lead to brain herniation across dural or skull-defined compartments. Because increased intracranial pressure is a common mechanism of deterioration and death, herniation of the brain will be considered before specific types of injury are described, because the brain lives in a closed box, immediate consequence of placing additional volume into the fixed space of the intracranial vault, If the volume of the lesion exceeds compensatory (CSF) volume reduction, then cerebral blood flow can have immediate adverse consequences.(4) development of cerebral edema can complicate any process that gives rise to increased pressure, creating a self-perpetuating cycle in which increasing edema begets increasing pressure which in turn begets more edema.(22)

The extent of injury by a bullet is related to the amount of kinetic energy possessed by the bullet, which is transferred to the tissue during transit. Elementary mechanics taught that, The amount of energy possessed by a projectile increases much more rapidly as a function of velocity than mass; therefore, injury is related more to missile velocity than mass. As a result, rifles use high-velocity projectiles with lower mass compared with handguns. Missile passage through the soft compliant brain is associated with cavitation, lasting several milliseconds with subsequent collapse of the cavity to form the bullet track within the tissue. Bullet injuries can be amplified by bullet fragmentation and ricochet and the formation of secondary missiles from fragmented skull, scalp, and clothing.(23) Following severe (TBI), patients may remain comatose, reside in a persistent vegetative state, or show varying degrees of motor, cognitive, affective, and coordination impairment. The neuropathology of these states has been limited.(24)(25)

Epidemiologic studies have shown that TBI is a significant risk factor for neurodegenerative disorders such as Alzheimer's disease, Parkinson's disease, and amyotrophic lateral sclerosis. In addition, chronic traumatic encephalopathy is a neuropathologically unique condition that has received increased study.(26)

a study conducted to review 13 studies about Penetrating Bihemispheric Traumatic Brain Injury show that mean mortality rate of all (GSHI) was 62% in adults and 32% in children, and bihemispheric (GSHI) had greater mortality rates of 82% in adults and 60% in children. (27)

The Managements of Gunshot Head Injury (GSHI) are start from arrival according to Advanced Trauma Life Support primary survey and resuscitation of the patient, post-resuscitative (GCS) of the patients should be documentedand, noted of CSF, bleeding, or brain parenchyma oozing from the wound, and all the orifices must be checked for retention of foreign bodies, the missile, teeth, and bone.

the neurological deficit should be documented, Hemotympanum suggests a skull base fracture. The superficial scalp should also be observed for powder burns, which would imply a close range firearm injury. Clinical features suggestive of raised intracranial pressure (ICP) must be documented carefully. Neurological examination, which should be followed by a complete examination of other organ systems, is recommended as PBI patients may have multiple organ injuries. Once the initial evaluation is done, the patient should be transferred to (CT), and the cerebral angiography (either CT or catheter) is recommended in patients with (GSHI) where there is an increased risk of vascular injury.

The surgical intervention for small entrance bullet wounds to the head in patients whose scalp is not devitalized and have no significant intracranial pathologic findings is recommended. More extensive wounds with nonviable scalp, bone, or dura should be debrided more extensively before primary closure or grafting to secure a watertight wound. When there is significant mass effect, necrotic brain tissue should be debrided and safely accessible bone fragments should be removed. Intracranial hematomas with significant mass effect should be evacuated. Routine surgical removal of bone or missile fragments lodged distant from the entry site especially in the eloquent areas of the brain is not recommended. Although removal of these foreign bodies from eloquent cortex may decrease the risk of posttraumatic epilepsy, it has been documented to correlate with worse outcomes and higher morbidity, A conservative approach toward cerebral debridement in general has, thus, been recommended.

The Surgical treatment should be performed within 12 h of the injury to decrease the risk of infectious complications. Surgical incision should be done in such a fashion so as to incorporate (if possible) the area that needs debridement and vascular supply of the flap. When the trajectory of the missile violates an open air sinus, a water tight closure of the dura should be done as the literature suggests that it may decrease the risk of abscess formation and CSF fistulas.

A recent large study of military patients suffering from severe (GSHI) reported optimum outcomes with early decompressive craniectomy. In military settings, there has been a recent paradigm shift toward an aggressive approach comprising of rapid, far forward cranial decompression with water-tight dural closure followed by rapid evacuation to a major trauma center. This approach, accompanied by subsequent aggressive critical care, has led to better outcomes in wartime (GSHI) patients.(28)

CONCLUSION

The Gunshot Head Injury is more important issue for society and health care providers. The rapid transportation to the hospital, and availability of neurosurgeons will all facilities is required to provide the best of care for Gunshot victims or all Trauma head injuries as a whole, they play an important role to undergoing urgent surgery, prevent the brain damages as much as possible. The hospital environment is very important to prevent the infections and early detected of sepsis.
The surgical intervention was an effective solution rather than conservative management.

REFERENCES

1. TBI: What is Traumatic Brain Injury | Brain Injury Information | Brain Injury Treatment [Internet]. [cited 2017 Aug 8]. Available from: http://www.traumaticbraininjury.com/understanding-tbi/what-is-traumatic-brain-injury/
2. Traumatic Brain Injury (TBI) - Definition and Pathophysiology: Overview, Epidemiology, Primary Injury [Internet]. [cited 2017 Jul 31]. Available from: http://emedicine.medscape.com/article/326510-overview#a1
3. Traumatic Brain Injury. [cited 2017 Aug 8]; Available from: https://medlineplus.gov/traumaticbraininjury.html
4. Winn HR. Youmans and Winn neurological surgery. 7th ed. 3610 p.
5. Sosin DM, Sacks JJ, Smith SM. Head Injury-Associated Deaths in the United States From 1979 to 1986. JAMA J Am Med Assoc [Internet]. 1989 Oct 27 [cited 2017 Jul 31];262(16):2251. Available from: http://jama.jamanetwork.com/article.aspx?doi=10.1001/jama.1989.03430160073033
6. Taylor CA, Bell JM, Breiding MJ, Xu L. Traumatic Brain Injury–Related Emergency Department Visits, Hospitalizations, and Deaths — United States, 2007 and 2013. MMWR Surveill Summ [Internet]. 2017 Mar 17 [cited 2017 Aug 8];66(9):1–16. Available from: http://www.cdc.gov/mmwr/volumes/66/ss/ss6609a1.htm
7. CDC. e p a rt m e nt of H e a l t h a nd H um a n Se rv ice s C e nt e rs f or D is e a s e C ont rol a nd Pre v e nt ion. [cited 2017 Aug 8]; Available from: www.cdc.gov/TraumaticBrainInjury
8. TBI: Causes of Traumatic Brain Injury [Internet]. [cited 2017 Aug 9]. Available from: http://www.traumaticbraininjury.com/understanding-tbi/what-are-the-causes-of-tbi/
9. Aarabi B, Mossop C, Aarabi JA. Surgical management of civilian gunshot wounds to the head. In: Handbook of clinical neurology [Internet]. 2015 [cited 2017 Jul 31]. p. 181–93. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25702217
10. AANS | Gunshot Wound Head Trauma [Internet]. [cited 2017 Aug 9]. Available from: http://www.aans.org/Patients/Neurosurgical-Conditions-and-Treatments/Gunshot-Wound-Head-Trauma
11. Federico Vinas. Penetrating Head Trauma: Background, History of the Procedure, Problem [Internet]. [cited 2017 Aug 9]. Available from: http://emedicine.medscape.com/article/247664-overview#a5
12. Civilian gunshot wounds to the head: a prospective study. [Internet]. [cited 2017 Aug 9]. Available from: http://reference.medscape.com/medline/abstract/2259398
13. Civilian craniocerebral gunshot wounds. [Internet]. [cited 2017 Aug 9]. Available from: http://reference.medscape.com/medline/abstract/1870690
14. Civilian craniocerebral gunshot wounds: an update in predicting outcomes. [Internet]. 2005 [cited 2017 Aug 9]. Available from: http://reference.medscape.com/medline/abstract/16447469
15. Al Madni O, Kharosha MAA, Shotar AM. Firearm fatalities in Dammam, Saudi Arabia. Med Sci Law [Internet]. 2008 Jul [cited 2017 Jul 19];48(3):237–40. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18754211
16. Elfawal MA, Awad OA. Firearm fatalities in Eastern Saudi Arabia: impact of culture and legislation. Am J Forensic Med Pathol [Internet]. 1997 Dec [cited 2017 Jul 19];18(4):391–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9430293
17. Softah AL, Eid Zahrani M, Osinowo O. Gunshot injuries in adults in the Abha region of Saudi Arabia. Afr J Med Med Sci [Internet]. 2002 Mar [cited 2017 Jul 19];31(1):41–4. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12518928
18. Statistical Yearbook - Statistical Yearbook [Internet]. 2013 [cited 2017 Aug 9]. Available from: http://www.moh.gov.sa/en/ministry/statistics/book/pages/default.aspx
19. WHO | World Health Statistics 2007. WHO [Internet]. 2010 [cited 2017 Aug 9]; Available from: http://www.who.int/whosis/whostat2007/en/
20. Lawrence Marshall, Howard Eisenberg, John Jane, Thomas Luerssen, Anthony Marmarou MF. A new classification of head injury based on computerized tomography. 1991 [cited 2017 Aug 9];75:s14–20. Available from: http://thejns.org/doi/abs/10.3171/sup.1991.75.1s.0s14
21. Mathers CD, Loncar D, Boreham J, Thun M, Heath J, Doll R. Projections of Global Mortality and Burden of Disease from 2002 to 2030. Samet J, editor. PLoS Med [Internet]. 2006 Nov 28 [cited 2017 Aug 9];3(11):e442. Available from: http://dx.plos.org/10.1371/journal.pmed.0030442
22. Allen KA. Pathophysiology and Treatment of Severe Traumatic Brain Injuries in Children. J Neurosci Nurs [Internet]. 2016 Feb [cited 2017 Aug 9];48(1):15–27; quiz E1. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26720317
23. Peeters W, van den Brande R, Polinder S, Brazinova A, Steyerberg EW, Lingsma HF, et al. Epidemiology of traumatic brain injury in Europe. Acta Neurochir (Wien) [Internet]. 2015 Oct [cited 2017 Aug 9];157(10):1683–96. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26269030
24. Gururaj G. Epidemiology of traumatic brain injuries: Indian scenario. Neurol Res [Internet]. 2002 Jan 19 [cited 2017 Aug 9];24(1):24–8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/11783750
25. Ivins BJ, Schwab KA, Warden D, Harvey LS, Hoilien MM, Powell CJ, et al. Traumatic Brain Injury in U.S. Army Paratroopers: Prevalence and Character. J Trauma Inj Infect Crit Care [Internet]. 2003 Oct [cited 2017 Aug 9];55(4):617–21. Available from: http://www.ncbi.nlm.nih.gov/pubmed/14566111
26. Warden D. Military TBI during the Iraq and Afghanistan wars. J Head Trauma Rehabil [Internet]. [cited 2017 Aug 9];21(5):398–402. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16983225
27. Turco L, Cornell DL, Phillips B. Penetrating Bihemispheric Traumatic Brain Injury: A Collective Review of Gunshot Wounds to the Head. World Neurosurg [Internet]. 2017 Aug [cited 2017 Aug 9];104:653–9. Available from: http://linkinghub.elsevier.com/retrieve/pii/S1878875017307672
28. Kazim SF, Shamim MS, Tahir MZ, Enam SA, Waheed S. Management of penetrating brain injury. J Emerg Trauma Shock [Internet]. 2011 Jul [cited 2017 Aug 9];4(3):395–402. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21887033