An-Najah National University
Faculty of Graduate Studies

Major Causes of Traumatic Brain Injuries in Patients Admitted to Rafidia, Al-Ittihad and Specialized Arab Hospitals (2006-2007)

By
Rafif Husni Mohammad Younis

Supervisor
Dr. Mohammad Musmar

Co-supervisor
Dr. Samer Hamidi

Submitted in Partial Fulfillment of the Requirements for the Degree of Master in Public Health, Faculty of Graduate Studies, An-Najah National University, Nablus, Palestine.
2008

Major Causes of Traumatic Brain Injuries in Patients Admitted to Rafidia, Al-Ittihad and Specialized Arab Hospitals (2006-2007)

By
Rafif Husni Mohammad Younis

This thesis was defended successfully on 17/7/2008 and approved by:

Committee members	Signature
Dr.Mohammad Musmar (Supervisor)	----------
Dr. Samer Hamidi (Co-Supervisor)	----------
Dr. Ayman Hussein (Internal Examiner)	----------
Dr. Somaya Saej (External Examiner)	----------

ACKNOWLEDGMENTS

It is not possible to credit the many who have contributed toward the accomplishment of this research. However, I would like to give particular recognition to those who helped and guided me through this study. Special thanks are due to my advisors, Dr. Mohammad Musmar and Dr. Samer Hamidi, for their help and support.

My acknowledgment also goes to all the staff at Rafidia hospital and to Dr. Muthhar Darwazeh in particular, for their cooperation, patience and kind assistance in providing me with the necessary information. And an acknowledgment goes to people working at Al-Ittihad and the Specialized Arab hospitals, and Bethlehem Arab Society for Rehabilitation for the considerable help they provided me while conducting this study.

I shall never be able to express adequately my acknowledgment to Mr. Mohammad Majali, Dr. Ibrahim Ali Khalil, Mrs. Samaher Imleh, and to all my supportive friends, who were very co-operative and helpful.

Sincere thanks, true appreciation, and love go to all my family members, especially to my father and mother, for their patience, encouragement, and endless support during my graduate study.

إقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

الأسباب الرئيسية المؤدية لإصابات الدماغ عند المرضى الذين تم إدخالهم مستشفى رفيديا، الإتحاد، والعربي التخصصي من فترة 2006–2007

Major Causes of Traumatic Brain Injuries in Patients Admitted to Rafidia, Al-Ittihad and Specialized Arab Hospitals (2006-2007)

أقر بأن ما اشتملت عليه هذه الرسالة إنما هي نتاج جهدي الخاص، باستثناء من تمت الإشارة إليه حيثما ورد، وأن هذه الرسالة ككل، أو أي جزء منها لم يقدم من قبل لنيل أية درجة أو لقب علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: ---------- اسم الطالب:

Signature: ---------- التوقيع:

Date: ---------- التاريخ:

LIST OF ABBREVIATIONS

ADL	Activities of Daily Living
AIS	Abbreviated Injury Scale
BASR	Bethlehem Arab Society Rehabilitation Center
CHI	Closed Head Injury
GCS	Glasgow Coma Scale
GOS	Glasgow Outcome Scale
JPBC	Jerusalem Princess Bassma Center
KARRC	Khalil Abu Society For Rehabilitation
MoH	Ministry of Health
OHI	Open Head Injury
PCBS	Palestinian Central Bureau of Statistics
PTA	Post Traumatic Amnesia
RC	Road Crash
RTA	Road Traffic Accident
TBI	Traumatic Brain Injury
TBIs	Traumatic Brain Injuries
UK	United Kingdom
USA	United States of America
WHO	World Health Organization

LIST Of CONTENTS

LISTS OF TABLES

LISTS OF FIGURES

Major Causes of Traumatic Brain Injury in Patients Admitted to Rafidia, Al-Ittihad and Specialized Arab Hospitals (2006-2007)

By
Rafif Husni Mohammad Younis
Supervisor
Dr. Mohammad Musmar
Co-supervisor
Dr. Samer Hamidi

Abstract

According to the World Health Organization (WHO), Traumatic Brain Injury (TBI) is one of the 21st century epidemics similar to malaria and HIV/AIDS; and it is not only restricted to the developed world[1]. In Palestine, since the outbreak of Al-Aqsa Intifada in 2000, there has been an increase in the number of assaults by bullet injuries used by Israeli soldiers. Morbidity and mortality reports showed that high numbers of injuries were in the head; consequently, the Traumatic Brain Injuries (TBIs) are considered a major public health problem in Palestine.

Objectives of the study

The main aim of the study was to determine the major causes of TBI in patients admitted to Rafidia, Al-Ittihad, and the Specialized Arab hospitals between 2006- 2007.

Subjects and Methods

The study was carried out retrospectively by reviewing the medical records of TBI patients admitted to the three targeted hospitals in Nablus in 2006 and 2007. Gathering data for 312 TBI patients from their medical

records by filling of case survey sheet for each patient. Glasgow Coma Scale (GCS) was used to assess the level of severity of TBI.

Results

The study showed that the major causes of TBI were assaults (33%), followed by falls (32.1%), road traffic accidents (29.8%), and hits by heavy objects (3.2%). Falls and hits by heavy objects were more common among children aged less than 5 years old, while assaults and road traffic accidents were more common among age group 19-29 years. Males were found to be more exposed to the causes of TBI than females.

The study also showed that about 29.2% of the study population had sustained functional disability, and 6.7% had been fatally injured as outcome following TBI at hospital discharge. Among the admitted patients with head injuries, 66.7% had died due to assaults, 19% due to road traffic accidents, 9.5% due to falls, and 4.8% due to hits by heavy objects.

Conclusion

Assaults are the major leading cause of TBI. Majority of them, assaults were caused by bullets and head blows of Israeli forces. Assaults were associated with more severe injuries compared to the others. Morbidity and mortality are very high among assaults victims.

Key Words : Traumatic Brain Injury (TBI), Assaults.

CHAPTER I

INTRODUCTION

1.1 Background and Need for the study

1.1.1 Definition

Worldwide, head injury is recognized as a major public health problem. TBI is the leading cause of death and disability in children and adults in their most productive years, and makes considerable demands on health services. As such, this is a problem that is a major social and economic burden to society**.** TBI has been termed by the WHO to be a 21st century epidemic similar to malaria and HIV/AIDS; and it is not restricted to the developed world[1].

The Brain Injury Association (BIA, USA) (2000) defines TBI as a non-degenerative, non–congenital insult to the brain from an external physical force, possibly leading to permanent or temporary impairments of cognitive, physical and psychosocial functions with an associated diminished or altered state of consciousness[2].

TBI may occur as a result of road traffic accident (RTA), fall or physical assault. RTA or motor vehicle traffic accident includes autos, trucks, motorcycles, bicycles, and pedestrians hit by vehicles. The highest morbidity and mortality is among drivers aged 15-19[1,2]. Motor vehicle crashes account for 50% of all TBIs[2]. The second most common cause of the injury is falls from height or being hit by falling debris, approximately 20-30% of TBI, and falls are the leading cause among the very young and the elderly[2]. In many parts of the world, physical assault is fast becoming one of the leading causes of TBI, particularly in the lower socio-economic groups and war-torn countries. Firearms or gunshots, blow–sharp/penetrating instruments to the head are the third leading cause of TBI

(12% of all TBIs)[1]. In addition, sports or recreational-related activities are the leading cause of TBI. This is common among sportsmen such as boxers and soccer player[1,3].

1.1.2 Head Injury in Palestine

Palestine, one of the most some trouble parts of the world, has been plagued with an open conflict for more than six decades. Physical assault, as a result, is becoming one of the leading causes of injuries and head injuries in particular. Firearms or bullet injuries are one kind of assault and are considered one of the major causes of head injuries in the country.

During the last eight years, since the outbreak of Al-Aqsa Intifada on the 29th of September 2000, Israeli military authorities have started a policy of incursions into the Palestinian territories . The Israeli army, during its operations, uses live ammunition against Palestinians (machine guns, tear gas, and stun bombs). As a result a lot of people have been killed or seriously wounded.

Since 2000, the Palestinians have sustained over 48,021 casualties.Most of them have sustained either permanent or temporary impairment that has led to have more and more disabled people. According to Palestinian Central Bureau of Statistics (PCBS), the disability percentage was 1.9% in 1997 census as opposed to 3.2% in 2006[4].

From the end of September 2000 to mid-2006, the total number of casualties in the West Bank was 32,442 compared to 15,579 in the Gaza Strip[5] .

Table 1.1: Distribution of casualties in Palestine from September 29, 2000 to June 30, 2006.

Area	Population #	Casualties	
		Number	Rate/ 1,000
West Bank	2,444,478	32,442	13.2
Gaza Strip	1,443,814	15,579	10.8
Palestine	3,888,292	48,021	12.3

*Source: Palestinian Ministry of Health (MoH), Palestinian Health Information Center, biannual report 2006

The highest rate of casualties among Palestinian governorates was Nablus governorate with 7,457 injuries at the rate of 45.02 per /1,000, followed by Ramallah governorate with 6,106 injuries at the rate of 42.9 per/1,000 respectively. In the Gaza Strip's Rafah governorate, the rate of causalities was 3,356 injuries at a rate of 40.1 per /1,000 population[6].

Table 1.2: Distribution of casualties in Palestine's northern governorates, (2005).

Governorate	Casualties	
	Number	Rate/1,000
Nablus	7,457	45.02
Tulkarm	3,294	38.72
Jenin	2,026	13.29
Qalqilia	755	15.81
Salfit	249	7.91

*Source: Palestinian MoH, Al-Aqsa Intifada, Chapter VIII, annual report 2005

During Al-Aqsa Intifada, the morbidity and mortality reports showed that high numbers of injuries were in the head . Number of Palestinians, who were killed by shooting at head, from September 29, 2000 to December 31, 2006 was 319 as opposed to 4,276 who sustained head injuries[7]. Tables 1.3 and 1.4 summarize the distribution of Palestinian casualties and martyrs who died of head injuries in northern governorates, and distribution of Palestinian disabled people due to TBIs, according to sex and northern governorate, between September 29, 2000 and December 31, 2006[7].

Table 1.3: Distribution of Palestinian casualties and martyrs who died of head injuries according to northern governorate

Status	Governorate	Sex		Total
		Male	Female	
Casualties	Nablus	1,118	141	1,259
	Tulkarm	452	21	473
	Jenin	294	15	309
	Qalqilia	121	6	127
	Salfit	24	3	27
	Total	2,009	186	2,195
Martyrs	Nablus	88	5	93
	Jenin	60	3	63
	Tulkarm	28	1	29
	Qalqilia	15	0	15
	Salfit	2	0	2
	Total	193	9	202

*Source: Palestinian MoH, Palestinian Health Information Center, Nablus Branch, Bullet head injuries statistics, 2000-2006.

Table 1.4: Distribution of Palestinian disabled people sustaining head injuries according to sex and northern governorate

Governorate	Sex		Total
	Male	Female	
Nablus	39	4	43
Jenin	30	3	33
Tulkarm	2	0	2
Qalqilia	1	0	1
Salfit	1	0	1

*Source: Palestinian MoH, Palestinian Health Information Center, Nablus Branch, Bullet head injuries statistics, 2000- 2006.

Most of patients with bullet head injuries, living in the northern part of West Bank, are referred to Rafidia hospital.

Table 1.5: Distribution of Palestinian casualties and martyrs who died of head injuries according to Nablus hospitals, September 29, 2000 – December 31, 2006[7].

Status	Hospital	Sex		Total
		Male	Female	
Casualties	Rafidia	1,079	126	1,205
	Al-Ittihad	40	6	46
	Nablus Specialty	30	4	34
	St. Lukes	14	5	19
	Total	1,163	141	1,304
Martyrs	Rafidia	90	5	95
	Al-Ittihad	3	0	3
	St.Lukes	1	0	1
	Total	94	5	99

*Source: Palestinian MoH, Palestinian Health Information Center, Nablus Branch, Bullet head injuries statistics, 2000-2006.

Some patients who had sustained either temporary or permanent disability, following TBI, were referred to centers specialized in brain injuries rehabilitation. One such rehabilitation center is Abu Raya in Ramallah. Another is Jerusalem - based Princess Bassma Rehabilitation Center for individuals with special needs for young people with TBI. A third center is Bethlehem Arab Society for Rehabilitation in southern West Bank.

1.1.3 Rehabilitation centers for in-patients with brain injuries in West Bank:

- **Bethlehem Arab Society Rehabilitation Hospital (BASR) Specialized Rehabilitation and Surgery Hospital**

BASR stands for Bethlehem Arab Society for Rehabilitation which was founded in 1960 as one of Leonard Cheshire's homes. Now-a-days, it is non-governmental organization that is nationally recognized for the comprehensive medical and rehabilitation services, it renders to beneficiaries from different parts of Palestine, particularly those with special needs regardless of their gender, age, religion or social class.

The society's aim to admit badly disabled young children with serious injuries and disabilities and give them intensive treatment, usually over a 3 – 6 months period, after which they return to their families.

BASR does not exclusively work with children; it also provides medical treatment and rehabilitation services to older disabled children and adults, including nursing care, physiotherapy, occupational therapy and speech therapy. The new Centre, built in 1990, provides a vocational training. Through this work, the centre aims now at provide holistic rehabilitative care.

- **Rehabilitation Services in BASR**

BASR provides rehabilitation services by a qualified multi-disciplinary team who assesses the patients referred, plans and implements their rehabilitation program and monitors their progress. Patients and their families are involved in decision making regarding the rehabilitation

process. The rehabilitation departments receive patients with head injuries, these departments encompass; The medical Rehabilitation Department, Nursing Department, Physiotherapy Department, Occupational Therapy Department, Audiology Department, Speech and Language Therapy Department, Psychology Department, Intensive Care Unit, Psychiatry Clinic, Social Services Department, Orthotics And Prosthetics Department, Special Education Department, Community Based Rehabilitation (CBR) program, and Vocational Training Program.

- **Patient's Friends Society/Ramallah Khalil Abu Raya Rehabilitation Center (KARRC):**

Patient's Friend's Society was established in Ramallah, in 1978 as a nonprofit charitable institution with a legal capacity. The society's major objective was to provide primary health care services. The society is officially registered with the Palestinian Ministry of Social Affairs and with the Ministry of Interiors. In 1990, the society was able, with Swedish assistance, to KARRC to provide specialized rehabilitation services at the national level in response to the Palestinian community needs resulting from the increase in the number of patients and injured during the Intifada in 1987. Since its establishment, the center was able to provide specialized medical and rehabilitation services for thousands of physically disabled and wounded Palestinians. KARRC carries out rehabilitation activities through the following departments, programs and committees which meet the Society's current and future objectives:

1) The Administrative Departments include :

Secretarial activities and filing, Development and Public Relations Department, Accounting, Personal, Purchase and Supplies Department, Services Department, and Library.

2) The Medical departments include :

Outpatient clinics, Nursing Department, Physiotherapy Department, Occupational Department, Social Service Department, Children Department (Spinal Cord Injuries), Laboratory, Radiology, A workshop for manufacturing, and maintenance of wheel chairs, and rehabilitation aids and a clinic for manufacturing artificial limbs.

3) Supporting Programs :

Field Follow-up Program (Outreach Program), Local Community-Based Rehabilitation Program, Social Committee Program, Family Integration and Rehabilitation, Continuous Education and Training Committee.

Table 1.6: Information about in-patients and out-patients treated in KARRC between January 1, 2006 – December 31, 2006.

Department	Number of Out-patients	Number of In-patients	Total
Physiotherapy Department	1575	276	1851
Occupational Department	92	276	368
Out Patient Clinics	1849	139	1988
Nursing Department	------	139	139

* Source: KARRC, annual report 2006

In Palestine, there is one center for rehabilitation called Jerusalem Princess Bassma Center for disabled children receive children with TBI for rehabilitation, located in Jerusalem. Children living in northern part of

Palestine like Nablus, or Jenin are referred to this center to receive intensive rehabilitation services.

- **Jerusalem Princess Bassma Center for Disabled Children (JPBC)**

JPBC offers vocational training for children and youth with disabilities. Through its sheltered workshops, JPBC provides rehabilitation and job training services allowing its graduates to find viable employment in the community. Through their participation in these programs, women with disabilities have been able to network, problem solve and achieve greater financial and social independence.

Children less than 15 years old are admitted for a period of one week to three months, depending on their needs. Being a charitable, non-governmental, non-profitable institution, the children's families are charged a nominal fee of one hundred dollars a month. The mother is admitted with her child free of charge. As well as basic medical care, the services at the center include: physiotherapy, hydrotherapy, and recreational therapy, occupational center for making prosthetic devices, academic schooling and out-patient physiotherapy services.

As there are specialized rehabilitation centers for TBI in West Bank like BASR, KARRC, and JPBC in Jerusalem, in northern part of West Bank, there is no one center specialized in brain injury for inpatient care and rehabilitation located in Nablus or other northern governorates.

1.1.4 Geography of Nablus and general features

The Nablus governorate is an administrative district under the Palestinian National Authority. Nablus is 63 Km north of Jerusalem, it has

a total area of 613,5 sq.km, while Nablus city is 28,5 sq. km between two mountains. Mount Ebal, the northern mountain, is the taller peak at 940 meters, while Mount Gerizim, the southern mountain, is 881 meters high. The Nablus governorate is the home to 336,380 inhabitants, including three refugee camps and several surrounding villages. The estimated population of the city in 2006 is 134,116 according to PCBS[8].

Table 1.7: Population for Nablus governorate by locality 2006.

Locality	Population
Nablus Governorate	336,380
Nablus	134,116
Asker refugee Camp	12,706
Balata refugee Camp	17,645
Ein Beit elMa refugee Camp	5,036
Surrounding Villages	166,877

*Source: PCBS website

The majority of the patients with TBI in the West Bank, and from Nablus and other northern governorates in particular are mostly admitted to KARRC or BASR.

According to annual reports of BASR, the total number of TBI, rehabilitated in the society, since the outbreak of Al-Aqsa Intifada till 2006, was about 367.

Road traffic accidents, falls, and bullet injuries respectively were the major causes of TBI seen in patients admitted to BASR.

1.1.5 Demography of Palestine in Population Age and Sex Ratio

- The Palestinian population in the Palestinian Territories is young. More than half of the Palestinians (53.0%) were children under the age of 18

in 2004 (1,954,000 children). Of these 42.2% were refugees: 37.9 % in the West Bank, and 62.1% in the Gaza Strip[8].

- In 2005, the percentage of Palestinians who were 65 years old and older in Palestine was 2.8% [8].
- In 2005, the estimated number of males in Palestine was 1,905,640 as opposed to 1,856,360 females. The sex ratio in Palestine is 102.7 males per 100 females. In the West Bank, the number of males was 1,202,110 compared with 1,170,110 females. The sex ratio was 102.7. In the Gaza Strip, the number of males was 703,530 compared with 686,260 females. The sex ratio was 102.5[8].

1.2 Significance of the study to Palestine

Since the eruption of Al-Aqsa Intifada which created a war situation in Palestine, there has been an increase in the number of assaults by bullet injuries used by Israeli soldiers. Morbidity and mortality reports showed that high numbers of injuries were in the head, thus causing head injuries and leading to brain damage. These injuries are considered a major public health problem in Palestine. However, Palestinian MoH and other health organizations had no national data on overall prevalence and incidences of head injuries or head injuries leading to brain injuries. The only data available was that concerning bullet injuries causing head injuries. Data concerning accidental injuries or deaths from accidents, like road traffic accidents or falls, were available, but these data failed to identify head injuries.

After reviewing medical records of patients with TBI in hospitals, it was found that data concerning this subject were insufficiently documented or addressed.

This study is the first attempt designed in order to describe the major causes of TBI and TBI outcome, and to address the available rehabilitation services. The researcher focused on the northern part of West Bank and on Nablus in particular due to the absence of inpatient rehabilitation hospitals providing medical and intensive rehabilitation services for patients with permanent disability resulting from a TBI.

1.3 Objectives of the Study

The Present study has the following objectives:

1) To determine the major causes TBI in patients admitted to Rafidia, Al-Ittihad, and the Specialized Arab hospitals between 2006- 2007.
2) To describe the population at risk for TBI
3) To describe outcomes following TBI among the targeted population of study.
4) To describe the rehabilitation services as provided for patients with TBI among the targeted population of study.

1.4 Research Questions

This study may attempt to address the followings:

1) Is there any relationship between the causes of TBI and socio-demographic variables (patient's gender, age, place of residence, and marital status)?

2) Is there any relationship between outcomes following TBI at hospital discharge, and socio-demographic variables (patient's age, and level of education)?
3) Is there any relationship between outcomes following TBI at hospital discharge, and causes of TBI?

1.5 The Hypotheses

1) There is no relationship between causes of TBI and gender at a significant level 0.05

2) There is no relationship between causes of TBI and age at a significant level 0.05

3) There is no relationship between causes of TBI and place of residence at a significant level 0.05

4) There is no relationship between causes of TBI and marital status at a significant level 0.05

5) There is no relationship between outcomes following TBI at hospital discharge and causes of TBI at a significant level 0.05

6) There is no relationship between outcomes following TBI at hospital discharge and age at a significant level 0.05

7) There is no relationship between outcomes following TBI at hospital discharge and level of education at a significant level 0.05

1.6 Limitations of the study

This present study had one major limitation. It addressed the outcomes following TBI at the time of hospital discharge. However, for data collection, the researcher used a scale called GCS Score, also used by the physicians, and its scores are documented in medical records. This scale can determine the severity of injury, but can't determine worse outcomes as functional disability or coma. The researcher gathered the information from the patient or his caregivers about the outcomes following TBI at the time of hospital discharge that should be determined at onset of injury. Therefore, data collection for outcomes during hospital discharge will not be accurate when taken by patient or his caregivers after one or two years of injury.

Moreover, this current study is limited to terms used in case survey, whereas coma and vegetative state are used as the same term. While these terms have a different use, the researcher couldn't determine them because they can be only determined at the time of hospital discharge for the patient and the data of this study were retrospective collected after the development of head injury or TBI. Also permanent and temporary functional disability couldn't be determined easily by the researcher.

Working on the medical records was the most important obstacle which the researcher faced in her study. The data concerning head injuries were found to be insufficiently documented or addressed in medical records. Also there was a difficulty through work and searching in archives departments. There was no staff assigned to help the students or researchers to search through medical records. There was also neither a classification in

the medical records of head injuries nor a separation of these records from other records. That led to spending of much time going through all medical records of the targeted hospitals.

CHAPTER II

REVIEW Of THE LITERATURE

2.1 Introduction

This chapter, on review of literature and studies pertinent to TBI, includes definition of head injury and TBI, TBI classifications, brain functions, mechanisms of TBI and clinical implications, symptoms of TBI, fractures associated with TBI, causes of TBI, and incidence of TBI. The chapter also includes regional and international studies which researched into the causes of TBI. The chapter also includes surveys and studies conducted on outcomes following TBI, related to age and gender. The chapter ends with a look at the rehabilitation of TBI.

2.2 Definition of head injury and TBI

Some medical definitions of head injury include cases of minor facial laceration, jaw fractures, and nose injuries; even though brain dysfunction is not suspected. Others require that an alteration in consciousness or evidence of neurological deficit prevail[9].

The American National Head Injury Foundation (NHIF) 1988 refers to head injury as a traumatic insult to the brain capable of producing physical, Intellectual, emotional, social, and vocational changes. This definition of head injury implies brain damage and associated dysfunctions such as a dysfunction in coordinating movements, speech, reasoning, or etc[9].

The 1997 Reauthorization of (IDEA) (Individuals with Disabilities Education Act) defined TBI as “an acquired injury to the brain caused by an external physical force resulting in total or partial functional disability or psychosocial impairment, or both, that adversely affects a child's educational performance.”[10].

Head injury is a trauma to the head that may or may not include injury to the brain. However, "Brain injury " and " Head injury" are often used interchangeably in the medical literature[11].

The term "head trauma" applies to open or closed head injuries resulting in impairments in one or more areas, such as cognition, language, memory, attention, reasoning, abstract thinking, judgment,problem-solving, sensory, perceptual and motor abilities, and psychosocial behavior. Thus, the term does not apply to brain injuries that are congenital or degenerative, or induced by birth trauma[10].

Most definitions of head injury depend on evidence of a blow to the head, and exclude facial injuries and foreign bodies in the nose and ears. A head injury is any trauma that leads to injury of the scalp, skull, or brain.

Head injuries fall into two categories; those are outside the skull and those that are within the skull or the brain. **External (Scalp) injury** means the scalp is rich in blood vessels, so even a minor cut there will yield bleeding profusely. The "goose egg" or swelling that may appear after a head blow is the result of the scalp veins leaking fluid or blood into (and under) the scalp. It may take days or even weeks to disappear[13]. While **suspected internal injury**; the brain is cushioned by cerebrospinal fluid, but a severe blow to the head may knock the brain into the side of the skull or tear blood vessels. Any internal head injury –fractured skull, torn blood vessels, or damage to the brain itself – can be serious and possibly life threatening[12]**.**

2.3 TBI classifications

TBI occurs when a sudden physical assault on the head that causes damage to the brain. The damage can be focal, confined to one area of the brain, or diffuse involving more than one area of the brain. TBI can result from a closed head injury or a penetrating head injury[12]. Closed Head Injury (CHI): (non-missile) occurs when there is an injury to the head, but nothing penetrates the skull, the skull remains intact. In other words, the head seems to have escaped injury, but that is not necessarily true. Although the skull may not appear to be damaged, the brain itself can have injuries due to impact. CHI may or may not produce a skull fracture, and tend to cause generalized or diffuse cerebral involvement. CHI usually results from motor vehicle accidents and falls that cause rapid acceleration and deceleration of the head[12]. While open head injury (OHI) is a penetrating head injury which typically produces discrete and focal lesions. It occurs when an object pierces the skull and breaches the Dura mater. This usually happens when you move at high speed, such as going through the windshield during a car accident. It can also happen from a bullet, knives or blunt instrument to the head[12,13].

2.4 Brain Functions

In TBI, the brain may be injured in a specific location or the injury may be diffused to many different parts of the brain. It is this indefinite nature of brain injury that makes treatment unique for each individual patient. We can make certain conclusions about the nature of the problem from the location of a lesion[14] .

The brain constitutes about (1/50) of the body weight and lies within the cranial cavity. The parts are: (Cerebrum or fore brain, Midbrain, Pons Varolii, Medulla Oblongata, and Cerebellum).

The brain is made up of different areas, called lobes, namely the frontal lobe, the parietal lobe, the temporal lobes and the occipital lobes with each of these lobes, along with the brainstem and cerebellum, being responsible for different activities[15].

The frontal lobe, located in the front of the head is responsible for reasoning; behind this is the parietal lobe (near the back top of the head) which handles touch and pressure. There are two temporal lobes located at the side of the head just above the ears, and they are responsible for hearing. At the back of the brain, behind the temporal and parietal lobes, is the occipital lobe which handles our vision[15].

The brain stem is found deep in the skull and links the spinal cord to the brain. It handles heart rate, breathing as well as blood pressure. At the base of the skull is the cerebellum which handles balance and muscle coordination. When there is a brain injury, it can affect just one area of the brain, or more commonly several areas[15]. For further understanding, illustration and further discussion is indicated in appendix E.

2.5 Mechanisms of TBI and clinical implications

Some patients may have linear or depressed skull fractures. A depressed skull fracture occurs when pieces of the broken skull press into the tissue of the brain . This can cause bruising of the brain tissue, called a contusion. A contusion can also occur in response to shaking of the brain within the confines of the skull, an injury called "countercoup"[11,16]

Shaken baby syndrome is a severe form of head injury that occurs when a baby is shaken forcibly enough to cause extreme countercoup injury. Damage to major blood vessels within the head can cause a hematoma or heavy bleeding into or around the brain[16].

If intracranial hemorrhage occurs, a hematoma within the skull can increase pressure within the skull. Types of intracranial hemorrhage include subdural, subarachnoid, and extradural hematoma. Craniotomy surgeries are used in these cases to lessen the pressure by draining off blood[11].

Specific problems after TBI:

- Skull fracture, lacerations to the scalp and resulting hemorrhage of the skin.
- Traumatic subdural hematoma, a bleeding below the Dura mater which may develop slowly.
- Traumatic extradural or epidural hematoma, bleeding between the Dura mater and the skull
- Traumatic subarachnoid hemorrhage
- Cerebral Contusion, a bruise of the brain
- Concussion (a temporary loss of function due to trauma)
- Dementia pugilistica or " punch –drunk due to trauma" caused by repetitive head injuries, for example in boxing or other contact sports.

- A severe head injury may lead to a coma or death.

The severity of a head injury can range from a mild concussion to the extremes of coma or even death.

2.6 Symptoms of TBI

Presentation varies according to the injury. Some patients with head injury stabilize and other patients deteriorate. A patient may present with or without neurological deficit. Patients with concussion may have a history of seconds to minutes unconsciousness, then normal arousal. Disturbance of vision and equilibrium may also occur. Common symptoms of TBI include coma, confusion, drowsiness, personality change, seizures nausea and vomiting, headache and a lucid interval during which a patient appears conscious only to deteriorate later[11].

2.7 Fractures associated with TBI

The skull may fracture from the force of the blow in the area of or at a distance from the actual impact site. The patient with brain injury from a motor vehicle accident or a fall may have other systemic injuries, such as fractures of the extremities, shoulder girdle, pelvis or face, cervical fractures with possible spinal cord injury, abdominal trauma, and pneumothorax or other chest cavity trauma[2].

2.8 Causes of TBI

The most frequent cause associated with both fatal and non-fatal brain injury is road – related accidents. It involves motor vehicles, bicycles, motorcycles and pedestrians injured in transport accidents and accounts for

around 50% of all accidents[17,18]. Motor vehicle accidents are the most common cause of TBI, with the highest morbidity and mortality among drivers aged 15-19[19].

The second most significant cause of TBI is the falling accidents which accounts for 20% - 30% of all injuries, especially among the very young and the elderly[2, 17,19].Children less than 10 years old are at the greatest risk of incurring fall-related injury. They are injured in falls at approximately twice the rate as that of the total population (except individuals older than 65 years old, who have fall-related injury rates similar to those of children) [20]. Falls are also the most frequent cause of any injury during infancy (an estimated 35.1 per 1000 infant years[21]). The combination of curiosity, immature motor skills, and lack of judgment renders preschool children particularly susceptible to falling (e.g., as they climb on furniture to obtain toys that are out of reach).

More than 80% of fall-related injuries in children less than 4 years old occur at home. Children aged 5-14 years, approximately one-half of the injuries occur at home and one-quarter at school. Infants are at risk for falling from furniture or stairs[22].

Children from low-income families are more likely to be injured from falls due to lack of safety equipment (e.g., window guards) or deteriorating housing[23,24,25,26]

Interpersonal violence ranks the third cause, although in some urban areas, the percent of head injury caused by violence may exceed that caused by falls or motor vehicle accidents[19]. On the other hand in many parts of the world, assault is fast becoming one of the leading causes of

TBI, particularly in the lower socio-economic groups and war –torn countries [1,3].

Alcohol consumption is considered as contributing factor to accidents resulting in TBI, with estimates that approximately 50% of people who sustain TBI were intoxicated at the time of injury[27].

2.9 Incidence of TBI

The incidence of TBI peaks in the age group 15-30 years, and the elderly. On the other hand, TBI due to falling accidents is more common among the elderly and younger persons especially those under 5 years of age who are at a moderate risk for head injury due to falls[1,2,17]. Moreover, TBI is also more common among unmarried individuals[2,17].

In USA, more than 40,000 children less than 15 years old were hospitalized because of fall-related injuries in 2000. In 2001, 2.4 million children less than 15 years old were treated in hospital emergency departments for fall-related injuries. Children less than 5 years old represented the largest proportion of visits[28].

TBI is more common in males than in females, with ratio of 2:1 (M:F). This is likely due to differences in risk exposure and lifestyles[1,2,29]

A survey was conducted through a Palestinian MoH, the highest number of head injuries in Palestinians by bullet injuries was among males, while the highest number was among age group 19-29[7].

Table 2.1: Distribution of Palestinian casualties and martyrs who died of by head injuries in West Bank according to age, and sex, September 29, 2000 – December 31, 2006.

Status	Age group	Sex		Total
		Male	Female	
Casualties	19-29	1,546	64	1,610
	10-17	1,232	74	1,306
	30-49	557	77	634
	18	232	10	242
	5-9	152	30	182
	Above 50	120	41	161
	Below 5	58	20	78
	Unknown	58	5	63
	Total	3,955	321	4,276
Martyrs	19-29	152	1	153
	10-17	67	5	72
	30-49	56	3	59
	18	17	0	17
	Above 50	10	2	12
	5-9	4	0	4
	Below 5	0	1	1
	Unknown	1	0	1
	Total	307	12	319

*Source: Palestinian MoH, Palestinian Health Information Center, Nablus Branch, Bullet head injuries statistics, 2000-2006.

2.9.1. Causes of TBI Worldwide

- **Local and regional studies**

A retrospective study was conducted on 595 Israeli- Arabs who had sustained rubber bullets by Israeli police during Israeli-Arab a confrontation in early October, 2000. The researchers analyzed the medical records of 595 casualties who admitted to a frontline clinic in Umm el Fahem, two regional hospitals in Nazareth, and the level (I) trauma centre at Ram bam Medical Center in Haifa. The researchers included in the study 152 casualties with proven injuries induced by rubber bullets. Of 152 patients with 201 proven rubber –bullet injuries, there were 151 males and one female, with an age range of 11–59 years were included in the study. In

whom 201 proven injuries by rubber bullets were detected, injuries were distributed randomly over the body surface and were mostly located in the limbs (n=73), but those to the head, neck, and face 61, chest 39, back 16, and abdomen 12 were also frequently noted. 39 (16%) patients had blunt injuries, and 59 (39%) patients had penetrating ones. Two casualties died after a penetrating ocular injury into the brain and one died as a result of postoperative aspiration after a knee injury[30].

- **International Studies**

A study was conducted retrospectively on head injuries patients admitted to accident and emergency department at Khoula hospital, Oman, for the period of two years 1999-2000. GCS was used to assess the level of severity of head injury. The aim of the study was to determine the morbidity and mortality due to head injury among trauma victims, the study showed that majority of head injuries occur due to falls followed by road traffic accidents, assaults and sports injuries. However, of the total head injury patients (54.2%) were due to falls, (42.1%) due to road traffic accidents, (3.2%) due to assaults and (0.5%) due to sports injuries. The study also showed that road traffic accidents were associated with more severe head injuries compared to the others and mortality was very high among road traffic accidents victims, whereas mortality was (7.4%) among admitted head injury patients. Of all deaths 86.6% due to road traffic accidents, 12.8% due to falls, and 0.6% due to assaults[31].

Another retrospective study was conducted in Jordan, on 816 patients with head injury who attended departments of three military hospitals in Jordan (King Hussein hospital, Queen Alia hospital, in

Amman, and Hashem hospital in Alzarqa) between June 2000 and July 2001. The aim of the study was to evaluate the radiological findings in patients attending to the emergency department with head injury and to find the correlation between the radiological findings and clinical factors. The study showed that there was a direct correlation between mild, moderate and severe head injury and the radiological findings. The study also showed that 541 (66.3%) patients were males, 275 (33.7%) was females. 32.3% below 15 years, 48.2% between 15-65 years, and 19.5% above 65 years. Falling accidents is the most common cause of head injury (71.6%) followed by road traffic accidents (22.4%), and missiles (6%)[32].

Domestic animal–related injuries in general, camel-related in particular are potential cause of serious injuries and a major public health problem for children in Gulf countries. However, a retrospective study was conducted at division of Pediatric Surgery, Tawam Hospital in United Arab Emirates. The medical records of all children admitted to the hospital with camel- related injuries were retrospectively reviewed for age, sex, mechanism of injury, type of injuries, treatment, and outcome. The findings of this study were 78 children with camel –related injuries were seen at the hospital. Most of them were camel jockeys. All were males, and their ages ranged from 4 -15. The causes of injury, ranged; 74 from a racing camel, 3 were kicked by a camel, and 1 had a camel bite. 44 (56.4%) had head injury, which was moderate to severe in 17, and 6 of them had associated skull fractures, whereas 3 had intracranial hematomas[33].

There are other significant causes of head injuries, in which the sports and recreational related activities injuries are common in Western Countries[2,4]. Head injuries are estimated to comprise from 4%- 22% of the

total injuries in Football[2,4]. While most of the research regarding head injuries in football has focused on concussions, more severe head injuries do occur. Injuries such as skull fractures and internal head injuries are too infrequent to study prospectively and are best examined by referring to emergency department data, where these more serious injuries are almost always treated. In a recent review of head injuries from different sports resulting in a visit to emergency departments in the USA it was estimated that there were 28,000 injuries that occurred during participation in football were classified as either a skull fracture or internal head injury (cerebral contusion, intracranial hemorrhage, epidural or subdural hematoma) over 10-years period throughout the entire United States. When combined with participation data during the same period, the rates of skull fracture or internal head injury were roughly one to two injuries per 10,000 football players per year in the USA[34].

A study was conducted in Emergency department, Fremantle hospital and Forensic pathology department, in Western Australia, whereas the aim of the study was to assess the incidence of and identify factors associated with Road Crash (RC)- related fatal head injuries in rural and metropolitan Western Australia. Examination of demographics, driving behavior and RC characteristics for RC fatalities involving a head injury. (Abbreviated Injury Scale (AIS) > or = 2) between 1 January 1998 and 31 December 1999 was carried out using the State Coronial Database. Through findings of this study, there were 328 deaths. The median age was 28 years and 74.1% of cases were males. 60% of total RC and 65% of at-scene deaths occurred in rural areas. Single-vehicle crashes comprised 45% of total crashes, of which 72.8% occurred in rural locations. Rural people

comprised 61% of rural crash victims, and 91% of these victims died as a result of rural crashes. The incidence of road traffic death associated with head injury in the rural population is 13.4 deaths /100,000 per year, more than double that for the metropolitan population (6.4 deaths/100,000 per year; $p < 0,001$). The rural population of Western Australia is over presented in head injury- related RC deaths[35].

2.10 Epidemiology of TBI

Head injury is recognized as a major public health problem that is a frequent cause of death and disability in young people and makes considerable demands on health services. Epidemiological data are required to initiate appropriate preventive measures and to plan necessary services. However, reliable statistics are difficult to extract from routinely collected data.

International statistics for accidental deaths and road traffic deaths do not identify head injuries, but they do indicate differences in accident rates between countries and over time. For example, RTA deaths are more than twice as frequent in France, Australia, and the USA, as in the UK or the Netherlands, but in developed countries they are steadily decreasing each year. In developing countries, accident rates are increasing as traffic increases, and they greatly exceed those of developed countries[36].

In developing countries, road traffic injuries in particular are increasing in incidence, and injuries are projected to be the third leading cause of death and disability worldwide by 2020[37]. Worldwide, an estimated 1.20 million people are killed in RC each year and as many as 50

million are injured[38]. RTA is major cause of mortality and morbidity with head injuries as worldwide.

The incidence of TBI has steadily increased over the years. Although trauma is the cause of brain injury as well as the cause of spinal cord injury, brain injury as a result of trauma is 40 times more likely to occur than spinal cord injury[29].

In developed countries as USA, estimates of the incidence of head injury indicate that 2 million people sustain head injuries per year, with more than 500,000 new head injuries people admitted to hospitals each year, and each year there are approximately 100,000 deaths from TBI and an estimated 70,000-90,000 patients are left with permanent neurological disabilities. However, RTA is major cause of head injuries among American people followed by other causes as falls, physical assaults, or sports accidents. Firearms are a frequent cause of injury, mostly the result of children playing with their parent's guns[1,2]. The annual number of serious head injuries had decreased over the past two decades, and of those patients who were admitted to hospital, the mortality and long term morbidity have also declined. The two major reasons for this reduction in death and disability after trauma appear to be a result of:

1) Widespread implementation of preventive measures, safety legislation, and public education initiatives.

2) Further improvements in and wider availability of emergency medical systems and regional trauma centers. Improvements in neurosurgical care and implementation of evidence-based treatment

guideline for severe head injury victims may also, in part responsible for improved survival rates and reduced disability rates[39].

In Sweden, head injuries were due to transportation collision and were reduced over a 14-year period of analysis between 1987-2000. Falls persisted as the dominant cause of head injury. Overall, men had (2:1) times the incidence of head injury compared to women. There was a decline in younger ages experiencing a head injury over this interval while the number of head injuries among elderly people increased over time[40].

Head injuries are less common in the UK than in many other countries, but they are still a major problem for health services. In UK, motor vehicle accidents were the third most common cause of head injury, after falls and assaults. However, most of the recent reduction in child death rates from RTA in England and Wales appeared to be because there were fewer child pedestrians and cyclists as more children travelled by car[41]. Assaults form a small minority of childhood injuries in the UK and were often sustained in play.

In Australia, motor-vehicle-related trauma accounted for about two-thirds of moderate and severe head injury, with falls and assaults being the next most common causes. Sporting accidents and falls account for a far greater percentage of mild injuries. Alcohol consumption is associated with up to half of all cases of head injuries[29].

In Israel, head injuries, especially in young children, is frequent and may cause long-lasting impairments. For both Jews and Arabs, the most frequent cause of head injury was falls followed by hits by objects and car accidents[42].

In Jordan, health statistics indicate that RTA is the major cause of deaths among people are less than 25 years old with 40% of all deaths, and deaths occur due to head injuries, which is the major leading cause of morbidity about 13% as well[43].

TBI is a leading cause of morbidity, mortality, and socioeconomic losses in India and other developing countries. In India, it is estimated that nearly 1.5-2 million persons are injured and 1 million sustaining deaths every year in India. Road traffic injuries are the leading cause (60%) of TBI followed by falls (20-25%) and violence (10%)[44].

In Pakistan, total of 260,000 patients admitted with head injury over a 5-year period to various neurological centers for the period of 5 years (1995-1999). The majority of patients presented were males about 75%, and 25% females with a ratio of (3:1). RTA was the commonest cause of head injury[45].

Africa as developing countries faces three major types of wars: civil, regional and road wars leading to a great number of mortalities and tremendous economic loss.

RTA causes 700,000 deaths every year in the world[46], three quarter of them in developing countries[47].

In developing countries, RTA is the first or second cause of death in the 15-45 age groups. RTA is responsible for the majority of head injury, causing 80% of all head injuries in Nigeria alone[48].

Rural roads are hazardous, particularly at night as vehicles sometimes travel with no light. Rural locations present difficult challenges

in providing acceptable standards of treatment. The population is separated by vast distances from hospitals, with bad roads, no communication, no doctors and no ambulance services. In such situations, the patient must travel hundreds of kilometers to reach and time delay will be dangerous as it leads to the development of secondary brain damage when head injury occurs as a result of RTA. Collisions with animals crossing roads in rural areas are quite common, and these injuries crashed with animals lead to more collision, injuries and deaths. Young children are also injured as they run across roads while playing or running after a ball or are hit while riding on bicycles[49].

RTA is also common and a major cause of deaths in Arab Gulf countries. The death rate from RTA in the Arab Gulf countries[50] is reported to be much higher than that in the USA. RTA is a major cause of head injuries among Arab Gulf countries.

A retrospective study was conducted on all patients who attended the Hamad General Hospital's accident and emergency department for trauma, Qatar, between January 1991 and December 1995. Data were identified from the hospital computer data base and analyzed to determine the general incidence and early mortality pattern. Severity of injury using the GCS and outcome in terms of morbidity and mortality using the Glasgow Outcome Scale (GOS). 3,901 patients admitted over a period of 5 years. The general incidence of head injury was 457/100,000 years, but only 29.8% required admission. Of the 128/100,000/year admitted with TBI, majority were males or children less than 10 years old. About (43.1%) resulted from road traffic accidents, and (33.6%) sustained their injuries from falls. Road

traffic accidents accounted for (78.7%) of severe injuries GCS Score (3-8), and (97.7%) of overall mortality.

More severe injuries were sustained by pedestrians than by motor vehicle occupants. Sport injuries including falls from camels and horses, objects falling on patient's head, assaults and other sources of trauma accounted for the remaining (23.3%)[51].

2.11 Occupations at risk

Occupational accidents contribute to head injuries and deaths with affected persons, as part of other body injuries. Among occupational accidents, head injuries were the common cause of deaths, and occupations at risk are construction, manufacturing, mining, agriculture, electricity, and driving motor vehicles[52].

2.12 Outcomes following TBI

TBI commonly cause life-long impairments in physical, cognitive, behavioral and social function. The cognitive, behavioral and personality deficits are usually more disabling than the residual physical deficits. Recovery from TBI can continue for at least 5 years after injury[1,2,53].

2.12.1 Some facts of coma

The outcome of a patient can be associated with their best response in the first 24 hours after injury. Using the GCS (3-15), with 3 being a person in a coma with the lowest possible score, and 15 being a normal appearing person). A research shows that if the best scale is (3- 4) after 24 hours, 89% of those individuals will either die or remain in a vegetative

state and only 11% will had a moderate disability or good recovery. In patients with a scale from (5-7), 58% will die or remain in a vegetative state; while 42% will have a moderate disability and/or good recovery. In patients with a GCS of (8 - 10), 29 % will die or remain in a coma; while 71% will have a moderate disability and/or good recovery. In patients who have a scale from (11- 15), only 11% will be expected to die or remain in a coma, while 89% would expect to have at least a moderate disability and/or good recovery [2,54].

Table 2.2: Outcome expectations within 24 hours after injury by using GCS Score

GCS	Outcome expectations within 24 hours after injury
(3-4)	89% the patients will die or remain in vegetative state, and 11% will have a moderate disability or a good recovery
(5-7)	58% will die or remain in a vegetative state, and 42% will have a moderate disability, and/ or good recovery.
(8 -10)	29% will die or remain in a coma, while 71% will have moderate disability or a good recovery
(11-15)	Only 11% will be expected to die or remain in a coma, while 89% would expect to have at least a moderate disability and/or good recovery

2.12.2 Outcomes, age, and sex

Mortality rates are also higher in males, indicating likelihood that males may sustain more severe injuries than females. And the mortality from TBI is higher in the geriatric population at all levels of head injury, and have worse outcome than the young population. Age itself is an independent predicator for mortality in TBI [1,3]

Pre-injury factors such as extremes of age have been linked to increased mortality and poorer outcome, and a history of previous head injury, alcohol abuse, lower socio-economic and educational status have been associated with worse outcome after TBI [1,55]

In USA, a retrospective study was conducted for analysis of all adult patients with isolated TBI (AIS score > or = 3) admitted during a 5 –year period to either (2) or (1) trauma centers. Mortality, GOS Score at discharge, therapy, and complications were compared for elderly (age > or = 65 years) and younger patients. The findings of this study were of 694 patients, 22% were defined as elderly. The mortality for the elderly group was twice that of their younger counterparts (30% vs 14%, $p < 0.001$), even for those with mild to moderate TBI (GCS Score of 9-15). 13% of elderly survivors had a poor functional outcome (GOS Score of 2 or 3) at hospital discharge versus 5% in the young group. The mortality from TBI was higher among the geriatric population at all levels of head injury, in addition functional outcome at hospital discharge was worse. Although some of this increased mortality may be explained by complications or type of head injury, age itself is an independent predictor for mortality in TBI[56].

There have been few studies examining gender differences in outcome following TBI in humans. One Positive finding comes from Grosswasser et al[57] who found in a study of 334 of TBI individuals aged 5-56 years, that female TBI patients had a better predicted outcome according to work capacity at discharge for rehabilitation than did males. Another study by Slewa-Younan et al[58] found lower GCS and longer Post Traumatic Amnesia (PTA) duration in males relative to females, but no sex differences in outcome. A more recent study by Farin et al[59] found higher frequencies of brain swelling and intracranial hypertension and a trend towards poorer outcome on the GOS in female aged < 51 years. Others have found worse outcomes in older females. Kirkness et al[60] showed lower Glasgow Outcome Scale–Extended (GOSE) and Functional Independent

Measure (FIM) scores in female patients aged over 30 and Gan et al found that females over the age of 64 showed a trend towards a higher mortality rate than males[61]. Overall, the findings regarding gender differences in outcome in humans have been both limited and inconsistent to date.

2.12.3 Consequences (types of disability) following TBI

1) Neurological impairment (motor, sensory and autonomic)

- Motor function impairment (Physical dysfunction): coordination, balance, walking, hand function, speech[2]
- Sensory loss – taste, touch, hearing, vision, smell[2]
- Sleep disturbance – insomnia, fatigue[2]
- Medical complications–spasticity, hydrocephalus, heterotypic ossification[2]
- Sexual dysfunction [2]

2) Neurobehavioral Outcome after closed head injury

The neurobehavioral consequences of CHI consist of alterations in cognitive functioning including general intellectual ability, memory, information processing and language, as well as changes in behavior and psychosocial adaptation[62]. Pre-injury factors reflecting the emotional stability of the patient and support of the family may influence the neurobehavioral disturbance beyond the acute stages. In addition, a higher degree of premorbid education and occupation may have impact on a better prognosis for return to work[63,64].

a) Cognitive impairment

- Memory impairment, difficulty with new learning, attention and concentration; reduced speed and flexibility of thought processing; impaired problem-solving skills[2]
- Problems in planning, organizing, and making decisions[2]
- Language problems – dysphasia, problems finding words, and impaired reading and writing skills[2]
- Impaired judgment and safety awareness[2]

b) Personality and behavioral changes (Psychological dysfunction, and behavioral disturbance)

- Impaired social and coping skills, reduced self-esteem [2]
- Altered emotional control; poor frustration tolerance and anger management; denial, and self-centeredness[2]
- Psychiatric disorders – anxiety, depression, post-traumatic stress disorder, psychosis[2]
- Apathy, a motivational state[2]

c) Language dysfunction

Research has indicated the high frequency of language disturbances in survivors of head injury, even in the absence of obvious clinical manifestations. Anomia or word finding difficulty is one of the most salient features of acute aphasia following head injury[65]. Wernicke's aphasia is another common clinical syndrome characterized by fluent speech but impaired comprehension for auditory and written information and defective repetition which may in part reflect an in ability to understand the

command[66]. Thomsen[67]also found aphasias and anomia common in patients who had been in coma for at least 24 hours. Duration of coma has been an inconsistent predicator of linguistic disturbance in studies which have combined patients with diffuse and focal injuries.

3) Common lifestyle consequences

- Unemployment and financial hardship[2]
- Inadequate academic achievement[2]
- Inadequate recreational opportunities[2]
- Difficulties in maintaining interpersonal relationships, marital breakdown[2]
- Loss of pre-injury roles; loss of independence[2]

About 75% of TBI that occur each year are concussions or other forms of mild TBI. Repeated mild TBI occurring over an extended period of time (i.e., months, years) can result in cumulative neurological and cognitive deficits. Repeated mild TBI occurring within a short period of time (i.e., hours, days, or weeks) can be catastrophic or fatal[53].

Head injuries, especially in young children, are frequent and may cause long-lasting impairments. A study was conducted for the study population consisted of Jews and Arabs (n=792), aged 0-17 years old, hospitalized for injuries in six hospitals in Israel. Caregivers were interviewed during hospitalization, regarding circumstances of the injury and socio-demographic variable. Information on injury mechanism, profile and severity and length of hospitalization was gathered from the medical

files. Five months post injury; the caregivers were interviewed by phone regarding physical limitations and stress symptoms. The findings of the study showed that head injuries occurred in 60% of injured children, and of these, 22.2% suffered TBI with loss of consciousness type (1). Among the rest, 22% of Jewish children and 28% of Arab children remained with at least one activity limitation[68].

The important contributing factors to short-term outcome of Central Nervous System (CNS) trauma in Bronx, N.Y, USA, were studied in 818 patients admitted to six Bronx hospitals during a 6-month period. Severity of injury was determined by the GCS and short-term outcome at hospital discharge was measured. The motor component of the GCS was the most important predictor of short-term outcome. In a multiple logistic regression analysis for adult cases, lower GCS, pupillary unreactivity, presence of OHI, and older age increase the probability of in-hospital deaths. OHI was largely attributable to gunshot wounds which had poor outcome across all levels of severity. Patients with mild injury whose trauma resulted from gunshot wounds had a 33.3% case-fatality ratio compared to 0.7% of the mildly injured due to other causes. It was also found that the predictability of outcome by GCS as derived from an adult population which cannot be applied to the pediatric population: the outcome of pediatric cases with similar neurological function is considerably better than the outcome for adults with the same GCS levels[69].

And to measure long term outcome after head injury, a study was conducted in Aquitaine (population 2.7 million), using data from a 1986 population-based study looking at all injuries serious enough to result in death or hospital admission. Out of the 7,281 patients identified, a cohort

of 1,005 which included 407 head injury patients was selected for follow up. Survivors were sent a letter five years after the initial trauma and were interviewed with a 200 item questionnaire at the institution or at home, or by phone, or by filling in the questionnaire at home and sending it back by post .Wherever possible a close family member was interviewed separately to supply information on the patient's behavior. Out of the 407 head injury patients, 64 had died, 36 were lost to follow up, and three refused to participate, so data were available on 304 patients. The findings of the study; patients in the cohort were predominantly less than 60 years old 90%, and 50-60% were less than 30 years old at the time of their injury. About two thirds were males, and almost all had received their head injury in a RTA or fall. Almost all the patients lived at home. About 4% needed family support because of behavioral or cognitive problems, and this was permanent in about 20% of the most severe cases[70].

And to assess the patient outcome in the year following severe head injury and relative's psychiatric and social functioning. 57% consecutive severe male head injury patients together with a defined female relative were assessed at home after 3, 6 and 12 months of the injury to measure the psychiatric and social impact on the relative. Relatives were found to have significant and persistent psychiatric and social dysfunction and they considered themselves to have a high burden in caring for the relative throughout the year. The findings suggest the need for comprehensive rehabilitation of head injury patients and their relatives[71].

2.13 Rehabilitation for TBI

Rehabilitation is broadly defined as " a problem solving educational process aimed at reducing disability and handicap experienced as a result of disease or injury"[72]. The goal is to help the person achieve the maximum degree of return to their previous level of functioning within limits imposed by their residual physical, functional and cognitive impairments. After TBI, return of function is not restricted to physical reintegration but also includes reintegration in the social, emotional, community and vocational domains[72,73]

Engaging TBI patients with moderate and sever injuries actively in the rehabilitation process requires the participation of the multiply – challenged TBI patient in various aspects of multidisciplinary rehabilitation. Hence, there is a need for a specialized interdisciplinary team of rehabilitation professionals; led by a rehabilitation physician (See table 2.3).Central to this is the patient and his family or primary caregivers.

Table 2.3: The multi-disciplinary rehabilitation team

The brain injury rehabilitation team
Patient and patient's family or caregivers
Rehabilitation Physician
Rehabilitation Nurse, Rehabilitation Technicians
Primary Neurosurgeon
Allied health professional: Physiotherapist, Occupational therapist, Speech and language pathologist, Clinical psychologist, Neuropsychologist, Social worker and Counselor
Paramedical health professionals: Orthotist, and Rehabilitation engineer
Vocational rehabilitation services and counselors
Volunteers from support or spiritual groups

TBI rehabilitation often consists of 2 phases: the **inpatient** phase which may last from 1-3 months, including the acute neurological and early rehabilitation phase prior to transfer to a specialized brain injury unit and the **outpatient** or community rehabilitation phase, which may continue for 1-2 years depending on the age of the patient, injury severity, and residual disability[72].

In-patient management: is required for those with a moderate to severe degree of physical, cognitive and /or behavioral deficits. The rehabilitation team focuses on a comprehensive assessment for TBI-related neurological and functional impairments and the development of an individualized programme based on specific functional goals.

Community rehabilitation: follows discharge from an inpatient rehabilitation stay. Patients may benefit from further training in household independence and community reintegration through an outpatient programme or through a transitional living unit where patients are largely self-managing under health professional supervision .Helping a person with TBI return to maximal independence is a challenging task and requires the dedicated involvement of the patient, treatment team, and family.

Vocational assessment and rehabilitation, driving training, and computer –aided cognitive rehabilitation may be required to address the needs of high-functioning TBI survivors. Issues of caregiver coping and long-term psychological or peer support for caregivers or spouses of patients who are unable to return to independent living may be provided by caregiver support or volunteer groups[73].

2.14 Summary

After reviewing the related literature and studies on major causes of TBI, local studies showed that assaults by bullet injuries were the major cause of TBI. A retrospective study was conducted on 595 Israeli- Arabs who had sustained rubber bullets by Israeli police during a confrontation in early October 2000. In regional studies conducted in Oman and Jordan, it was found that majority of head injuries had occurred due to falls followed by road traffic accidents, assault and sports injuries. In an international study conducted in Sweden, it was found that the majority of head injuries were due to transportation collision and were reduced over a 14-year period of analysis between 1987-2000. Falls persisted as the dominant cause of head injury. In UK, motor vehicle accidents were the third most common cause of head injury, after falls and assaults. However, most of the recent reduction in child death rates from RTA in England and Wales appeared to be because there were fewer child pedestrians and cyclists as more children travelled by car while RTA was major cause of head injuries among American and Australian peoples too, followed by other causes as fall, physical assault, or sports accident. In Australia, motor-vehicle-related trauma accounted for about two-thirds of moderate and severe head injury, with falls and assaults being the next most common causes. On the other

hand, RTA was responsible for the majority of head injury among African and Arab Gulf countries too. A retrospective study was conducted on all patients who attended Qatar's Hamad General Hospital's accident and emergency department for trauma. The study showed that the major causes of head injuries among the patients were road traffic accidents followed by falls, sport injuries and assaults.

All studies showed that males were more exposed to TBI than females, and studies showed that mortality rates were also higher among males, indicating likelihood that males may sustain more severe injuries than females. And the mortality from TBI was higher among the elderly population at all levels of head injury, and had worse outcome than the young population.

CHAPTER III

METHODOLOGY

3.1 Introduction

According to this present study, TBI defined as a non-degenerative, non-congenital insult to the brain from an external physical force as road traffic accidents, falls, hits by heavy objects, or assaults which including (penetrating instruments, head blows or exposing to bullet injuries used either by Israeli soldiers or other people). In this study, TBI patients admitted to Rafidia, Al-Ittihad or the Arab specialized hospital had sustained either permanent or temporary impairments of cognitive, physical and psychosocial functions with an associated diminished or altered state of consciousness.

And some patients with TBI in this present study had sustained death or good recovery as outcomes following trauma.

3.2 Study Variables

While causes of TBI, outcomes following TBI at the time of hospital discharge were dependent variables in this study, independent variables included socio-demographic characteristics as gender, age, place of residence, marital status, and family income. The causes of TBI are dependent variable too. Following is a brief description of some of them.

1) Age variable in this study was classified into seven groups; below 5 years, 5 – 9 years, 10 - 17 years, 18 year, 19 – 29 years, 30-49 years, 50 – 65 years, and above 65 years.

2) Marital status variable was classified into five conditions; Single, married, divorced, widow/widower, and not applicable was defined

in this study as a term used for people were under age for marriage (age 5 and below, and age between 5 - 9 years).

3) The nature of job of the person who had sustained TBI, that is depending on the type of occupation of the person admitted to one of the three targeted hospitals:

   1. Administrators (managers, clerks)
   2. Professional workers (physicians, engineers and teachers)
   3. Skilled workers (electricians, carpenters, industrial workers, barbers, sewers)
   4. Unskilled workers (traders, sellers, cleaners, workers at services (electricity, water), military, construction, and agriculture).
   5. Drivers (transport workers)
   6. Unemployed: For people who were under age for working, or studying (age 5 and below), elderly people (age 65 and above), and for people who at working age but don't work or stopped to work. Also unemployed term is used for housewives.

4) Education level variable was classified into six levels; Illiterate, less than tawjehi, tawjehi, diploma, diploma and above, and not applicable was defined in this study as a term used for people were under age for education (age 5 and below).

5) Causes of TBI variable in this study were classified into five causes; Road traffic accidents, falls, hits by heavy objects, assaults (penetrating instruments, head blows, and bullet injuries).

6) Outcomes following TBI at hospital discharge variable in this study was classified into four outcomes; Functional disability, coma/vegetative state, death, and forth outcome was a good recovery.

3.3 Design of Study

The study is a retrospective descriptive epidemiological survey. It was designed to describe the major causes of TBI in patients attended departments in the three hospitals in Nablus in 2006 and 2007.

3.4 Study Population

The study population included 312 patients's records with TBI who were admitted to the three targeted hospitals in Nablus in 2006 and 2007. GCS was used to assess the level of severity of TBI and was classified as mild, moderate, and severe.

The study was done during 7th of January, till 20th of March 2008. The study was conducted at Archives department for each of the three targeted hospitals in Nablus (Rafidia, Al-Ittihad, and Specialized Arab hospital), also the study was conducted at Archives department of BASR to review patients's records who had sustained moderate and severe head injuries, and admitted for rehabilitation.

3.5 Data Collection

3.5.1 Data Sources and the procedures

1) Medical records

1) Reviewing the medical records of patients admitted to the three targeted hospitals in Nablus in 2006 and 2007, and the patients were reported as persons had sustained head trauma or head injury, then TBI.

2) Gathering data about the patients from medical records, in which the data needed for the study, were included:

   - **Socio-demographic characteristics of the patients at their injuries time:** (patient's age, sex, province, place of residence, marital status, type of occupation, level of education and family income)

   - **Medical information about the patient at hospital admission:** (injury date, injury cause, previous history of injury, associated injuries with TBI , injury severity, and outcomes following TBI at hospital discharge, and information about if the patient was referred to another hospital to complete medical intervention or not, and where?).

   - **Information about rehabilitation services after a medical treatment:** (Current outcomes TBI, type of the functional disability, rehabilitation services provided for the patient, rehabilitation services duration, place of rehabilitation services,

patient's independency in activities of daily living, and if the patient is still need a follow up in rehabilitation, and what kind of rehabilitation services are still needed).

3) Medical records for patients, who had moderate or severe injury and sustained functional disability or coma/ vegetative state and were discharged from targeted hospitals and referred to BASR, were reviewed. The medical records in the rehabilitation center included (full demographic data about the patient, diagnosis, medical history, past history, patient status during admission period. BASR adopted a test is called a (Rancho Los Amigos Levels of Cognitive Functioning) to describe higher- level cognitive, behavioral, and emotional barriers to optimal functioning, and was used to measure levels of recovery of the patients during their rehabilitation program.(See Appendix D). In addition, they included the rehabilitation services provided for the patient, discharge report, head of rehabilitation department recommendations, and re-evaluation report if the patient was re-admitted again to the center

4) Filling of case survey sheet for each patient with TBI who was admitted to one of the three targeted hospitals between 2006-2007, and this sheet was filled by the researcher. (See Appendix A).

Case survey sheet that was constructed by the researcher, translated, evaluated, and reviewed by specialized physicians. A pretest was carried out on 30 records to find the capacity to fill data needed about the patients with TBI and filling them in. Case survey layout was modified after the pilot testing.

2- Direct contact with patients

1) Any missing data included in case survey sheet, and were not included in medical records, were taken by direct contact with the patients through telephone calls or meeting them or their caregivers at home, if were accessible to the researcher.

2) Most of 312 patients with TBI were directly contacted by the researcher to fill information about injuries missed in medical records. About 240 out 312 patients with mild, moderate or severe injury were directly contacted by the researcher. This number of patients was accessible by the researcher, while the rest 72 out 312 patients, some of their data needed to fill case survey were remaining as missed.

3) GCS was adopted to assess the level of severity of injury which was classified as mild, moderate, and severe, and to predict Outcome. Medical records included using of a GCS by the physicians. (See Appendix B).

4) In this study, the researcher adopted another scale to determine TBI outcome, and this scale was called GOS. (See Appendix C).

In the study, patients with initial GCS Score were of (13-15/15) had sustained mild head injury, and most of their TBI outcomes was complete or nearly complete recovery. Patients with initial GCS Score was of (9-12/15) sustained moderate head injury, while patients with initial GCS Score were of (8 or less/15) sustained severe head injury. Injury outcome on patients with moderate or

severe head injury at hospital discharge were either death, coma /vegetative state or functional disability. These findings are noted by the researcher according to patients' records on discharge report. Other severe outcomes such as functional disability or coma/vegetative state) were also noted by the researcher through direct contact or telephone calls with the patients or caregivers during data collection procedure.

5) Patients who were discharged or re-evaluated by BASR at end of 2007 or at beginning of 2008, their medical records were reviewed without referring to or meeting them, because their injury outcome data were updated.

6) Patients who were discharged earlier from BASR in 2006 or at beginning of 2007 and their injury outcome needed to be updated. The researcher visited some of them at home whom been reached, and interviewing their close caregivers to have further information about outcome of their injuries. The same work was done for the patients with moderate or severe head injury, but they were not referred to BASR or other rehabilitation centers, and were accessible to the researcher to meet.

7) Patients who had sustained moderate or severe injury, who were referred to BASR and were not accessible to the researcher, case survey were filled through telephone calling them or their caregivers. The same work was done for the patients with moderate or severe head injury, but they were not referred to BASR or other

rehabilitation centers, and weren't accessible to the researcher to meet.

3.5.2 Steps for data collection at targeted hospitals (Rafidia, Al-Ittihad, and Arab Specialized hospital).

First: Steps were done at Archives department in Al-Ittihad hospital:

- The researcher had used a manual search for the records of 2006 and 2007 through:

1) Referring to all emergency records of 2006 and 2007; the number of patients registered in emergency records in 2006 reached 9,516 patients, while the number of patients in 2007 reached 10,490 patients.

2) Searching through emergency records of the patients who had sustained RTA, fall, or head blow, and were not classified, but predicted to have head trauma or head injury, and admitted to the departments of the hospital. Patient's name and his hospital admission date were taken through searching on emergency records, to refer to the admission records and taking number of patient's record.

3) Referring to admission records and reaching to numbers of records of the patients. The total number of patients who had been searched and were predicted that they had sustained head trauma was 354 patients in 2007 and 381 patients in 2006, so the total reached 735 patients.

4) By records numbers, the researcher reached to the medical records of the patients, reviewing them and doing data collection by filling of case survey for the patients who had sustained head trauma, then TBI. The total number of medical records included in this study for Al-Ittihad hospital was about 95 records. The records of patients with TBI with poor documentation were excluded in this study.

Second: Steps were done at Archives department in Rafidia hospital:

1) Using a computerized data system at Rafidia hospital to search of all patients admitted to neurosurgery department and intensive care unit between 2006-2007. The total number of records numbers listed for those patients admitted and classified to have bullet injury, RTA, fall, and predicted to have head trauma was 628 patients in 2006 and 550 patients in 2007, and those admitted to neurosurgery, intensive, and intermediate unit.

2) According to records numbers listed, the researcher was referring to medical records, and then reviewing medical records to study the patients who had sustained head trauma, then TBI. The total number of medical records included in this study for Rafidia hospital was about 149 records, and the records for the patients with TBI with poor documentation were excluded in this study.

Third: Steps were done at Archives department in Specialized Arab hospital:

1) The researcher had taken permission from the head of physicians in Specialized Arab hospital to conduct the study in, and they gave the

researcher permission to review some of the medical records about 80 out 258 records for patients admitted to Neurosurgery department between 2006-2007 and were treated by special neurosurgeons in the hospital.

2) Using a computerized data system in Specialized Arab hospital to search of 80 patients who treated by special neurosurgeons in the hospital, and those patients were not classified, but predicted to have head trauma.

3) 68 Medical records out of 80 were reviewed to study patients with head trauma, then TBI.

4) Specialized Arab hospital applying a consistent system in privacy to use medical records, they keep on patient's privacy while they don't allow the researchers or persons from outside to see or review the medical records.

3.6 Ethical Considerations

- Formal letters from Al-Najah University were submitted to targeted hospitals to give permission for the researcher to conduct the study in.
- Through contact with TBI patients to collect data about their injuries, the researcher explain to them the importance and objectives of the study.
- Dealing so privately with information that taken from medical records and direct contact with patients.

3.7 Data analysis

After collection of data, they were entered into the computer, and computed using SPSS program. Descriptive statistics for the demographic data and analytical statistics for the study hypotheses were applied. Tests were used; frequency distribution tables, and cross-tabulations.

- **Cross-tabulations** were done to study the association of independent variables with dependent variables (causes of TBI and outcomes following TBI) and tested for significance by chi-square test in the significant level (95%) (P value = 0.05).

CHAPTER IV

FINDINGS Of THE STUDY

4.1 Descriptive analysis

4.1.1 Frequencies of socio –demographic characteristics of the study Population

- **Gender**

Table 4.1: Distribution of the study population according to gender

Gender	Frequency	%
Male	253	81.1
Female	59	18.9
Total	312	100

Table 4.1 shows that the highest percentage 81.1% of the study population was males, while females were 18.9% of the study population**.**

- **Age**

Table 4.2: Distribution of the study population according to Age

Age	Frequency	%
19- 29	70	22.4
10 - 17	59	18.9
30 - 49	54	17.3
Below 5 years	48	15.4
5- 9	47	15.1
Above 65	15	4.8
18 year	11	3.5
50-65	8	2.6
Total	312	100

Table 4.2 shows that the highest percentage 22.4% of the study population was at age group 19-29, followed by 10-17 (18.9%), and the lowest percentage 2.6% of the study population, was at age group 50-65. This indicates that those people at age 19-29 are more exposed to have TBI in Palestine, as they may be exposed to assaults from Israeli soldiers or working as motor vehicles drivers or at construction. In this study, people

who are working, and had sustained TBI, most of them working as unskilled workers or drivers, and these occupations at risk to sustain TBI[53] .

*** Province**

When the study population was distributed according to their province, the highest percentage 78.5% of the study population was from Nablus province, followed by Jenin 9.4%, Tulkarm 6.4%, and Qalqilia 5.4%. Missing subjects were 0.3%. (See Appendix H, table 1).

- **Place of residence**

Table 4.3: Distribution of the study population according to place of residence**.**

Place of residence	Frequency	%
Village	111	35.6
City	104	33.4
Camp	90	28.8
Missing Subjects	7	2.2
Total	312	100

Table 4.3 shows that the highest percentage 35.6% of the study population was from villages followed by cities 33.4%, and refugee camps 28.8%. Missing subjects were 2.2%.

- **Marital status**

Majority of the study population, nearly half 43.6% was single, followed by not applicable 28.8%, married 22.1%, and divorced 0.3%. Missing subjects were 5.2%. (See Appendix H, table 2).

- **Type of occupation**

The highest percentage 33.3% of the study population was students, followed by unemployed 28.5%, unskilled workers 18.9%, drivers 4.2%, skilled workers 3.2%, professional workers 1.3%, and administrators 1%. Missing subjects were 9.6%. (See Appendix H, table 3). These findings indicate that the persons among school age at 5- 9 or 10-17 years sustained head injury either by road traffic accidents as pedestrians, motor cycles or bicycles drivers, or by assaults through facing Israeli soldiers by stones when there were an Israeli curfews at their areas, or by falling down accidents at their schools or homes.

- **Level of education**

The highest percentage 52.6% of the study population, the level of education was less than tawjehi, followed by not applicable 17.3%, diploma and above 7.7%, tawjehi 7.4%, and illiterate 3.8%. Missing subjects were 11.2%. (See Appendix H, table 4).

- **Family income**

The highest percentage 32.7% of the study population, the family income was 201-400 JD, followed by up to 200 JD (28.5%), 401-600 JD (9%), and more than 600 JD (6.7%). Missing subjects were 23.1%. (See Appendix H, table5). These findings indicate that the Palestinian people are among worse economic situation due to the political situation. A continuous closure after Al-Aqsa Intifada led to have many persons without jobs, then getting bad economic situation among many shops, trading, and etc.

4.1.2 Frequencies of medical information about the study population at hospital admission.

- **Hospital name**

The highest percentage 47.8% of the study population admitted to Rafidia hospital followed by Al-Ittihad 30.4% and Specialized Arab 21.8%. (See Appendix H, table 6). These findings indicate that Rafidia is the most common governormental hospital in northern part of Palestine where most of persons with head injuries are from northern governorates referred to.

- **Year of injury**

The highest percentage 60.3% of the study population injured in 2006, followed by 2007 (39.4%). Missing subjects were 0.3%. (See Appendix H, table7). These findings indicate that the number of persons with head injuries due to Israeli assaults differ from year to year in which that depends on the number of Israeli curfews in the areas, whereas there has been an increase in the number of assaults by bullet injuries in 2006, while an decrease in 2007. Of the study population, 45 patients sustained bullet injuries in 2006 while 29 patients sustained bullet injuries in 2007.

- **Previous history of head injury**

The highest percentage 73.4% of the study population did not sustain a previous history of head injury, as the response to the question was (NO), while 9% of the study population sustained a previous history of head injury, as the response was (YES). This item of case survey was answered either by medical records or direct contact with patients. Missing subjects were 17.6%. (See Appendix H, table 8). These findings indicates that a

previous history of head injury did not play a role for worse outcomes post TBI among the study population since there was a highest percentage of the study population hadn't a previous history of head injury, but there was a high number about 44.9% of study population had sustained a worse outcomes post injury. These findings are not agreement with the studies showed that pre-injury factors such as a history of previous head injury has been associated with worse outcome after TBI[1,56]

- **Causes of TBI**

Table 4.4: Distribution of the study population according to causes of TBI.

Causes of TBI	Frequency	%
Assaults	103	33
Falls	100	32.1
Road traffic accidents	93	29.8
Hits by heavy objects	10	3.2
Missing Subjects	6	1.9
Total	312	100

Table 4.4 shows that the highest percentage 33% of the study population, sustained TBI due to assaults, while 32.1% due to falls, 29.8% due to road traffic accidents, and 3.2% due to hits by heavy objects. Missing subjects were 1.9%, that missing was due to unknown causes for few targeted patients, and sports injuries were invisible among the targeted population. These findings indicate that assaults are the major cause of TBI among Palestinians since occupations and conflict are a common situation there, sports activities are not common, while in USA, or UK as western countries, sports injuries are common causes of head injuries.

- **Types of road user accident**

The highest percentage 14.1% of the study population who sustained TBI by road traffic accidents were pedestrians, and 10.9% were occupants. Subjects were excluded in this item of case survey were 75%, means patients hadn't been involved in road traffic accidents. (See Appendix H, table 9). These findings indicate that road traffic injuries or deaths in Palestine had been occurred by pedestrians, than by motor vehicle occupants. This reflects the ignorance of traffic rules and speed of the vehicle by drivers to cause injury for the pedestrians.

- **Types of assault**

Table 4.5: Distribution of the study population according to the types of assault

Types of assault	Frequency	%
Bullet injuries	74	23.7
Head blow	28	9.5
Penetrating instruments	1	0.3
Subjects were excluded in item	209	66.5
Total	312	100

Table 4.5 shows that the highest percentage 23.7% of the study population had sustained bullet injuries as type of assault, while 9.5% had a head blow, and 0.3% had sustained penetrating instruments to head. Subjects were excluded in this item of case survey 66.5%, means patients did not sustain assault as a cause of TBI.

- **Causes of assault**

The highest percentage 27.9% of the study population, had sustained assault by Israeli soldiers, while 5.1% by other people. Subjects were

excluded in this item of case survey 67%, means patients did not sustain assault as a cause of TBI. (See Appendix H, table 10).

- **Associated injuries**

The highest percentage of the study population 55.8% did not sustain associated injuries with head, while 42% had sustained associated injuries. Missing subjects were 2.2%. (See Appendix, table11).

- **Types of associated injuries**

The highest percentage 29.5% of the study population had sustained other injuries as a type of associated injuries, while 9.9% had sustained limbs fractures, 2.9% had sustained spinal cord injuries, and 1% had sustained limbs amputation. Subjects were excluded in this item of case survey 56.7%, means patients did not sustain associated injuries with head. (See Appendix H, table 12). These findings indicate that the patients with TBI are steadily in need of rehabilitation services, either because of worse outcomes following TBI as functional disability, coma, or because of associated injuries.

- **Severity of TBI**

The highest percentage 53.8% of the study population had mild TBI, followed by severe 27.3%, and then moderate TBI 17.6%. Missing subjects were 1.3%. (See Appendix H, table 13). These findings indicate that the patients, who sustained mild head injury, had a good recovery, and the patients who had sustained moderate or severe injury, had a functional disability, coma, or death.

- **Outcomes following TBI at hospital discharge**

Table 4.6: Distribution of the study population according to outcomes following TBI at hospital discharge

Outcome following TBI	Frequency	%
Good recovery	168	53.8
Functional disability	91	29.2
Coma /Vegetative	28	9
Death	21	6.7
Missing Subjects	4	1.3
Total	312	100

Table 4.6 shows that the highest percentage 53.8% of the study population had sustained a good recovery as outcome following TBI at hospital discharge, followed by functional disability 29.2%, coma/vegetative 9%, and death 6.7%**.** Missing subjects were 1.3%.

- **Period of functional disability**

The highest percentage 23.1% of the study population who had sustained functional disability had permanent functional disability, while 6.1% had temporary disability. These findings indicate that TBI is steadily causing a permanent disability more than temporary. Subjects were excluded in this item of case survey 70.8%, means patients did not sustain functional disability as an outcome following TBI at hospital discharge, but had sustained good recovery, death, or coma. (See Appendix H, table 14).

- **Stay duration at hospital**

The highest percentage 89.1% of the study population, stay duration at hospital was up to 1 month, followed by 2-3 months 8%, 4-6 months 0.6%, and more than 6 months 0.6%. Missing subjects were 1.7%. (See Appendix H, table 15). These findings indicate that the targeted population who had sustained mild head injury, a good recovery consisted majority of

the targeted population and stayed a shorter period of time in hospital about up to 1 month, or patients with moderate or severe head injury were referred to other hospitals.

- **Referring to other hospitals**

The highest percentage 79.8% of the study population was not referred to other hospitals, while 17.9% was refereed, whereas the patients who had worse outcome as functional disability or coma at discharge who might be refereed to other hospital either national or abroad hospitals to complete the medical treatment. Missing subjects were 2.3%. (See Appendix H, table 16).

- **Which hospitals the patients referred**

The highest percentage 12.1% of the study population was referred to national hospitals, while 5.8% was referred to abroad hospital. Subjects were excluded in this item of case survey 82.1%, means patients were not referred to other hospitals. (See Appendix H, table 17).

4.1.3 Frequencies of rehabilitation services provided after medical treatment

- **Outcomes following TBI after hospital discharge**

Table 4.7: Distribution of the study population according to outcome following TBI after hospital discharge.

Outcome following TBI after hospital discharge	Frequency	%
Functional Disability	87	27.9
Good recovery/ Improved	14	4.5
Death	13	4.2
Coma /Vegetative state	4	1.2
Subjects were excluded	194	62.2
Total	312	100

Table 4.7 shows that the highest percentage 27.9% of the study population had sustained functional disability as outcome following TBI after hospital discharge post months of injury. This firstly indicates that TBI is steadily causing a permanent functional disability, and secondly indicates that there are currently patients with TBI have either mono or multiple dysfunctions as physical , cognitive , behavioral and psychological where patients steadily in need of rehabilitation services. 4.5% of the study population had improved, or had a good recovery as outcome following TBI after hospital discharge, means that there were patients who had sustained temporary disability had improved. And the patients with mild head injury, good recovery, and had associated injuries with head as limbs fractures, they had involved in or still need rehabilitation services after hospital discharge. On the other hand 4.2% of the study population had sustained death as outcome following TBI after hospital discharge, means TBI among young or elderly people steadily causing severe injury that may lead death either at hospitalization period or after in months, or years of the

medical treatment and hospital discharge. Also 1.2% of the study population had sustained coma/vegetative state, and still receives medical treatment and rehabilitation services. Subjects were excluded in this item of case survey were 62.2%, this item was only for the patients who had sustained moderate or severe injury with functional disability, or coma as outcomes following TBI at hospital discharge while death outcome at hospital discharge was excluded, and mild injury without associated injuries needed rehabilitation services were also excluded.

- **Types of functional disability**

Table 4.8: Distribution of the study population according to types of functional disability

Types of functional disability	Frequency	%
More than one dysfunction	75	24
Psychological/mental dysfunction	5	1.6
Behavioral disturbance	3	1.1
Cognitive disability	2	0.6
Speech dysfunction	1	0.3
Physical disability	1	0.3
Subjects were excluded	225	72.1
Total	312	100

Table 4.8 shows that the highest percentage 24% of the study population, who had sustained a functional disability, had more than one dysfunction, 1.6% had a psychological or mental dysfunction, 1.1% had a behavioral disturbance, 0.6% had a cognitive dysfunction, 0.3% had a physical dysfunction, and 0.3% had a speech dysfunction. These findings indicate that TBI may steadily cause more than one dysfunction rather than a mono-dysfunction, and the psychological and behavioral disturbances are the commonest outcomes following TBI post months or years after hospital discharge. Subjects were excluded in this item of case survey 72.1%, means patients did not sustain functional disability as an outcome

following TBI after hospital discharge, but they had sustained good recovery, death, or coma.

- **Rehabilitation services provided**

The highest percentage 13.8% of the study population who had sustained worse outcome (functional disability, coma) at hospital discharge, with the patients with mild injury and had sustained associated injuries and needed rehabilitation services, were not involved in rehabilitation services, followed by integrated therapy 13.1%, physiotherapy 7.1%, more than one service 3.2%, occupational therapy 0.3%, and speech therapy 0.3%. Subjects were excluded in this item of case survey 62.2%, this item was only for the patients who had sustained moderate or severe injury with functional disability, or coma as outcomes following TBI at hospital discharge while death outcome at hospital discharge was excluded and mild injuries (good recovery) without associated injuries needed rehabilitation services were also excluded. (See Appendix H, table 18).

- **Rehabilitation services duration**

The highest percentage 8% of the study population who had sustained worse outcome (functional disability, coma) at hospital discharge, with the patients with mild injury and had sustained associated injuries and needed rehabilitation, services duration for rehabilitation was up to 1 month, followed by 2-3 months 6.4%, 4-6 months 3.5%, more than 6 months 3.5%, and patients still involving in the services 2.3%. Subjects were excluded in this item of case survey 76.3%, this item was only for the patients had sustained moderate or severe injury with functional disability, or coma as

outcomes following TBI at hospital discharge and were involved in rehabilitation services, while death outcome at hospital discharge was excluded, and mild injuries (good recovery) without associated injuries needed rehabilitation services were also excluded, and patients were not involved in rehabilitation services were also excluded. (See Appendix H, table 19).

- **Place of rehabilitation services**

The highest percentage 14.1% of the study population who had sustained worse outcome (functional disability, coma) at hospital discharge, with the patients with mild injury and had sustained associated injuries and needed rehabilitation services, referred to BASR services, followed by hospital (4.3%), Nablus centers (3.7%), Abu Raya (1%), Princess Bassma 0.3%, and Jenin centers 0.3%. This indicates BASR is a center specialized in TBI in Palestine which receives the patients from northern or southern part in West Bank. This center provides a comprehensive rehabilitation services for the patients. Subjects were excluded in this item of case survey 76.3%, this item was only for the patients had sustained moderate or severe injury with functional disability, or coma as outcomes of TBI at hospital discharge while death outcome at hospital discharge was excluded, and mild injuries (good recovery) without associated injuries needed rehabilitation services were also excluded, and patients were not involved in rehabilitation services were also excluded. (See Appendix H, table 20).

- **Independency in activities of daily living (ADL)**

Table 4.9: Distribution of the study population according to independency in ADL

Independency in ADL	Frequency	%
Needs assistance	41	13.1
Fully Independent	37	11.9
Dependent	27	8.7
Subjects were excluded	207	66.3
Total	312	100

Table 4.9 shows that the highest percentage 13.1% of the study population who had sustained outcomes after hospital discharge as functional disability, coma, or sustained improve after temporary functional disability, with the patients had a good recovery (mild injury) and had sustained associated injuries, need assistance followed by fully independent 11.9%, dependent 8.7%. Subjects were excluded in this item of case survey 66.3%), this item was only for the patients had sustained moderate or severe injury with functional disability, or coma as outcomes following TBI at hospital discharge while death as outcome at or after hospital discharge was excluded, and mild injuries (good recovery) without associated injuries needed rehabilitation services were also excluded.

- **If the patients still need a follow-up in rehabilitation services**

Table 4.10: Distribution of the study population according to their need of follow- up in rehabilitation services.

If the patients still needs follow up	Frequency	%
YES	91	29.2
NO	14	4.5
Total	105	33.7
Subjects were excluded	207	66.3
Total	312	100

Table 4.10 shows that the highest percentage 29.2% of the study population who had sustained outcomes after hospital discharge as functional disability, coma, improve after temporary functional disability, with the patients had a good recovery (mild injury) and had sustained associated injuries , still need a follow –up in rehabilitation services, while 4.5% don't need a follow- up. Subjects were excluded in this item of case survey 66.3%, this item was only for the patients had sustained moderate or severe injury with functional disability, or coma as outcomes of TBI at hospital discharge while death as outcome at or after hospital discharge was excluded, and mild injuries without associated injuries needed rehabilitation services were also excluded.

- **Services needed as a follow – up in rehabilitation services**

Table 4.11: Distribution of the study population according to services needed as a follow- up in rehabilitation services.

Services needed as a follow-up in rehabilitation services	Frequency	%
More than one service	63	20.2
Integrated / Comprehensive therapy	13	4.2
Psychological therapy	8	2.6
Speech and language therapy	3	1
Occupational therapy	2	0.6
Physiotherapy	2	0.6
Total	91	29.2
Subjects were excluded in the item	221	70.8
Total	312	100

Table 4.11 shows that the highest percentage 20.2% of the study population who had sustained outcomes after hospital discharge as functional disability, coma, improve after temporary functional disability, with the patients had a good recovery (mild injury) and had associated injuries still need a follow –up in rehabilitation, need more than one rehabilitation service, while 4.2% need integrated (comprehensive therapy),

2.6% need psychological therapy, 1% need speech therapy and language therapy, 0.6% need physiotherapy, and 0.6% need occupational therapy. This indicates rehabilitation services as physiotherapy, occupational therapy, psychological therapy, or speech therapy are much needed with TBI, but maybe there are few therapists working on providing these services for TBI patients in northern part of West Bank.

4.2 Analytical findings

4.2.1 Findings of the first hypothesis

In order to study the truth of the hypothesis “There is no significant relationship, at a significant level of 0.05, between causes of TBI and gender ". We used Pearson chi square test, the findings were as shown in the table below.

Table 4.12: Pearson Chi Square test between causes of TBI and gender

Dependent Variable	Independent	P. value
Causes of TBI	Gender	0.001

Table 4.12 shows that there was a significant relationship at (P. value < 0.05) between the causes of TBI and the gender. The highest number 75 patients of the study population who had been involved in road traffic accidents, the gender was males, while the highest number 69 patients of the study population who had been involved in falls, the gender was males, also the highest number 10 patients of the study population who had been involved in hits by heavy objects, the gender was males, and the highest number 93 patients of the study population who had been involved in assaults, the gender was also males. The following figure shows the relationship between causes of TBI, and gender.

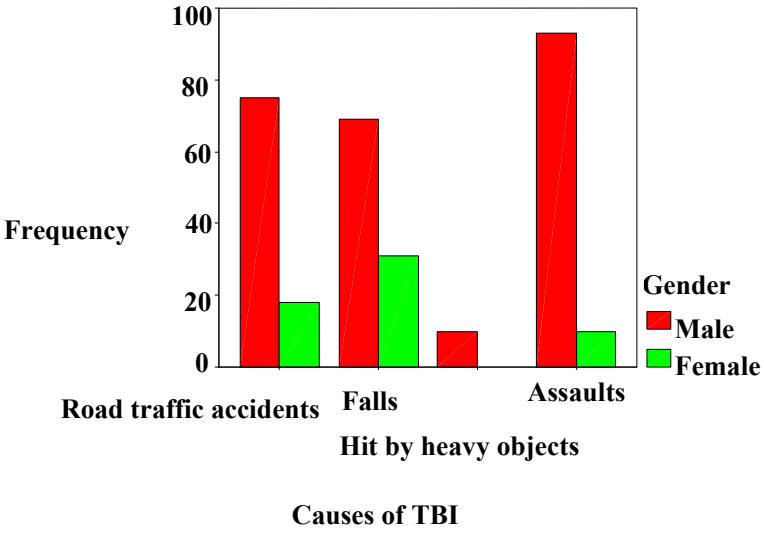


Figure 4.1: The Relationship between the causes of TBI and gender

4.2.2 Findings of the second hypothesis

In order to study the truth of the hypothesis "There is no significant relationship, at a significant level of 0.05, between causes of TBI and age "We used Pearson chi square test, the findings were as shown in the table below.

Table 4.13: Pearson Chi Square test between causes of TBI and age

Dependent Variable	Independent Variable	P. value
Causes of TBI	Age	0.000

Table 4.13 shows that there was a significant relationship (P. value < 0.05) between causes of TBI and age. The highest number 25 patients of the study population who had been involved in road traffic accidents, the age group 19-29, while the highest number 37 patients of the study population who had been involved in falls, the age less than 5 years old, also the highest number 4 patients of the study population who had been involved in hits by heavy objects, the age less than 5 years old, and the highest number 36 patients of the study population who had been involved

in assaults, the age group 19-29. The following figure shows the relationship between causes of TBI and age.

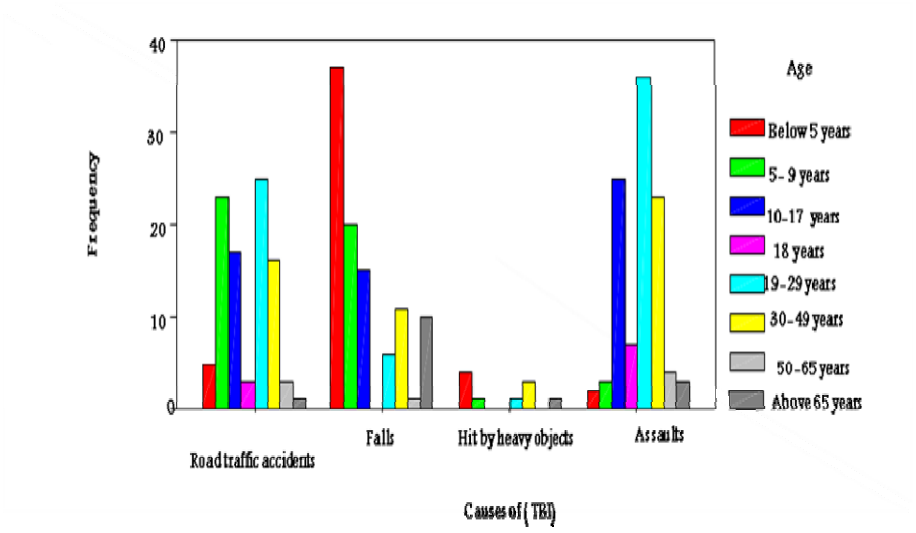


Figure 4.2: The relationship between the causes of TBI and age

4.2.3 Findings of the third hypothesis

In order to study the truth of the hypothesis “There is no significant relationship, at a significant level of 0.05, between causes of TBI and place of residence "We used Pearson chi square test, the findings were as shown in the table below.

Table 4.14: Pearson Chi Square test between causes of TBI and place of residence

Dependent Variable	Independent Variable	P. value
Causes of TBI	Place of residence	0.006

Table 4.14 shows that there was a significant relationship (P. value < 0.05) between causes of TBI and place of residence.

The highest number 42 patients of the study population who had been involved in road traffic accidents as cause of TBI, the places of residence were villages, while the highest number 33 patients of the study population who had been involved in falls, the places of residence were cities or villages, also the highest number 6 patients of the study population who were involved in hits by heavy objects, the places of residence were villages, and the highest number 40 patients of the study population who had been involved in assaults as cause of TBI, the places of residence were refugee camps. The following figure shows the relationship between causes of TBI and place of residence.

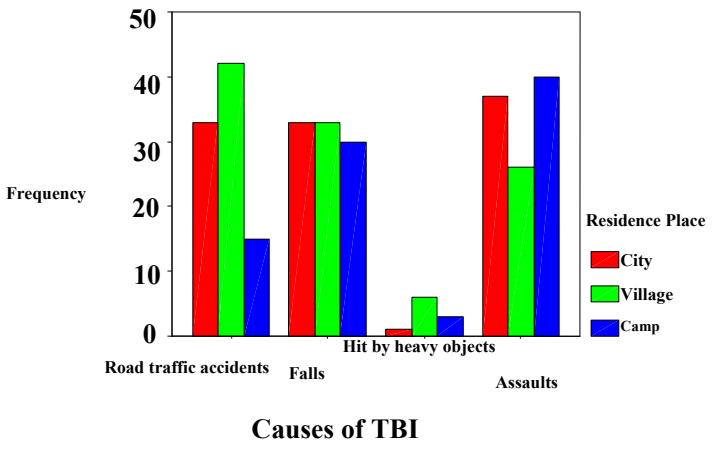


Figure 4.3: The relationship between causes of TBI and place of residence

4.2.4 Findings of the forth hypothesis

In order to study the truth of the hypothesis “There is no significant relationship, at a significant level of 0.05, between causes of TBI and marital status " We used Pearson chi square test, the findings were as shown in the table below.

Table 4.15: Pearson Chi Square test between causes of TBI and marital status

Dependent Variable	Independent Variable	P. value
Causes of TBI	Marital status	0.000

Table 4.15 shows that there was a significant relationship (P. value < 0.05) between causes of TBI and marital status. The highest number 39 patients of the study population who has been involved in road traffic accidents, the marital status was single, while the highest number 54 patients of the study population who had been involved in falls, the marital status was single, also all patients 10 of the study population who had been involved in hits by heavy, the marital status was single and the highest number 66 patients of the study population who had been involved in assaults, the marital status was single. The following figure shows the relationship between causes of TBI and marital status.

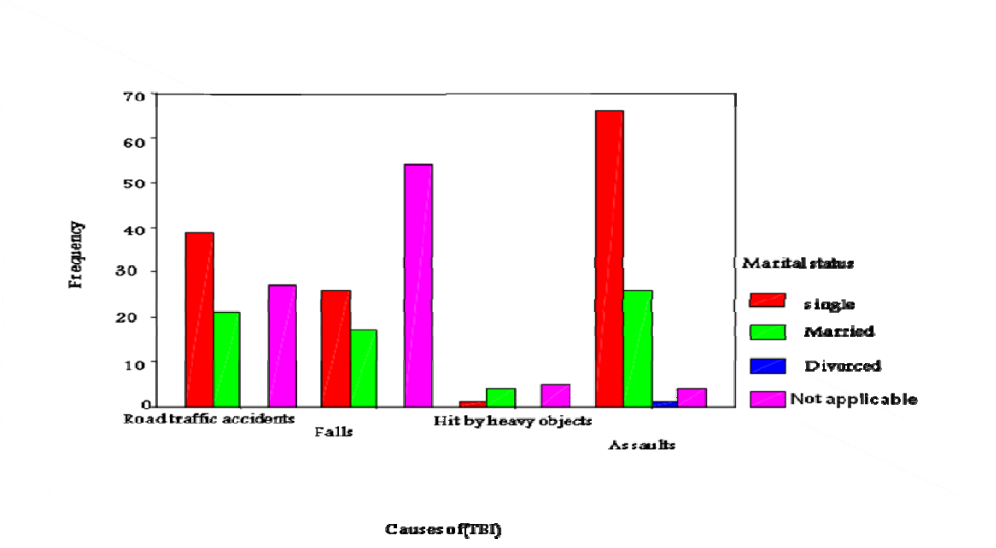


Figure 4.4: The relationship between causes of TBI, and marital status

4.2.5 Findings of the fifth hypothesis

In order to study the truth of the hypothesis “There is no significant relationship, at a significant level of 0.05, between outcomes following TBI at hospital discharge, and causes of TBI "We used Pearson chi square test, the findings were as shown in the table below.

Table 4.16: Pearson Chi Square test between outcomes following TBI and causes

Dependent Variable	Independent Variable	P .value
Outcomes following TBI	Cause of TBI	0.001

Table 4.16 shows that there was a significant relationship (P. value < 0.05) between outcomes following TBI at hospital discharge and causes of TBI. The highest number 38 patients of the study population who had sustained functional disability as an outcome of TBI, had involved in assaults as a cause of TBI, while the highest number 12 patients of the study population who had sustained coma/ vegetative state, had been involved in road traffic accidents, also the highest number 14 patients of the study population who had sustained death, had been involved in assaults, and the highest number 68 patients of the study population who had a good recovery, had been involved in falls. The following figure shows the relationship between outcomes following TBI and causes.

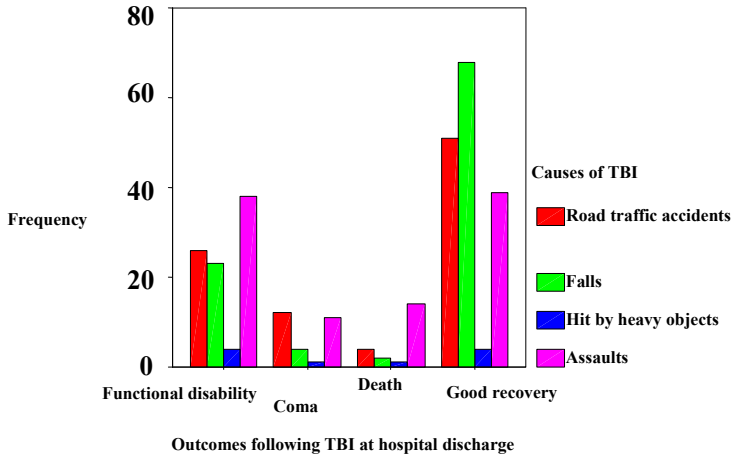


Figure 4.5: The relationship between outcomes following TBI and causes of TBI

4.2.6 Findings of the sixth hypothesis

In order to study the truth of the hypothesis "There is no significant relationship, at a significant level of 0.05, between outcomes following TBI at hospital discharge, and age "We use Pearson chi square test, the findings were as shown in the table below.

Table 4.17: Pearson Chi Square test between outcomes following TBI and age

Dependent Variable	Independent Variable	P. value
Outcomes following TBI	Age	0.140

Table 4.17 shows that there wasn't a significant relationship (P. value > 0.05) between outcomes following TBI at hospital discharge and age. The highest number 22 patients of the study population who had sustained functional disability, the age group 10-17, while the highest number 8 patients of the study population who had sustained coma, the age group 30-49, and the highest number 6 of the study population who had sustained death, the age group 19-29, and the highest number 39 patients of the study

population who had a good recovery, the age group 19-29. The following figure shows no relationship between outcomes following TBI, and age.

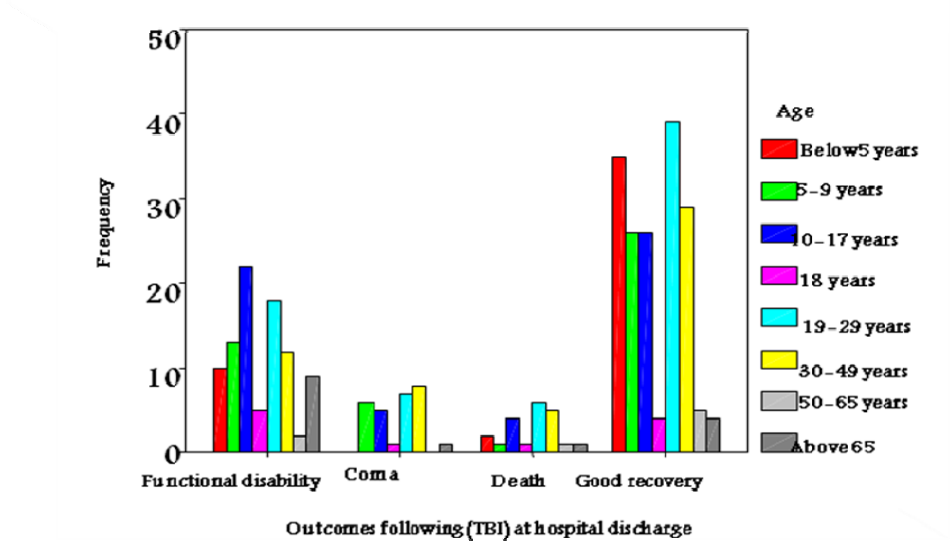


Figure 4.6: Not significant relationship between outcomes following TBI, and age

4.2.7 Findings of the seventh hypothesis

In order to study the truth of the hypothesis "There is no significant relationship, at a significant level of 0.05, between outcomes following TBI at hospital discharge, and level of education "We use Pearson chi square test, the findings were as shown in the table below.

Table 4.18: Pearson Chi Square test between outcomes following TBI and level of education

Dependent Variable	Independent Variable	P. value
Outcomes following TBI	Level of education	0.038

Table 4.18 shows that there was a significant relationship (P. value < 0.05) between outcomes following TBI at hospital discharge and level of education. The highest number 55 patients of the study population who had sustained functional disability, the level of education was less than tawjehi, while the highest number 21 patients of the study population who

had sustained coma, the level of education less than tawjehi, and the highest number 12 of the study population who had sustained death, the level of education less than tawjehi , and the highest number 73 patients of the study population who had a good recovery, the level of education less than tawjehi. The following figure shows relationship between outcomes following TBI, and level of education.

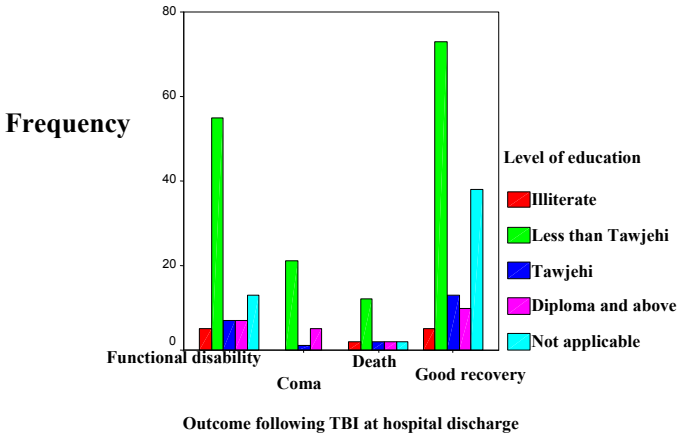


Figure 4.7: The relationship between outcomes following TBI and level of education.

4.3 Summary

<u>First:</u> Relationship between the causes of TBI and socio-demographic characteristics:

- **A significant relationships are**

1) There is a significant relationship, between causes of TBI and gender.

2) There is a significant relationship, between causes of TBI and age.

3) There is a significant relationship, between causes of TBI and place of residence.

4) There is a significant relationship, between causes of TBI and marital status.

<u>Second</u>: Relationship between the outcomes following TBI at hospital discharge and causes of TBI, socio-demographic characteristics.

- **Significant relationships are:**

1) There is a significant relationship, between outcome following TBI at discharge and causes of TBI.

2) There is a significant relationship, between outcome following TBI at discharge and level of education.

- **Non –Significant relationships are**

3) No significant relationship found between outcome following TBI at hospital discharge and age.

CHAPTER V

DISCUSSION

5.1 Relationship between the causes of TBI and socio-demographic characteristics

One finding of this study is that there was a significant relationship between the causes of TBI and the variables of gender, age, marital status, place of residence at P. value < 0.05.

Findings of other studies showed similar relationships to this finding of the study. One finding of this study is that there was a significant relationship between the causes of TBI and gender. The study showed that males were more exposed to causes of TBI such as road traffic accidents, assaults, falls, and hits by heavy objects. This finding is consistent with those of several other studies[1,2,7,29,30,32,35,40,45,51]showed that TBI occurred more frequently in males than in females by a ratio 2:1. This is likely due to differences in risk exposure and lifestyles. Furthermore, this study is consistent with a study conducted by Palestinian MoH on people who had sustained bullet injuries causing head injuries between September 29, 2000 and December 31, 2006. The findings of this study showed that the highest number of head injuries was among males[7]. Also this study is consistent with a retrospective study conducted in Jordan on 816 patients with head injuries who attended departments of three military hospitals. According to the findings of this study, out of the 816 patients, 541 were males and 275 were females. Furthermore, the study is consistent with a study conducted in Western Australia to assess the incidence of and identify factors associated with road crash –related fatal head injuries in rural and urban areas. In that study, 74.1% of cases involved males[35]. This clearly shows that males are more exposed to TBI than females.

In addition, this current study showed that there was a significant relationship between the causes of TBI and the age variable . The study found that the age group 19-29 was more exposed to assaults, while children less than 5 years old were more exposed to falls and hits by heavy objects accidents. These findings of the study are very close to the findings of a study conducted by Palestinian MoH on persons who sustained head injuries resulting from bullets used by Israeli soldiers[7]. However, the study of Palestinian MoH showed that the age group 19-29 was more exposed to bullet injuries due to assaults by Israeli soldiers. This is also consistent with this study finding. Also this study is in harmony with other studies which showed that children less than 10 years old are at the greatest risk of incurring fall-related injury . They are injured in falls at approximately twice the rate as that of the total population[20]. Falls are also the most frequent cause of any injury during infancy[21]. Also this study is consistent with a retrospective study conducted on all patients who attended the Hamad Hospital in Qatar, to determine the general incidence and early mortality pattern. The findings of this study showed that the majority of TBI patients who were admitted to the hospital, as a result of falls, road traffic accidents or objects falling on head, were children under 10 years old[51].

The marital status was also found to be significantly related to the causes of TBI. This study revealed that unmarried people were more vulnerable to road traffic accidents and assaults. And the same for falls accidents and hits by heavy objects which were more common with not applicable, and that term defined as for (people who are less than 5 years old, and at age 5-9 years old), which means that those people were also

single. Most of the study population was single, and this is consistent with other studies which revealed that unmarried individuals are at risk of sustaining TBI[1, 2,17].

The findings of study also revealed that there was a significant relationship between causes of TBI and place of residence. People from villages were more exposed to RTA (the leading cause of TBI). This study finding is consistent with findings of other studies. This study support findings of a study conducted in Western Australia, in which it was found that 60% of total road traffic accidents and 65% of at-scene deaths occurred in rural areas. The incidence of road traffic death associated with head injury in rural population was more than double that for the urban population. The rural population of Western Australia is over represented in head injury- related road crash deaths[35]. This study finding is also consistent with findings of studies conducted in developing countries such as Africa where rural roads are hazardous, particularly at night as vehicles sometimes travel with no light and rural locations present difficult challenges in providing acceptable standards of treatment. The population is separated by vast distances from hospitals, with bad roads, no doctors and no ambulance services. In such situations, the patient must travel hundreds of kilometers to reach a hospital and time delay will be dangerous as it leads to the development of secondary brain damage when head injury occurs as a result of RTA[49]. Likewise, same conditions may occur in rural locations in Palestine where collisions with animals crossing roads in rural areas are also quite common, and these injuries with animals lead to more collisions, injuries and deaths. Young children are also injured as they run

across roads while playing or running after a ball or are hit while riding on bicycles in rural areas in Palestine.

5.2 Relationship between the outcomes of TBI at hospital discharge and the causes of TBI, socio-demographic characteristics

This study found a significant relationship between the outcomes following TBI at discharge, and causes of TBI, and level of education at P. value < 0.05. The study also revealed that there wasn't a significant relationship between the outcomes following TBI at discharge and age at P. value > 0.05.

A significant relationship was found between the outcomes following TBI at discharge and the causes of TBI. The finding of this significant relationship is consistent with those of some other studies[69], However, other studies[31,35,48,51]contradict these findings. They found that road traffic accidents were associated with more severe injuries compared to other causes, and mortality was very high among road traffic accidents. One study was conducted retrospectively on head injuries patients admitted to accident and emergency department at Khoula hospital in Oman. Mortality was (7.4%) among admitted head injury patients. Of all deaths, 86.6% died due to road traffic accidents, 12.8% due to falls, and 0.6% due to assaults[31]. In present study, assaults were associated with more severe injuries that caused deaths among admitted head injury patients (6.7%). Of these 66.7% died due to assaults, 19% died due to road traffic accidents, 9.5% due to falls, and 4.8% due to hits by heavy objects. This is consistent with a study[69] conducted on 818 patients admitted to six Bronx hospitals during a 6-month period to study the contributing short-term outcome of

central nervous system (CNS) trauma in Bronx, N.Y, USA. The findings of this study showed that assaults to head were largely attributable to gunshot wounds which had poor outcome across all levels of severity. Patients with mild injury whose trauma resulted from gunshot wounds had a 33.3% case-fatality ratio compared to 0.7% of the mildly injured due to other causes.

Regarding age, the relationship between the outcomes following TBI at hospital discharge and age was not significant in this study. This doesn't support the study which showed that geriatric trauma patients had a worse outcome than the young with comparable injuries, whereas the mortality from TBI was higher among the geriatric population at all levels of head injury. In addition, functional outcome at hospital discharge was worse; age itself is an independent predictor for mortality in TBI[1,55,56]. The study isn't also consistent with a study that was conducted on 818 patients admitted to six Bronx hospitals during a 6-month period to study the contributing short-term outcome of Central Nervous System (CNS) trauma in the Bronx, N.Y, USA. The findings of this study showed that the predictability of outcome by GCS as derived from an adult population which cannot be applied to the pediatric population: the outcome of pediatric cases with similar neurological function is considerably better than the outcome for adults with the same GCS levels[69]. The study isn't consistent with those aforementioned studies. The reason is probably because the number of elderly persons with TBI admitted to the targeted hospitals was few, whereas age group 50-65, and older than 65 consisted of 2.6%, and 4.8% of all the patients respectively. On the other hand, the percentage of Palestinians 65 years old and more is only 2.8% of all population[8]. This is in contrast to the geriatric population in developed

countries, whereas in many of them, ageing represents a relatively high proportion of the population.

Regarding the level of education, the relationship between the outcomes following TBI at hospital discharge and the level of education was a significant. The findings of the study showed that the patients who sustained worse outcomes following TBI at hospital discharge (functional disability, coma, or death), had a level of education less than tawjehi. This is consistent with studies which showed that the lower level of education was associated with worse outcome after TBI[1,55]. The findings are also consistent with studies which showed that higher degree of premorbid education may have impact on a better prognosis for return to work[63,64] Furthermore, the study showed that patients whose their level of education was less than tawjehi were more exposed to worse outcomes. This is in harmony with a reality that people at age 18 or less are more exposed to head injuries than older people.

5.3 Major causes of TBI in patients admitted to targeted hospitals

In this study, the most common cause of traumatic brain injury in patients admitted to Rafidia, Al-Ittihad, and the Specialized Arab hospitals was assaults (33%), followed by falls (32.1%), road traffic accidents (29.8%), and hits by heavy objects (3.2%).

In other countries in the Arab world, namely Jordan and Qatar, one study showed that falls were the most common cause of head injury in patients admitted to the three military hospitals in Jordan (71.6%), followed by road traffic accidents (22.4%), and missiles (6%). In Oman, one study showed that the most common cause of head injury in patients admitted to

the targeted hospital was falls (54.2%), followed by road traffic accidents (42.1%), assaults (3.2%) and sport injuries (0.5%). In Qatar, one study showed that the most common cause of head injury in patients admitted to the targeted hospital was road traffic accidents (43.1%) followed by falls (33.6%), and sports injuries, including falls from camels and horses, objects falling on patient's head, assaults and other sources of trauma, accounted for the remaining (23.3%). In India, road traffic injuries are the leading cause of TBI followed by falls and violence.

In Israel, for both Jews and Arabs, the most frequent cause of injury was falls followed by hits by objects and car accidents.

In developed countries such as the USA, road traffic accidents are the major cause of head injuries among American people followed by other causes as falls, physical assaults, or sports accidents. In Sweden, head injuries were due to transportation collision and were reduced over a 14-year period of analysis between 1987-2000. Falls persisted as the dominant cause of head injury. Also in UK, motor vehicle accidents are the third most common cause of TBI, after falls and assaults.

Conclusion

Palestine one of the most some trouble parts of the world has been plagued with an open conflict for more than six decades. Physical assault as a result, is becoming one of the leading causes of injuries and head injuries in particular. Bullet injuries are one kind of assault and are considered as one of the major causes of head injuries in the country.

In present study, the findings showed that the major causes of TBI in 312 patients admitted to Rafidia, Al-Ittihad, and the Specialized Arab hospitals between in 2006 and 2007 were assaults (33%), followed by falls (32.1%), road traffic accidents (29.8%), and hits by heavy objects (3.2%). Sports injuries, causing TBI were invisible in the study population.

The highest percentage of the study population who had been involved in assaults, had sustained bullet injuries as type of assault followed by head blow, and penetrating instruments to the head, mostly caused by Israeli soldiers.

Also the highest percentage of the study population who had been involved in road traffic accidents was more likely to be injured as pedestrians than occupants.

Falls and hits by heavy objects which caused TBI were more common among children less than 5 years old, while assaults and road traffic accidents were more common among age group 19-29. Males were found to be more exposed to the causes of TBI than females. The highest percentage of the study population who had been involved in road traffic

accidents was from villages, while the majority of those who had been involved in assaults were from refugee camps.

On the other hand the majority of study population who was exposed to road traffic accidents, falls, and hits by heavy objects or assaults was single.

For outcomes following TBI, the highest percentage of the study population, had mild injury followed by severe, and moderate. Whereas the majority of the patients had a good recovery as outcome following TBI at hospital discharge, while the patients who had sustained moderate or severe injury, had a functional disability, coma, or death as outcomes following TBI at hospital discharge. However, there were 29.2% of the study population had sustained functional disability, 9% sustained coma/vegetative state. 6.7% had been fatally injured. Among the admitted patients with head injuries, 66.7% had died due to assaults, 19% due to road traffic accidents, 9.5% due to falls, and 4.8% due to hits by heavy objects. And among the patients who sustained functional disability (29.2%). 41.8% of them had functional disability due to assaults, 28.6% due to road traffic accidents, 25.2% due to falls and 4.4% due to hits by heavy objects. There are also about 23.1% of the study population who had sustained functional disability had permanent disability, and 6.1% had temporary disability. This means that the patients who had sustained permanent disability had a functional dysfunction as physical, cognitive, speech, psychological, behavioral, or integrated. And those patients may need rehabilitation services to be provided as integrated or a mono-service, that according to the patient's need.

In this study there were about 13.1% admitted in rehabilitation services as integrated therapy, while there were about 13.8% of the study population who had sustained either temporary or permanent functional disability, they needed rehabilitation services, but they could not been admitted in. While for the patients admitted to rehabilitation services as integrated therapy or more than one service for rehabilitation, the majority of patients 14.1% were involved in BASR. This center is specialized in TBI rehabilitation in Palestine, which receives the patients from northern or southern part in West Bank. No one center is specialized in TBI rehabilitation in northern part of West Bank.

In this study there were about 29.2% of the study population who had sustained outcome following TBI after hospital discharge as functional disability, coma/vegetative state or improve, still need a follow- up in rehabilitation services as they need either integrated therapy or mono-service for rehabilitation. However, 20.2% need more than one service, while 4.2% need integrated therapy, 2.6% need a psychological therapy, 1% need speech therapy and language therapy and 0.6% need occupational therapy as a mono-service. This means that rehabilitation services as physiotherapy, occupational therapy, psychological therapy, or speech therapy are much needed with TBI patients, but maybe there are few therapists working on providing these services for TBI patients in northern part of West Bank.

Recommendations

As falls among children were considered a major cause of TBI among the study population, preventive measures should be done towards falls with children by raising awareness and health education for their caregivers. Also as road traffic accidents causing TBI were common with people living in rural location among the study population, adequate preventive measures should be done towards rural roads to be more safe with good light at night, build capacity in the emergency services in health care providers in Palestine. Also funds should reallocate to projects target young males, since males were more exposed to TBI among the study population.

However, planning for health services should focus on establishing a center specialized in TBI rehabilitation in northern part of West Bank, and applying a system in the hospitals involve necessary rehabilitation services provided for TBI patients admitted to the hospitals. These necessary rehabilitation services can be physiotherapy, and occupational therapy. This will decrease referral of patients with TBI from northern part in West Bank to BASR which will reduce the economic and psychological burden on patients and their families.

Health information system should be established with a classification on head injury patients admitted to the hospitals, as it was difficult without this system to reach to the medical records of TBI patients admitted to the targeted hospitals. On the other hand the medical records should be well documented and include more information about socio-demographic data for TBI patients.

Further researches about head injury in Palestine should be done about incidence of TBI in patients admitted to emergency departments of the Palestinian hospitals. Other further researches about the effect of Israeli occupation on head injury patients and on evaluating the rehabilitation services provided for head injury patients in Palestine should also be done.

References

1) Karen, SG Chau, Yee-Sein Ng, Samantha GM Yap, Chek-Wai Bok. (2007). **A Brief Review of Traumatic Brain Injury Rehabilitation**. Annuals Academy of medicine .Vol.36 No1.P: (31-42).

2) Lorraine, W. Pedretti, M. (2000).Occupational Therapy Practice Skills for Physical Dysfunction . **Traumatic Brain Injury.** Chapter 38. P: (671-700). Fifth Edition

3) Kraus JF, MCArthur DL**.** (1996)**. Epidemiology Aspects of Brain Injury**. Neurology Clinics .14:435-50.

4) Palestinian Central Bureau of Statistics . **Summary of Final Results for Demographic Statistics of Palestinian Population** (1997-2006). PCBS website.

5) Palestinian Ministry of Health. (2006)**. Statistics of Casualties in Palestine (2000-2006)**. Palestinian Health Information Center. Biannual report

6) Palestinian Ministry of Health. (2005). **AL-Aqsa Intifada**. Annual Report. Chapter VIII.

7) Palestinian Ministry of Health. **Bullet Head Injuries Statistics (2000-2006).** Palestinian Health Information Center. Nablus Branch.

8) - Palestinian Central Bureau of Statistics. (2005-2006). **Demographic Statistics of the Palestinian People between**.

- Palestinian Central Bureau of Statistics. (2005). **Palestinian Children- Issues and Statistics.** Annual Report**.**

9) Begali, V. (1992). **Head Injury in Children and Adolescents.** A resource And Review for School and Allied Professionals. Second Edition. Clinical Psychology Publishing Company, Inc.

10) Brain Resource Information Network. **About Traumatic Brain Injury**. Available at: http://www.tndisability.org/brain/About-Traumatic-Brain-Injury.php (Accessed on March 15,2008)

11) Wikipedia, the free encyclopedia. **Head Injury**. Available at :Head injury -Wikipedia, the free encyclopedia.mht .(Accessed on March 15, 2008)

12) Kids Health for Parents. **Head Injuries**. Available at : http://kidshealth.org/parent/firstaid_safe/emergencies/head_injury.html (Accessed on March 15,2008)

13) Medline Plus Medical Encyclopedia. **Head Injury**. Available at http://www.nlm.nih.gov/medlineplus/ency/article/000028.htm. (Accessed on March 15, 2008)

14) Traumatic Brain Injury Resource. **Brain Functions and Map.** Available at:www.neuroskills.com/**brain**.shtml**.** (Accessed on April 4, 2008)

15) Traumatic Brain Injury. **Brain Functions**. Available at: http://tbibraininjury.com/brain-functions.php. (Accessed on April 4,2008)

16) Health24 Medical Conditions Centers. **Traumatic Brain Injury - Client**. http://www.health24.com/medical/Condition_centres/777-792-1077-1707,11912.asp

17) Thurman, DJ. Alverson, C. Dunn, KA. Guerrero, J. Sniezek, JE. (1999)**. Traumatic Brain in the United States**: A public health perspective. Journal Head trauma rehabilitation.13:1-8.

18) Thurman, D. (2001). **The Epidemiology and Economics of Head Trauma**. In: Miler L. Hayes R, editors. Head trauma: Basic, Preclinical, and Clinical Directions. New York (NY): Willey and Sons.

19) Elovic, E. Antoinette, T. (1996). **Epidemiology and Primary Prevention of Traumatic Brain Injury**. In L.J Horn and N.D.Zasler (eds). Medical Rehabilitation of Traumatic Brain Injury . P: (1-28). Philadelphia: Hanley and Belfus.

20) Centers for Disease Control and Prevention. **Leading Causes of Nonfatal Injury Reports**. Available at: webapp.cdc. Gov/sasweb/ ncipc/nfilead.html. (Accessed on March 8, 2008).

21) Powell, Ec. Tanz, RR. (2002). Adjusting our view of injury risk: **The Burden of Nonfatal Injuries in Infancy**. Pediatrics.110-792.

22) Agran, PF.Winnn, D.Anderson, C. et al. (2001). **Rates of Pediatric and Adolescent Injuries by Year of Age**. Pediatrics.108:E45.

23) Garrettsom, LK. Gallagher, SS. (1985). **Falls In Children and Youth**. Pediatric Clinical North America. 32:153

24) Mosenthal, Ac. Livingston, DH. Elcavage, J. et al. (1995). **Falls**. Epidemiology and Strategies for Prevention Jounral Trauma.38:753.

25) American Academy of pediatrics. (2001). **Falls From Heights**. Windows, roofs, and balconies. Pediatrics. 107:1188.

26) Sieben, RL. Leavitt, JD. French, JH. (1971). **Falls as Childhood Accidents**: an increasing urban risk .Pediatrics.47:886.

27) Agency for Health Care Policy and Research. (1999). **Rehabilitation for Traumatic Brain Injury.** (AHCPR publication 99-E006). Rockville, MD: US.A Public Health Service.

28) Ballesteros, MF. Schieber, RA. Gilchrist, J. et al. (2003). **Differential Ranking of Causes of Fatal Versus Non-Fatal Injuries among USA Children**. Injury Prevention. 9:137.

29) Peter, B Disler. Ian, D Cameron. (2003). **Rehabilitation after Traumatic Brain Injury**. The Medical Journal of Australia. 178(6):(290-295).

30) Mahajna,A.Aboud,N.Harbaji,I.Agbari,A.Lankovsly,Z.Michaelson,M.Fisher,D.Krausz,.M.M. (2002). **Blunt and Penetrating Injuries Caused By Rubber Bullets during the Israeli –Arab conflict In October, 2000**. A retrospective study, The Lancet Vol.359.

31) Shahbaz, M. (2002**). Trauma and Head Injury; the Khoula Hospital Experienc**e. Oman. The Middle East Journal of Emergency Medicine.Vol.2, No.2. The paper was presented at the Qatar International Trauma and Emergency Medicine Conference, Doha, Qatar (April 2003). P: 6.

32) Alissa, A. (2003). **Radiological Findings In Patients Who Attended The Emergency Department With Head Injury**; Emergency Department ,King Hussein Medical Center Jordan; Irbid . The Middle East Journal of Emergency Medicine, Vol.3, No.1, P: 5.

33) Nawaz, A. Matta, H. Hamchou, M. Jacobsz, A. AlSalem, A.H. (2005). **Camel-related injuries in the pediatric age group**; Division of Pediatric Surgery, Department of Surgery, Tawam Hospital, Al-Ain, Abu Dhabi, United Arab Emirates, Journal of Pediatric Surgery. Vol .40. Issue 8. P: (1248-1251).

34) AL-kashmiri, A. Scott Delaney, J. (2006). **Head and neck injuries in football (soccer).** Journal Trauma. 8:189-195

35) Stella, J. Sprivulis, P. Cooke, C. (2001). **Head Injury-Related Road Crash Mortality in Rural Western Australia**. ANZ Journal of Surgery. Vol.71 .Issue 11. P: (665-668).

36) E medicine from WebMD. **Traumatic brain injury, Definition, Epidemiology, Pathophysiology.** Available at**:**

http://www.emedicine.com/pmr/topic212.htm.

(Accessed on April 15, 2008)

37) World Health Organization. (1996). Geneva. **Ad Hoc Committee on Health Research Relating to Future Intervention Options**. Investing in Health Research and Development.

38) World Health Organization (WHO), and World Bank. (2008). **World Report on Road Traffic Injury Prevention.**

39) Kelly, Daniel M.D and Becker, Donald M.D. (2001). **Advances in Management of Neurosurgical Trauma: USA and Canada**. World Journal of Surgery. 25(9):1179-1185.

40) Kleiven, S. Pelosi, P.M. Holst, H.V. (2003). **The Epidemiology of Head Injuries in Sweden from (1987-2000)**. Injury control and safety promotion.Vol.10. No.3. P: (173-180)

41) Kay, Andrew and Teasdale, Graham. (2001). **Head Injury in the United Kingdom**. World Journal of Surgery. 25(9).1210-1220.

42) Sikron, F. Giveon, A. Daniel, L. Peleg.K. (2004). **My Home is my Castle! Or is it? Hospitalizations following Home Injury in Israel, (1997-2001)**. Israel National Center for Trauma and Emergency Medicine Research, Gertner Institute for Epidemiology and Health Policy Research,Sheba Medical Center, Tel Hashomer, Israel. IMAJ. Vol.6. P: (332-335).

43) Ministry of health, Jordan.(2006). **Statistics of Road Traffic Accidents in Jordan**. Annual Report

44) Gururaj, G. (2002). **Epidemiology Of Traumatic Brain Injuries**: Indian scenario. Neurological Research.24.24-28

45) Raja, Iftikhar, Vohra, Anjum and Ahmad, Mubasher. (2001). **Neurotruama In Pakistan** .World Journal of Surgery.25(9).1230-1237

46) Nakajima H. (1994). **Violence on Road Causes 7000,000 Death Each Year in the World** .World health organization. Lebanese Medical Journal 31(2) 80-2.

47) Odero W. Y., Zuri. (1997). **Road Traffic Injuries in Developing Countries**; A comprehensive review of epidemiological studies. Tropical Medicine and International Health- Journal Information 2(5) 445-60

48) El-Gindis, S. Mahdy, M. Abdel Azeem.A. (2001). **Traumatic brain injury in developing countries: Road War in Africa**. Egyptian Military Medical Academy and Egypt Air Hospital. Revista Espanola de Neuropsicologia 3, 3: 3-11.

49) Hammad M.A (N.D). **Road Safety**. The Role of Interdepartmental Coordination in the Reduction of Road Accidents.

50) AlTukhi, MH. (1998). **Road traffic accident statistics and data comprising Gulf Countries and Riyadh Area**. Annals of Saudi Medicine Journal 8:310A

51) Wilfred C. Mezue, EI-Fatih M. Bashir. (1998). **Head Injury Pattern in Qatar**, Neurosurgery Unit Department Of Surgery, Hamad General Hospital, Doha, Qatar. Pan Arab- Journals. Vol.2. No.2.

52) Jamous, L.(1994). **Fatal Occupational Injuries among Injured Workers in Jordan**. Unpublished Master Thesis. Jordan University for Sciences and Technology.

53) National Center for Injury Prevention and Control. **Outcomes**. Available at: http://www.cdc.gov/ncipc/tbi/Outcomes.htm (Accessed on April 20,2008)

54) Jannett, B.Teasdale, G**.** (1981**). Management of Head Injuries.** Philadelphia. FA Davis.

55) Luerssen, TG. Klauber, MR. Marshall, LF. (1988)**. Outcome from Head Injury Related To Patient's Age**. A longitudinal prospective study of adult and pediatric head injury. Journal Neurosurgery.68:409-16

56) Mosenthal, AC. Lavery, RF. Addis, M. Kaul, S. Ross, S. Marburger, R. Deitch, EA. Livingston, DH. (2002). **Isolated Traumatic Brain Injury: Age is an Independent Predicator Mortality and Early Outcome**. A service of the National Library of Medicine and the National Institutes of Health. Journal Trauma. 52(5):907-11.

57) Grosswasser.Z, Cohen, M. Keren, O. (1998). **Female TBI patients recover better than males**, Brain Injury 12. P:(805-808)

58) Slewa-Younan, S. Green, A.M. Baguley, I.J. et al .(2004). **Sex Differences in Injury Severity and Outcome Measures after Traumatic Brain Injury**. Archives of Physical Medicine and Rehabilitation 85. P: (376-370).

59) Farin, A. Deutsch, R. Biegon, A. Marshall, L.F. (2003). **Sex-related Differences in Patients With Severe Head Injury**: greater susceptibility to brain swelling in female patients 50 years of age and younger, Journal Neurosurgery 98.P:(32-36)

60) Kirkness, C.J. Burr, R.L. Mitchell, P.H. Newell, D.W. (2004). **Is There A Sex Difference in The Course Following Traumatic Brain Injury**, Biological Research For Nursing 5. P:(299-310)

61) Gan, B.K. Lim, J.H. Ng, I.H. (2004). **Outcome of moderate and Severe Traumatic Brain injury Amongst the Elderly in Singapore**, Annals Academy of Medicine Singapore33. P: (63-67)

62) Dikmen, S. Temkin, N. (1987). **Determination of the Effects of Head Injury and Recovery in Behavioral Research**. In: Levin HS, Grafman J, Eisenberg HM (Eds), Neurobehavioral Recovery from Head Injury. New York, Oxford University Press.

63) Dikmen, S. Mclean, A. Temkin, N. (1986). **Neuropsychological and Psychosocial Consequences of Minor Head Injury.** Journal of Neurology, Neurosurgery and Psychiatry .49:1227-1232

64) Rimeal, RW. Giordani, B. Barth, JT. Boll, TJ. Jane, JA**.** (1981). **Disability Caused By Minor Head Injury**. Neurosurgery. 9:221-229

65) Heilman, KM. Sarfra, A. Geschwind, N. (1971). **Closed Head Trauma and Aphasia**. Journal of Neurology, Neurosurgery and Psychiatry. 34:265-269

66) Sarno, MT. Levin, HS. (1985). **Speech and language disorders after closed head injury**. In: Darby J (ed), Speech and language Evaluation in Neurology: Adult disorders .San Diego, Grune and Stratton Inc.

67) Thomsen, IV. (1975). **Evaluation and Outcome of Aphasia in Patients with Severe Closed Head Trauma**. Journal of Neurology, Neurosurgery and Psychiatry. 38:713-718

68) Gofin, R. Avitzour, M. (2007). **Outcome of head and other injuries among Israeli- children, Physical limitation and Stress Symptoms**, Braun School of Public Health and Community Medicine, Hebrew University, and Hadassah Medical Center, Jerusalem, Israel. The Israel Medical Association of Journal .Vol.9. P: (531-536).

69) Wassertheil-Smoller, S.Tabaddor, K. Feiner, C. Shulman, K. (1982). **Factors Affecting Short-Term Outcome of Head Trauma Patient**, Albert Einstein College of Medicine, Central Nervous System Trauma Center, Bronx Municipal Hospital Center, Bronx, N. Y., USA, Neuroepidemiology. 1:154-166

70) **Long-term outcome after head injury**. (1997). Bandolier Journal. Available at: http://www.medicine.ox.ac.uk/bandolier/band44/b44-3.html: (Accessed on April 20, 2008).

71) Livingston, MG. Brooks, DN. Bond, MR. (1985). **Patient Outcome In The Year Following Severe Head Injury and Relative' Psychiatric and Social Functioning**. Journal of Neurology, Neurosurgery, and Psychiatry. Vol.48. 876-881.

72) Khan, F. Beguley, J. Cameron, ID. (2003). **Rehabilitation after Traumatic Brain Injury**. Medical Journal. 178:290-5

73) Rosenthal, M. Griffith, ER. Bond, MR.et al. (1990). **Rehabilitation of the adult and child with traumatic brain injury**, 2nd edition. Philadelphia: FA Davis.

74) Kampfl. (1998). **The Persistent Vegetative State after Closed Head Injury.** Journal of Neurosurgery.88(5):809-816

APPENDICES

APPENDEX (A)

Case Survey

Major causes of traumatic brain injury in patients admitted to Rafidia, Al-Ittithad, and Specialized Arab Hospitals (2006-2007)

- **Information out research**

Survey Number: ----------Date of Survey: ----------

Hospital: ----------Patient's Name: ----------

Phone #:----------Date of admission: ----------

Date of discharge: ----------

- **Information for research**

Part (1): Demographic data about the patient at injury:

1. Gender: a. Male b. Female

2. Age: a. below 5 b. (5 – 9) c. (10 – 17) d.18

e. (19 - 29) f. (30 - 49) g. (50 - 65)

h. above 65

3. Province: a. Nablus b. Jenin

c. Tulkarm d. Qalqilia

4. Place of residence: a. city b. Village c. Camp

5. Marital Status: a. Single b. Married

c. Divorce d. Widow/Widower

e. Not applicable

6. Type of Occupation

a. Student b. Administrator c. Professional Worker

d. Driver e. Skilled Worker f. Unskilled Worker g. Unemployed

7. Level of Education:

a. Illiterate b. Less than Tawjihi c. Tawjihi

d. Diploma and above e. Not applicable

8. Family Income: a. up to – 200 JD b. 201 – 400 JD

c. 401 – 600 JD d. more than 600 JD

Part (2): Medical Information About the patient at admission:

1. Hospital Name: a. Rafidia b. Specialized Arab c. Al-Ittihad

2. Year of injury: a. 2006 b. 2007

3. Patient's status during admission: a. Survival b. Death

4. Is there a Previous History of Injury: a. Yes b. No

5. Cause of TBI :

a. Road traffic accidents

b. Falls

c. Hits by heavy objects (Objects falling on head)

e. Assaults

5(a). <u>If the cause of TBI is road traffic accident: the person was:</u>

a. Motor vehicle occupant (Passenger/Driver)

b. Pedestrian

5(b). <u>If the cause of TBI is assault, type of assault is</u>

a. Penetrating instruments knife, etc)

b. Head Blow

c. Firearm/ Bullet injury

6. <u>If the cause of TBI in previous question is assault by penetrating instrument, head blow, or bullet injury, the cause of assault is:</u>

a. Israeli soldiers

b. Other people

7. <u>Are there Associated Injuries with head</u>: a. Yes b. No

8. <u>If yes which injuries</u>: a. limbs Fractures b. Spinal Cord Injury

c. limbs amputation d. other injuries

9. <u>Severity of TBI</u>: a. Mild b. Moderate c. Sever

10. <u>Outcomes following TBI at hospital discharge</u>:

a. Functional Disability

b. Coma / Vegetative State

c. Death

d. Good recovery

10(a). If TBI caused a functional disability, a period of disability is:

a. Permanent

b. Temporary

11. Stay Duration at hospital:

a. up to – 1 month b. Between 2- 3 months

c. 4 – 6 months d. more than 6 months

12. Is the patient referred to other hospitals for medical treatment?

a. Yes b. No

13. **If yes which hospitals**:

a. Abroad Hospitals

b. National Hospitals

Part (3): Information about rehabilitation services after a medical treatment:

1. Outcomes following TBI after hospital discharge

a. Good recovery/ improved b. Death

d. Coma / Vegetative State e. Functional Disability

2. If TBI caused a functional disability, what is the type of disability:

a. Physical dysfunction b. Cognitive dysfunction

c. Speech dysfunction d. Behavioral disturbance

e. Psychological dysfunction f. More than one dysfunction

3. Rehabilitation Services provided:

a. Physiotherapy b. Occupational Therapy

c. Speech and language Therapy d. Psychological Therapy

e. More than one service provided f. integrated therapy

g. No services were provided

4. Rehabilitation services duration

a. up to -1 month

b. 2 -3 months

c. 4- 6 months

d. more than 6 months

e. The patient still involve in the service

5. Place of rehabilitation services provided

a. Nablus Centers for rehabilitation

b. Jenin Centers for rehabilitation

c. Tulkarm Centers for rehabilitation

d. Qalqilia Centers for rehabilitation

e. Bethlehem Arab Society for rehabilitation

f. Abu Raya Center for rehabilitation - Ramallah

g. Princess Basma Center for rehabilitation- Jerusalem

h. abroad centers for rehabilitation

I. Hospital

6. Patient's independency in activities of daily living activities of daily living

a. Fully independent b. Dependent c. Needs Assistance

7. If the patient still needs follow –up in rehabilitation?

a. Yes b. No

8. <u>If yes</u>: <u>What services??</u>

a. Physiotherapy

b. Occupational therapy

c. Speech and language therapy

d. Psychological therapy

e. Vocational training

f. More than one service needed

g. Integrated (Comprehensive rehabilitation therapy)

ملحق (أ)

مسح حالة

الأسباب الرئيسية المؤدية لإصابات الدماغ عند المرضى الذين تم إدخالهم مستشفى رفيديا ، الإتحاد، والعربي التخصصي من فترة 2006- 2007

***معلومات خارج البحث:**

رقم المسح:---------- تاريخ المسح: ---------- اسم المستشفى:----------

اسم المريض:---------- رقم الهاتف:----------

تاريخ الدخول:---------- تاريخ الخروج:----------

*** معلومات خاصة بالبحث:**

القسم(1) : **معلومات عامة عن المنتفع عند حدوث الإصابة:**

1- الجنس: أ. ذكر ب. أنثى

2- العمر: أ. أقل من 5 سنوات ب. 5 - 9 ج. 10 - 17

د. 18 هـ. 19 - 29 و. 30 - 49

ي. 50 - 65 ع. فوق 65

3- المحافظة: أ. نابلس ب. جنين ج. طولكرم د. قلقيلية

4- مكان السكن: أ. مدينة ب. قرية ج. مخيم

5- الحالة الاجتماعية: أ. أعزب ب. متزوج

ج. مطلق د. أرمل هـ. لا ينطبق

6- نوع العمل: أ. طالب ب. أعمال إدارية ج . أعمال مهنية

د. سائق هـ. أعمال بحاجة إلى مهارة و. أعمال ليست بحاجة إلى مهارة

ي. عاطل عن العمل

7- المستوى التعليمي: أ. أمي ب. دون التوجيهي

ج. توجيهي د. دبلوم فأعلى هـ. لا ينطبق

8- مستوى الدخل: أ. أقل من 200 دينار ب. 201 - 400 دينار

ج. 401 - 600 دينار د. أكثر من 600 دينار

القسم (2): معلومات طبية عن المنتفع عند دخول المستشفى:

1- اسم المستشفى: أ. رفيديا ب. العربي التخصصي ج. الإتحاد

2- سنة الإصابة: أ. 2006 ب. 2007

3- **حالة المنتفع عند الدخول**

أ. حي ب. متوفى

4-هل هناك تاريخ حادث سابق للإصابة بالرأس؟

أ. نعم ب. لا

5- سبب الإصابة بالدماغ :

أ . حوادث سير

ب. حوادث سقوط

ج. حوادث سقوط أشياء ثقيلة على الرأس

هـ. إعتداءات

5(أ)- إذا كان سبب الإصابة بالدماغ هو نتيجة حادث سير، فأن الشخص المصاب:

أ. راكب

ب. مشاة

5(ب)- إذا كان سبب الإصابة بالدماغ هو نتيجة اعتداء ،فإن نوع الاعتداء هو :

أ. اختراق أدوات حادة(مثل سكين ، الخ)

ب.ضرب الرأس

ج. إطلاق نار

6- إذا كان سبب الإصابة في السؤال السابق هو اختراق أدوات حادة أو الإعتداء بإطلاق نار أو ضرب بالرأس، فما هو سبب الاعتداء ؟

أ. جيش الاحتلال الإسرائيلي

ب. آخرين

7- هل يوجد إصابات أخرى مصاحبة للرأس ؟

أ. نعم ب.لا

8- إن كانت الإجابة نعم في السؤال السابق، فما نوع الإصابة؟

أ. كسور بالأطراف ب. إصابة بالنخاع الشوكي

ج. بتر بالأطراف د. إصابات أخرى

9- شدة الإصابة بالدماغ: أ. بسيطة ب. متوسطة ج. شديدة

10- أثر إصابة الدماغ على المنتفع عند فترة الخروج من المستشفى:

أ. إعاقة وظيفية

ب. غيبوبة

ج. وفاة

د. شفاء

10(أ)- إذا كان أُثر إصابة الدماغ على المنتفع عند فترة الخروج من المستشفى هي إعاقة وظيفية، فإن مدة الإعاقة هي :

أ. دائمة

ب. مؤقتة

11- مدة الإقامة بالمستشفى: أ. أقل من شهر ب . 2 - 3 شهور

ج. 4- 6 شهور د. أكثر من 6 شهور

12- هل تم تحويل المريض إلى مستشفيات أخرى لتلقي العلاج؟ أ. نعم ب. لا

13- إذا كانت الإجابة نعم في السؤال السابق فأي مستشفى ؟ أ. خارجية ب. محلية

القسم(3): معلومات عن الخدمات التأهيلية بعد فترة العلاج الطبي:

1- أثر إصابة الدماغ على المنتفع بعد الخروج من المستشفى:

أ. شفاء / تحسن ب. وفاة ج. غيبوبة د. إعاقة وظيفية

2- **إذا كانت الإجابة هي إعاقة وظيفية في السؤال السابق،فما نوع الإعاقة؟**

أ. خلل وظيفي حركي ب. خلل وظيفي عقلي ج. خلل وظيفي نطقي

د. اضطرابات سلوكية هـ. اضطرابات نفسية و. أكثر من خلل وظيفي واحد

3-الخدمات التأهيلية التي قدمت:

أ. علاج طبيعي ب.علاج وظيفي

ج. علاج نطقي د. علاج نفسي

هـ. أكثر من خدمة تأهيلية واحدة و. علاج تأهيلي شامل ي. لم يتلقى أي خدمة

4-مدة الخدمات التأهيلية:

أ. أقل من شهر ب. 1 - 3 شهور ج. 3 - 6 شهور

د. أكثر من 6 شهور هـ . مازال المنتفع يتلقى الخدمة

5-مكان تقديم الخدمات التأهيلية:

أ. مراكز نابلس للتأهيل ب. مراكز جنين للتأهيل ج. مراكز طولكرم للتأهيل

د. مراكز قلقيلية للتأهيل هـ. جمعية بيت لحم العربية للتأهيل و. مركز أبو ريا للتأهيل

ي. مركز الأميرة بسمة للتأهيل ـ القدس ع. مراكز تأهيل في الخارج غ. المستشفى.

6-مدى اعتماد المنتفع على نفسه في الأمور الحياتية:

أ. مستقل ب. غير مستقل ج. بحاجة إلى مساعدة

7-هل المنتفع ما زال بحاجة إلى متابعة تأهيلية؟

أ. نعم ب. لا

8-إذا كانت الإجابة نعم في السؤال السابق ، ما الخدمات التأهيلية اللازمة؟

أ. علاج طبيعي ب. علاج وظيفي ج. علاج نطقي

د.علاج نفسي هـ. تأهيل مهني و.أكثر من خدمة تأهيلية واحدة ي.علاج شامل

APPENDIX (B)

Glasgow Coma Scale (GCS)

1. Definition:

GCS had been the traditional method used by health care professionals to assess levels of consciousness after a TBI. The GCS has been used to quantify the severity of brain injury and predict outcome. Three behavioral areas assessed in the GCS are motor responses, verbal responses and eye-opening. Although more recent studies have suggested that the GCS is not an effective predicator of long term TBI outcomes, the GCS is an effective indicator of acute TBI status[54]. The GCS provides a score in the range (3 – 15); patients with scores of (3 –8) are usually said to be in a coma. The total score is the sum of the scores in three categories. For adults the scores are as follows:

Table 1: GCS for Adult

Eye Opening Response	Spontaneous--open with blinking at baseline	4 points
	Opens to verbal command, speech, or shout	3 points
	Opens to pain, not applied to face	2points
	None	1 point
Verbal Response	Oriented	5points
	Confused conversation, but able to answer questions	4 points
	Inappropriate responses, words discernible	3points
	Incomprehensible speech	2points
	None	1 point
Motor Response	Obeys commands for movement	6 points
	Purposeful movement to painful stimulus	5 points
	Withdraws from pain	4 points
	Abnormal (spastic) flexion, decorticate posture	3 points
	Extensor (rigid) response, decerebrate posture	2 points
	None	1 point

For children under 5, the verbal response criteria are adjusted as follow:

SCORE	(2 -5) Years	(0- 23) Months
5	Appropriate words or phrases	Smiles or coos appropriately
4	Inappropriate words	Cries and consolable
3	Persistent cries and/or screams	Persistent inappropriate crying/& or screaming
2	Grunts	Grunts or is agitated or restless
1	No response	No response

2. Determining the severity of TBI

Injury Severity Category	Initial (GCS) Scores	Duration of PTA
Mild	(13 – 15)	less than (1) hour
Moderate	(9 – 12)	1 to 24 hours
Severe	(3 – 8)	1-7 days

- **Mild traumatic brain injury (MTBI)** or concussion: Is a common cause for admission at trauma centers, it is estimated that (70%–85%) of all traumatic brain injuries fall into the mild category. MTBI may be generally defined as an injury caused by blunt acceleration /deceleration forces which produce a period of unconsciousness for (20)minutes or less, and or brief retrograde amnesia, Glasgow Coma Scale Score of (13-15/15), no focal neurological deficit, no intracranial complication (e.g. seizure activity), and normal computed tomography (CT) finding.
- **Moderate and Severe TBI**

Moderate: Initial GCS Score of (9 – 12): Duration of PTA (1 – 7) days.

Severe: Loss of consciousness, and duration of PTA (1-4) weeks; initial GCS Score of (8) or less.

APPENDIX (C)

Glasgow Outcome Scale (GOS)

1. Definition

GOS have been developed to allow physicians to correlate " final" recovery levels to early treatment and prognostic indicators. The GOS is widely used. Its Categories are death, vegetative state, severe disability, (conscious but dependent), moderate disability (independent but disabled), and good recovery (able to participate in normal social life and return to work), with (90%) accurate assessment of prognosis possible 6 months post injury. The GOS does assess some aspects of mental and physical function in assigning outcome categories

2. Definition of terms

1. Dead

2. Persistent Vegetative State: Is a form of coma .In which the brunt of neurological destruction had occurred to the cerebral hemispheres, but the brain – stem has remained intact .A persistent vegetative state often results from hypoxia, or a lack of oxygen to the brain for a period of minutes . Because the brain-stem is fairly resistant to hypoxia,it is often spared, although cerebral hemisphere tissue is commonly destroyed. Sparing of the brain-stem allows the continued functions of respiration and the cough, gag, and swallowing reflexes, which significantly decreased the likelihood of fetal respiratory infections. As result, individuals can live for years in persistent vegetative states. A persistent vegetative state may be transient coma that continues for a period of days to months or longer. When the patient begins to emerge from vegetative state, he or she will awake into a condition of eye-open, unresponsive, unconsciousness, but demonstrate a reflexive response to painful or vigorous stimulation. This state is particularly difficult for family members because the patient appears conscious (eye open), but doesn't interact with any person or object in the environment. If the patient emerges from a vegetative state, he or she will have a clouding of consciousness

characterized by reduced wakefulness, reduced clarity of thought, confusion, decreased attention span, and memory lapse. Conversely, in complete consciousness the individuals poses awareness of the self and the surrounding environment, is able to perceive and correctly interpret his or her perceptions and displays appropriate response. Complete consciousness is a function of an intact cortex[74].

3. Sever Disability

Able to follow commands/ unable to live independently .This indicates that a patient is conscious but needs the assistance of another person for some activities of daily living every day. This may range from continuous total dependency (for feeding and washing) to the need for assistance with only one activity--such as dressing, getting out of bed or moving about the house, or going outside to a shop. Often dependency is due to a combination of physical and mental disability--because when physical disability is severe after head injury there is almost always considerable mental deficit . The patient cannot be left overnight because they would be unable to plan their meals or to deal with callers, or any domestic crisis which might arise. The severely disabled are described by the phrase "conscious but dependent "

4. Moderate Disability

Able to live independently; unable to return to work or school .These patients may be summarized as "independent but disabled," but it is perhaps the least easily described category of survivor. Such a patient is able to look after himself at home, to get out and about to the shops and to travel by public transport. However, some previous activities, either at work or in social life, are now no longer possible by reason of either physical or mental deficit. Some patients in this category are able to return to certain kinds of work, even to their own job, if this happens not to involve a high level of performance in the area of their major deficit.

5. Good Recovery

Able to return to work or school. This indicates the capacity to resume normal occupational and social activities, although there may be minor physical or mental deficits. However, for various reasons, the patient may not have resumed all his previous activities, and in particular may not be working.

- **Coma**: Is a state of sleep like (eye closed) as a result of brain damage. Coma that involves severe damage to the brain–stem often indicates a poor prognosis. The brain-stem contains the reticular activating system which is the arousal for the entire brain .When severe damage occurs to the reticular activating system, all communication between the body and the cerebral hemispheres is disrupted .The brain-stem controls vegetative functions such as a respiration and primitive stereotyped reflexes such cough reflex, gag reflex and swallowing reflex. Because individuals with severe brain stem involvement lose the cough, gag, and swallowing responses, they are likely to have fatal respiratory infections in 6 months to 1 year[74].

APPENDIX (D)

Rancho Los Amigos Levels of Cognitive Functioning

Definition

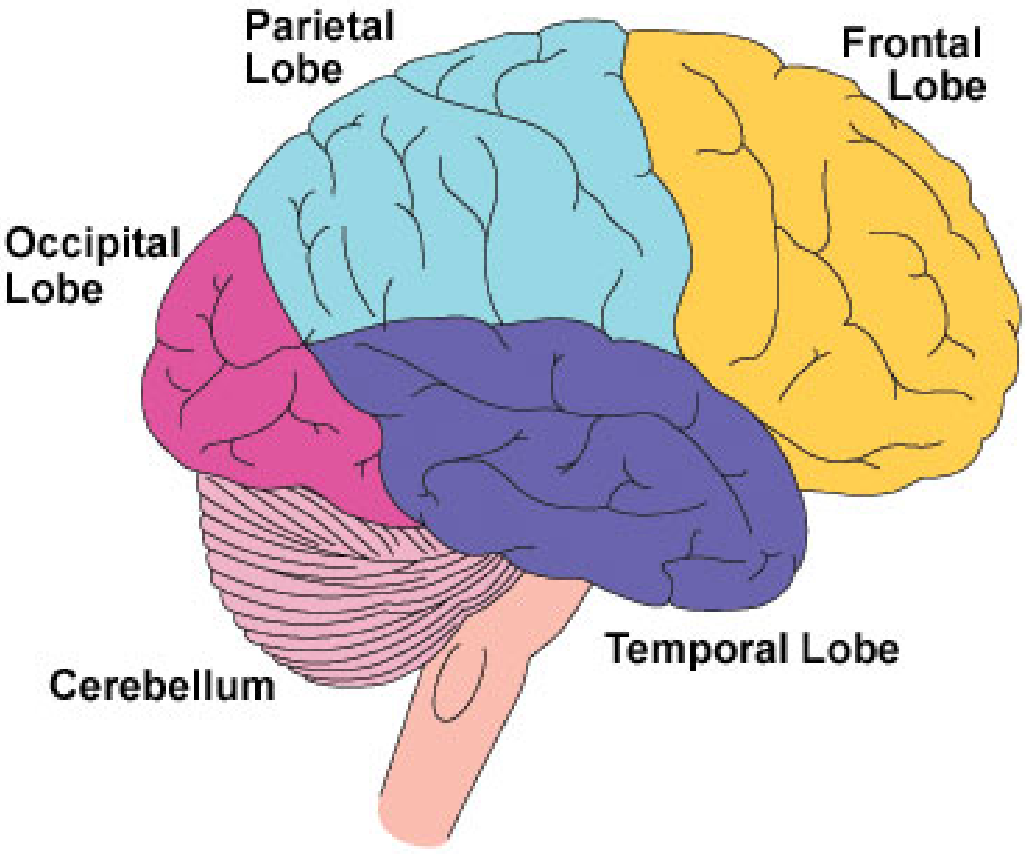
The Rancho Los Amigos Scale is an assessment that measures level of awareness and cognitive function. It can be used at any time after injury to assess level of awareness and cognitive function . It is not meant to be used as a predictive scale.

Rancho Los Amigos Level of Cognitive Functioning Scale.

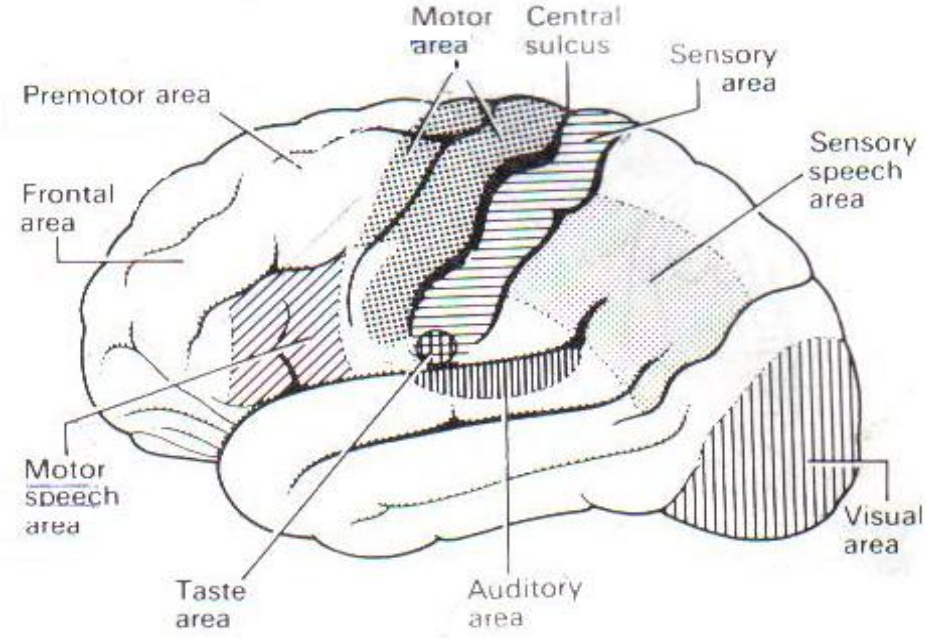
Rancho Los Amigos – Revised / Levels of Cognitive Functioning

Rancho Level	Clinical Correlate
I	No Response
II	Generalized response
III	Localized response
IV	Confused-agitated
V	Confused-inappropriate
VI	Confused-appropriate
VII	Automatic-inappropriate
VIII	Purposeful and appropriate

APPENDIX (E) (a)


Parietal Lobe
Frontal Lobe
Occipital Lobe
Temporal Lobe
Cerebellum

APPENDIX (E) (b)



Frontal Lobe (located under the forehead—anterior)

Temporal Lobe (located on the side of the head above ears)

Parietal Lobes (located near the back and top of the head)

Cerebellum (located just above the brain stem and toward the back of the brain)

Pons (located superior to the medulla oblongata and inferior to the midbrain)

Medulla Oblongata (The medulla oblongata functions as a cardiac and respiratory center. It is responsible for vasomotor control) nerves having muscular control of the blood vessel walls. It is also a center for cough, gag, swallow, and vomit).

Brain Stem (Located at the junction of the cerebrum and the spinal column, the brain stem consists of the midbrain, medulla oblongata, and the Pons).

APPENDIX (F)

Background about target hospitals

- **Rafidia Surgical Hospital**

One of the largest hospitals, established in 1976 in the west of Nablus city. It serves about 300,000 people. Many cases are transferred from other hospitals to Rafidia where unique specialties are provided such as Pathology, Ophthalmic Surgery, Neurosurgery and Burns, The hospital started with 40 beds, a year later the number reached 83, nowadays there are 165 beds. Rafidia hospital provides the following specialties:
(General Surgery, Orthopedic Surgery, Obstetrics and Gynecology, Ophthalmic Surgery, Jaw Surgery, Neurosurgery, Special Care Baby Unit, Management of Burns, Pathology, Nephrology, Orthopedic Department, Intermediate Care Unit, Operation room and Intensive Care Units, Burn Unit, Gynecology Department, Male Surgery, Surgery Subspecialties, Emergency Unit, Outpatients Clinics, lab and Blood Bank , Radiology Department, Physiotherapy, and Sterilization and Disinfection).

Rafidia hospital furnished with 165 beds, it received 13,671 admissions and the number of discharged during 2006 was 13,722, occupancy rate wad around 62.4%, and the average length of stay was 2.7 days. The number of administrative staff members is 148 while the number of nursing staff members is 150 and the numbers of physicians is 84.

- **Al-Ittihad Hospital**

Al -Ittihad hospital is a private, nonprofit able hospital, general medical hospital, it was established in 1971. It has many departments: Obstetrics-gyn. department, Neonatal department, I.C.U department, Emergency department, Internal medicine department, surgical department, Laboratory, blood bank departments, and X-Ray department. It directed by Arab Women Society which is a democratic nongovernmental organization that was established in 1921 as a charitable society. The number of beds in the year

2006 was 71. It received 6,525 admissions and the number of discharged during 2006 was 5,830 occupancy rate was around 52.5%, and the average length of stay was 2-3 days.

- **Specialized Arab Hospital**

Another modern Palestinian health institution established in 2000, where many sophisticated surgeries are carried out. The hospital consists of the following sub-sections:

- Annor Eye Center: a set operations are implemented such as (Corneal transplantation, IASIK (Laser assisted insitu keratomileusis, Cataract Surgery, Glaucoma Surgery, Treating diabetic retinopathy by laser)
- Razan Center for Infertility
- Hematology Center: surgeries like bone marrow transplantations are carried out.
- Cardiac Surgery: Open heart operation, Cardiac Catheterization, Angioplasty.

Specialized Arab Hospital furnished with 30 beds. It received 3,715 admissions and the number of discharged during 2006 was 3,695; occupancy rate was around 84.8% and the average length of stay 2.5 days.

APPENDIX (G)

Some Definitions Used

- **Concussion**

Mild concussions are not associated with any sequelae. However, a slightly greater injury can be associated with both anterograde and retrograde amnesia (inability to remember events before or after the injury). The amount of time that the amnesia is present correlates with the severity of the injury .In some cases the patients may develop post concussion syndrome, which can include memory problems, dizziness, and depression. Cerebral concussion is the most common head injury seen in children.

- **Epidural Hematoma**

Epidural hematoma (EDH) is a rapidly accumulating hematoma between the Dura mater and the cranium. These patients have a history of head trauma with loss of consciousness, then a lucid period, followed by loss of consciousness. Clinical onset occurs over minutes to hours .Many of these injuries are associated with lacerations of the middle meningeal artery. A "'lenticular" or convex, lens –shaped extra cerebral hemorrhage will likely be visible on a CT scan of the head. Although death is potential complication, the prognosis is good when this injury is recognized and treated.

- **Subdural hematoma**

Subdural hematoma occurs when there is tearing of the bridging vein between the cerebral cortex and a draining venous sinus. At times they may be caused by arterial lacerations on the brain surface. Patients may have a history of loss of consciousness but they recover and do not relapse. Clinical onset occurs over hours. A crescent shaped hemorrhage compressing the brain will be noted on CT of the head. Surgical evacuation

is the treatment. Complications include uncal herniation, focal neurologic deficits, and death. The prognosis is guarded.

- **Cerebral contusion**

Cerebral contusion is bruising of the brain tissue. The majority of contusions occur in the frontal and temporal lobes. Complications may include cerebral edema and transtentorial herniation. The goal of treatment should be to treat the increased intracranial pressure.

- **Focal injury:**

Because of the shape of the inner surface of the skull, focal injuries are most commonly seen in the frontal and temporal lobes, but can occur anywhere. Cerebral contusions are readily identifiable on computed tomography (CT) scans, but may not be evident on Day 1 scans, only becoming visible at Days 2 or 3. Deep intracerebral hemorrhages can result from arterial damage from either focal or diffuse damage.

- **Diffuse injury** (referred to as diffuse axonal injury or DAI) is only visible on CT scan in the worst 5%–10% of cases and most commonly seen as multiple punctuate sub cortical lesions in and around the corpus callosum and deep white matter and/or as intraventricular hemorrhages. The most consistent effect of diffuse brain damage, even when mild, is the presence of altered consciousness. The depth and duration of coma provide the best guide to the severity of the diffuse damage 8.The majority of patients with DAI will not have any CT evidence to support the diagnosis. Other clinical markers of DAI include high speed of injury, absence of a lucid interval, and prolonged retrograde and anterograde amnesia.

- **Posttraumatic amnesia (PTA)**

PTA is a loss of memory of day to day events after an injury. PTA lasting less than 1 hour indicates mild injury. 1-24 hours indicates moderate injury. 1- 7 days indicates severe injury, and more than 7 days indicates very severe injury.

- **Occupational therapy**

A treatment that focuses on helping people achieve independence in all areas of their lives — can offer kids with various needs positive, fun activities to improve their cognitive, physical, and motor skills and enhance their self-esteem and sense of accomplishment. Some people may think that occupational therapy is only for adults; children, after all, do not have occupations. But a child's main job is playing and learning, and an occupational therapist can evaluate a child's skills for play activities, school performance, and activities of daily living and compare them with what is developmentally appropriate for that age group

APPENDIX (H)

Tables

Table1
Distribution of the study population according to province

Province	Frequency	%
Nablus	245	78.5
Jenin	29	9.4
Tulkarm	20	6.4
Qalqilia	17	5.4
Missing Subjects	1	0.3
Total	312	100

Table 2
Distribution of the study population according to marital status

Marital Status	Frequency	%
Single	136	43.6
Not applicable	90	28.8
Married	69	22.1
Divorced	1	0.3
Missing Subjects	16	5.2
Total	312	100

Table 3
Distribution of the study population according to type of occupation

Type of occupation	Frequency	%
Students	104	33.3
Unemployed	87	28.5
Unskilled workers	59	18.9
Drivers	13	4.2
Skilled workers	10	3.2
Professional workers	4	1.3
Administrators	3	1
Missing Subjects	30	9.6
Total	312	100

Table 4
Distribution of the study population according to level of education

Level of education	Frequency	%
Less than Tawjehi	164	52.6
Not applicable	54	17.3
Diploma and above	24	7.7
Tawjehi	23	7.4
Illiterate	12	3.8
Missing Subjects	35	11.2
Total	312	100

Table 5
Distribution of the study population according to family income

Family Income	Frequency	%
201-400 JD	102	32.7
Up to 200 JD	89	28.5
401-600 JD	28	9
More than 600 JD	21	6.7
Missing Subjects	72	23.1
Total	312	100

Table 6
Distribution of the study population according to hospital name

Hospital Name	Frequency	%
Rafidia	149	47.8
Al-Ittihad	95	30.4
Specialized Arab	68	21.8
Total	312	100

Table 7
Distribution of the study population according to year of injury

Year of injury	Frequency	%
2006	188	60.3
2007	123	39.4
Missing Subjects	1	0. 3
Total	312	100

Table 8
Distribution of the study population according to previous history of head injury

History of head injury	Frequency	%
No	229	73.4
Yes	28	9
Missing Subjects	55	17.6
Total	312	100

Table 9
Distribution of the study population according to types of road user accidents

Types of road user	Frequency	%
Pedestrians	44	14.1
Occupants	34	10.9
Subjects were excluded	234	75
Total	312	100

Table 10
Distribution of the study population according to causes of assault

Causes of assault	Frequency	%
Israeli soldiers	87	27.9
Other people	16	5.1
Subjects were excluded	209	67
Total	312	100

Table 11
Distributions of the study population according to injuries associated with head Injury

If there are associated injuries	Frequency	%
No	174	55.8
Yes	131	42
Missing Subjects	7	2.2
Total	312	100

Table 12
Distribution of the study population according to types of injuries associated with Head injury

Types of associated injuries	Frequency	%
Other injuries	92	29.5
Limbs fractures	31	9.9
Spinal cord injuries	9	2.9
Limbs amputation	3	1
Subjects were excluded	177	56.7
Total	312	100

Table 13
Distribution of the study population according to severity of TBI

Severity of TBI	Frequency	%
Mild	168	53.8
Severe	85	27.3
Moderate	55	17.6
Missing Subjects	4	1.3
Total	312	100

Table14
Distribution of the study population according to period of functional disability

Period of functional disability	Frequency	%
Permanent	72	23.1
Temporary	19	6.1
Subjects were excluded	221	70.8
Total	312	100

Table 15
Distribution of the study population according to stay duration at hospital

Stay duration at hospital	Frequency	%
Up – 1 month	278	89.1
Between 2-3 months	25	8
4- 6 months	2	0.6
More than 6 months	2	0.6
Missing Subjects	5	1.7
Total	312	100

Table 16
Distribution of the study population according to if they were referred to other hospitals

If they referred to other hospitals	Frequency	%
No	249	79.8
Yes	56	17.9
Missing Subjects	7	2.3
Total	312	100

Table 17
Distribution of the study population according to which hospitals they were referred to

Which Hospitals	Frequency	%
National	38	12.1
Abroad	18	5.8
Subjects were excluded	256	82.1
Total	312	100

Table 18
Distribution of the study population according to rehabilitation services provided

Rehabilitation services were provided	Frequency	%
No services provided	43	13.8
Integrated therapy	41	13.1
Physiotherapy	22	7.1
More than one service provided	10	3.2
Occupational therapy	1	0.3
Speech and language therapy	1	0.3
Subjects were excluded	194	62.2
Total	312	100

Table 19
Distribution of the study population according to rehabilitation services duration

Rehabilitation services duration	Frequency	%
Up to 1 month	25	8
2-3 months	20	6.4
4-6 months	11	3.5
More than 6 months	11	3.5
Still involving in the services	7	2.3
Subjects were excluded	238	76.3
Total	312	100

Table 20
Distribution of the study population according to place of rehabilitation services

Place of rehabilitation services	**Frequency**	**%**
BASR	44	14.1
Hospital	14	4.3
Nablus centers	12	3.7
KARRC	3	1
Princess Bassma	1	0.3
Jenin Centers	1	0.3
Subjects were excluded	237	76.3
Total	312	100

جامعة النجاح الوطنية
كلية الدراسات العليا

الأسباب الرئيسية المؤدية لإصابات الدماغ عند المرضى الذين تم إدخالهم مستشفى رفيديا ، الإتحاد ، والعربي التخصصي من فترة 2006-2007

إعداد
رفيف حسني محمد يونس

إشراف
د. محمد مسمار
د. سامر حمايدة

قدمت هذه الأطروحة استكمالاً لمتطلبات درجة الماجستير في الصحة العامة بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين.
2008

الأسباب الرئيسية المؤدية لإصابات الدماغ عند المرضى الذين تم إدخالهم مستشفى رفيديا ، الإتحاد ، والعربي التخصصي من فترة 2006- 2007

إعداد
رفيف حسني محمد يونس
إشراف
د. محمد مسمار
د. سامر حمايدة

الملخص

أظهرت منظمة الصحة العالمية أن إصابات الدماغ هي مرض القرن الواحد والعشرين الوبائي السائد مثل مرض الملاريا ومرض الايدز ، وأظهرت أن هذا المرض ليس محدودا بالدول المتقدمة فقط . إن إصابات الدماغ هي أيضا مشكلة صحية عامة في فلسطين ، وخاصة بعد بداية إنتفاضة الأقصى حيث أصبح هناك عدد متزايد من حالات الإعتداء بواسطة إطلاق النار من قبل جيش الإحتلال الإسرائيلي ، حيث أظهرت تقارير حالات الوفاة والإعاقة أعلى رقم تصل اليه إصابات الرأس عن بقية الإصابات الأخرى المسببة لتلك الحالات.

أهداف الدراسة:

إن الهدف الرئيسي من الدراسة هو تحديد الأسباب الرئيسة المؤدية لإصابات الدماغ عند المرضى الذين تم إدخالهم إلى مستشفيات رفيديا ، الإتحاد ، والعربي التخصصي في فترة ما بين 2006 - 2007.

طرق البحث:

تم الرجوع إلى السجلات الطبية ل 312 حالة إصابة دماغ تم ادخالهم لمستشفيات رفيديا ، الإتحاد ، والعربي التخصصي في فترة ما بين 2006-2007 ، و تم جمع معلومات من السجلات عن المرضى ، وأستخدمت ورقة (مسح حالة) لتعبئة المعلومات فيها ، كما أستخدم مقياس (جلاسكو كوما سكيل) لقياس نسبة الغيبوبة للمرضى وذلك لتحديد شدة الإصابة.

النتائج :

أشارت الدراسة إلى أن أهم الأسباب المؤدية لإصابات الدماغ هي حالات الإعتداء بنسبة (33%) ويتبعها حوادث السقوط بنسبة (32.1%) ، حوادث السير بنسبة (28.9%) ، وسقوط أشياء ثقيلة على الرأس بنسبة (3.2%). إن حوادث السقوط وسقوط الأشياء الثقيلة على الرأس هي من أسباب إصابات الدماغ السائدة عند الأطفال الذين تقل أعمارهم عن 5 سنوات ، بينما الإعتداء وحوادث السير فهي سائدة عند الفئة العمرية ما بين 19-29 سنة , كما أظهرت الدراسة أن نسبة الإصابة عند الذكور أعلى منها عند الإناث.

كما أشارت الدراسة أن (29.2%) من المرضى يعانون من إعاقة وظيفية بعد الإصابة بالدماغ ، و (6.7%) حالة وفاة ، حيث (66.7%) منهم توفوا نتيجة الإعتداءات ، (19%) نتيجة حوادث السير ، (9.5%) حوادث السقوط و (4.8%) توفوا نتيجة سقوط أشياء ثقيلة على الرأس.

الملخص:

إن الإعتداءات من قبل جيش الإحتلال سواء إطلاق النار أو ضرب على الرأس هي الأسباب الرئيسية حول إصابات الدماغ ، كما تعتبر الإعتداءات هي من أكثر الأسباب المرتبطة بالإصابات الشديدة بالدماغ والتي تؤدي أما لحالات الوفاة أو الإعاقة في فلسطين.

الكلمات المستخدمة : إصابات ضربات الدماغ , الإعتداءات .