

*Sudan University of Science and Technology*

*College of Graduate Studies*

**Study of the Head Traumatic Injuries Using Computed  
Tomography**

دراسة اصابات الراس باستخدام الاشعة المقطعية المحوسبه

*A Complementary Research submitted for Partial Fulfillment  
of M.Sc. degree in Diagnostic Radiological Technology*

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# الآيه

بسم الله الرحمن الرحيم

قال الله تعالى:

(ومن الناس والدواب والانعام مختلف الوانه كذلك انما يخشي الله من عباده العلماء ان الله عزيز حكيم )

صدق الله العظيم

# Dedication

To the dearest in my life parents, husband, brother, and sisters

To how have always been there for me and supported me in the way that can not be expressed in words

# Acknowledgment

*My acknowledgments and gratefulness at the beginning and at end to Allah who gave us the gift of the mind. I would like to thank everyone who helped me in way or another to make this work appear to light especial thanks to*

**DR.: AWADADALLAN**

*for his support comprehensive and guidance to complete his work*

*Also special vote of thanks to:*

**Dr: ABD ALLH KAMAL**

## **Abstract**

Head injuries continue to be an enormous public health problem. Even with modern medicine, most patients have mild stages, the remaining injuries are divided equally between the moderate and severe.

The objective of this research is to study the role of computed tomography in the earliest and fastest diagnosis of head injuries, and to classify types of trauma based on the main cause of the traumatic brain injuries (TBI), type of lesion and type of hemorrhage.

This study was conducted in Khartoum state at two centers, Khartoum Advanced Diagnostic Center and Antalya Medical Center.

A sample of 50 patients, (70% males and 30% females) were grouped according to age into 7 age groups and were investigated using CT scanning to diagnose head injuries. CT findings revealed 24 positive cases (48%) and 26 negative cases (52%).

The study showed that the most common cause of head trauma was Road traffic accident (RTA) (70.6%) and 41.7% of head traumatic lesions were extradural hemorrhage and cerebral hemorrhage. The study also showed that 59.1% of fractures were in the facial bones.

Finally, CT is seen to be the diagnostic tool of choice in the diagnosis of traumatic head injuries compared with other imaging modalities because it is time saving.

## ماخص البحث

مازلت اصابات الراس تشكل المعضله الاكثر شيوعا والتيتهدد المجتمع الصحي حتي مع تقدم الطب وادواته ومعظم المصابين ينقسمون مابين مراحل متوسطه وحاده. الهدف من هذه البحث هو معرفه دور الاشعه المقطعيه في تشخيصا لاصابات بالرأس وتصنيف الاصابات بالرأس ومعرفه انواع النزيفهدفت الدراسه المعرفه دورالاشعة المقطعيه المحوسبه في التشخيص المبكر و السريع لاصابات الراس و تصنيفها مع الكشف عن اسبابها و تحديد انواع الانزفه الدماغيه

اجريت هذه الدراسه في ولايه الخرطوم في مركزي الخرطوم التشخيصي المتطور ومركز انطالياالطبي.

في هذه الدراسه خضعت عينه تضم 50مريض 70%منهمذكور و 30%اناثه وصنفتفي 7 مجموعات عمزیه وقد اظهرتالدراسهان 24 حالة كانت موجبه و 26 حالة سالبة بنسبه 48% و 52% على التوالي معظمها كانت بسببالحوادث بنسبه 70.6% ونزيف في الراس بنسبه 41.7% ومعظم اصابات الكسور كانت سطحيه بنسبه 59.1%.

اخيرا الاشعه المقطعيه هي اول خيار في تشخيص الاصابات بالرأسمقارنه بوسائل التصوير الطببالاخریوتتم في زمن قصير

## Table of Contents

الآيه.....	I
Dedication.....	II
Acknowledgment .....	III
Abstract.....	IV
ماخص البحث.....	V
List of figures .....	VIII
List of table .....	IX
Abbreviations:.....	X

## Chapter one:Introduction

1-1 Introduction: .....	1
1-2 Problem of the Study: .....	2
1-3 General objectives.....	2
1-4 Specific objectives: .....	2
1-5Material andMethodology:.....	2
1-5-1 data collection:.....	2
1-5-2 Sampling and Duration: .....	2
1-5-3 Site: .....	2
1-6Theses out line: .....	3

## Chapter two:Background and previous studies

2-1 Background:.....	5
2-1-1Nervous system .....	6
2-1-2 Skull .....	6

2-1-3 Brain.....	6
2-1-4 Lobes of the brain .....	7
2-1-4-1 Frontal lobe .....	7
2-1-4-2 Parietal lobe.....	8
2-1-4-3 Occipital lobe .....	8
2-1-5 Deep structures .....	8
2-1-6 Pituitary gland –.....	8
2-1-7 Pineal gland – .....	9
2-1-8 Thalamus – .....	9
2-1-9 Cranial nerves .....	9
2-1-10 Ventricles and cerebrospinal fluid.....	10
2-1-11 Blood supply.....	10
2-1-12 Cells of the brain.....	11
2-1-13 Head Injury:.....	12
2.1.13.1 Causes of Head Injuries:.....	12
2.1.13.2 Types of Head Injuries: .....	13
2.1.14 Pathological changes of brain trauma .....	16
2.1.15 Symptoms of traumatic brain injure.....	16
2.1.16 Computed tomography:.....	17
2-2 Pervious studies: .....	23

### **Chapter three:Material and methods**

3.1 Material:.....	26
3.1.1 Patient .....	26
3-1-1 Machines: .....	26
3.2 Methods: .....	27
3-2-1 Data collection:.....	27
3.2.3 Image interpretation .....	28

### **Chapter Four:Result**

Result .....	30
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### **Chapter Five:Discussion,Conclusion&Recommendations**



5-1 Discussion:.....	38
5-2 Conclusion:.....	39
5-3 Recommendations:.....	40
Reference .....	41
Appendices.....	

### List of figures

Fig NO	Title	NO
2-1	Anatomy of brain	5
Image(1)	Axial image inCT scan shows cerebral hemorrhage	30
Image(2)	Axial CT image epidural hematoma	31
Image(3)	Axial image inCT scan showcerebral contusion	32
Image(4)	Axial image in CT SCAN show subarachnoid hematoma.	33
Image(5)	Axial image in CTshow skull fracture	34

### List of table

Table	Title	No
2-1	Type of hemorrhage	15
3-1	shows study group gender distribution	26
4-1	shows study group gender	30
4-2	Study type of age distribution	31
4-3	shows CT findings	322
4-4	show study type of trauma	33
4-5	shows study type of lesion	34
4-6	shows study type of hemorrhage occur	35
4-7	shows study site of fracture	36

**Abbreviations:**

CT	computed tomography
T B	I traumatic BRAIN INJURE
FD	fall DOWN
HBS	HEAD BY STICK
L O C	LOSS OF CONSCIOUSNESS
H	hemorrhage
R T A	Road traffic accident
L O C	loss of consciousness
P	patient
MRI	magnetic Resonance imaging

# **Chapter one**

## Introduction

## Chapter one

### 1-1 Introduction:

Trauma is the most common cause of death. Trauma results from e.g., motor vehicle accident, unintentional accidents at home and in the work places, gunshot, stab wounds.

Death from traumatic injuries have three distributions:

- **First critical Period:** occurring seconds after the injury, death during this period results from laceration of the brain and spinal cord or the heart and great vessels.
- **Second critical period:** occurs during the first 4 hours following the injury, death generally in this period from internal hemorrhage from the liver and spleen or significant blood loss from multiple injuries.
- **Third critical period:** occurs days to week following the injury, when death results from infection and multiple organs failure.

In Sudan, all emergency departments have only conventional x-ray and there is no CT scanner emergency, urgent CT scan examinations for patient will be delayed for days, which in turn delay the treatment.

The conventional x-ray sometimes is not enough to diagnose all cases that come to the emergency department e.g. head trauma which may cause small cranial fractures, cerebral hemorrhage and edema. And abdominal trauma may cause rupture to the liver, kidney, spleen and pancreas. All of these mentioned cases of trauma need accurate diagnosis to plan urgent treatment.

### **Computed tomography:**

CT became well established in diagnosis of diseases of the central nervous system, and in some cases, and reduced the frequency of cerebral angiography.

A fundamental goal of CT is to provide maximum radiation dose to the patient CT is a non-invasive procedure, is nevertheless expensive and time consuming. Careful planning and documentation of each examination.

### **1-2 Problem of the Study:**

Most emergency departments have only conventional x-ray and there is no CT scanner emergency, urgent CT scan examinations for patient will be delayed for days, which in turn delay the treatment.

### **1-3 General objectives**

To determine the role of computed tomography in causes of head trauma

### **1-4 Specific objectives:**

- To determine the hemorrhage
- Fracture (skull fracture).
- Intracranial pressure (ICP) increases in pressure within skull.

### **1-5 Material and Methodology:**

#### **Material:**

- CT machine.
- Random samples of traumatic patients have done CT S

#### **1-5-1 data collection:**

Questionnaire form was designed to collect relevant data patient.

#### **1-5-2 Sampling and Duration:**

- The planned size of sample 51 patients.
- The duration of this study will be with three months.

#### **1-5-3 Site:**

The samples of traumatic patients was collected from two Antalya MEDICAL CENTER

- Khartoum Diagnostic Center.
- Antalya medical center.

**1-6Theses out line:**

This thesis consists of five chapters:

- Chapter one is the introduction and objectives.
- Chapter two is background and literature review.
- Chapter three is materials and methods.
- Chapter four is results, analysis and discussion.
- Chapter five is conclusion, recommendation and references.

# **Chapter Two**

## Background and previous studies



## Chapter two

### Background and previous studies

#### 2-1 Background:

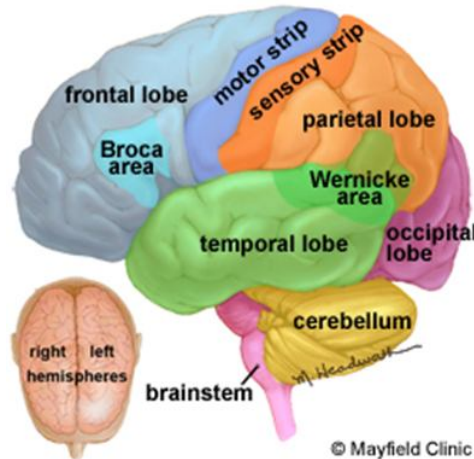


Figure (2-1) lateral view of skull

#### **Anatomy of the brain**

The brain is an amazing three-pound organ that controls all functions of the body, interprets information from the outside world, and embodies the essence of the mind and soul. Intelligence, creativity, emotion, and memory are a few of the many things governed by the brain. Protected within the skull, the brain is composed of the cerebrum, cerebellum, and brainstem. The brainstem acts as a relay center connecting the cerebrum and cerebellum to the spinal cord. The brain receives information through our five senses: sight, smell, touch, taste, and hearing - often many at one time. It assembles the messages in a way that has meaning for us, and can store that information in our memory. The brain controls our thoughts, memory and speech, movement of the arms and legs, and the function of many organs within our body. It also determines how we respond to stressful situations (such as taking a test, losing a job, or suffering an illness) by regulating our heart and breathing rate

### **2-1-1 Nervous system**

The nervous system is divided into central and peripheral systems. The central nervous system (CNS) is composed of the brain and spinal cord. The peripheral nervous system (PNS) is composed of spinal nerves that branch from the spinal cord and cranial nerves that branch from the brain. The PNS includes the autonomic nervous system, which controls vital functions such as breathing, digestion, heart rate, and secretion of hormones.

### **2-1-2 Skull**

The purpose of the bony skull is to protect the brain from injury. The skull is formed from 8 bones that fuse together along suture lines. These bones include the frontal, parietal, temporal, sphenoid, occipital (Fig. 1).

The face is formed from 14 paired bones including the maxilla, zygoma, nasal, palatine, lacrimal, inferior nasal conchae, mandible, and vomer

### **2-1-3 Brain**

The brain is composed of the cerebrum, cerebellum, and brainstem Figure 3. The brain is composed of three parts: the brainstem, cerebellum, and cerebrum. The cerebrum is divided into four lobes: frontal, parietal, temporal, and occipital.

#### **The cerebrum:**

is the largest part of the brain and is composed of right and left hemispheres. It performs higher functions like interpreting touch, vision and hearing, as well as speech, reasoning, emotions, learning, and fine control of movement.

- The cerebellum is located under the cerebrum. Its function is to coordinate muscle movements, maintain posture, and balance.
- The brainstem includes the midbrain, Pons, and medulla. It acts as a relay center connecting the cerebrum and cerebellum to the spinal cord. It

performs many automatic functions such as breathing, heart rate, body temperature, wake and sleep cycles, digestion, sneezing, coughing, vomiting, and swallowing. Ten of the twelve cranial nerves originate in the brainstem.

The surface of the cerebrum has a folded appearance called the cortex. The cortex contains about 70% of the 100 billion nerve cells. The nerve cell bodies color the cortex grey-brown giving it its name – gray matter (Fig. 4). Beneath the cortex are long connecting fibers between neurons, called axons, which make up the white matter. The surface of the cerebrum is called the cortex. The cortex contains neurons (grey matter), which are interconnected to other brain areas by axons (white matter). The cortex has a folded appearance. A fold is called a gyrus and the groove between is a sulcus.

#### **2-1-4 Lobes of the brain**

The cerebral hemispheres have distinct fissures, which divide the brain into lobes. Each hemisphere has 4 lobes: frontal, temporal, parietal, and occipital (Fig 3). Each lobe may be divided, once again, into areas that serve very specific functions. It's important to understand that each lobe of the brain does not function alone. There are very complex relationships between the lobes of the brain and between the right and left hemispheres.

##### **2-1-4-1 Frontal lobe**

- Personality, behavior, emotions
- Judgment, planning, problem solving
- Speech: speaking and writing (Broca's area)
- Body movement (motor strip)
- Intelligence, concentration, self awareness

#### **2-1-4-2 Parietal lobe**

- Interprets language, words
- Sense of touch, pain, temperature (sensory strip)
- Interprets signals from vision, hearing, motor, sensory and memory
- Spatial and visual perception

#### **2-1-4-3 Occipital lobe**

Interprets vision (color, light, movement)

#### **2-1-4-4 Temporal lobe**

- Understanding language (Wernicke's area)
- Memory
- Hearing
- Sequencing and organization

Messages within the brain are carried along pathways. Messages can travel from one gyrus to another, from one lobe to another, from one side of the brain to the other, and to structures found deep in the brain (e.g. thalamus, hypothalamus).

#### **2-1-5 Deep structures**

Hypothalamus - is located in the floor of the third ventricle and is the master control of the autonomic system. It plays a role in controlling behaviors such as hunger, thirst, sleep, and sexual response. It also regulates body temperature, blood pressure, emotions, and secretion of hormones.

#### **2-1-6 Pituitary gland –**

lies in a small pocket of bone at the skull base called the sella turcica. The pituitary gland is connected to the hypothalamus of the brain by the pituitary stalk. Known as the “master gland,” it controls other endocrine glands in the body. It secretes hormones that control sexual development, promote bone and muscle growth, respond to stress, and fight disease.

### **2-1-7 Pineal gland –**

is located behind the third ventricle. It helps regulate the body's internal clock and circadian rhythms by secreting melatonin. It has some role in sexual development.

### **2-1-8 Thalamus –**

serves as a relay station for almost all information that comes and goes to the cortex (Fig. 5). It plays a role in pain sensation, attention, alertness and memory. Basal ganglia - includes the caudate, putamen and globus pallidus. These nuclei work with the cerebellum to coordinate fine motions, such as fingertip movements. Limbic system - is the center of our emotions, learning, and memory. Included in this system are the cingulate gyrus, hypothalamus, amygdala (emotional reactions) and hippocampus (memory).

### **2-1-9 Cranial nerves**

The brain communicates with the body through the spinal cord and twelve pairs of cranial nerves (Fig. 6). Ten of the twelve pairs of cranial nerves that control hearing, eye movement, facial sensations, taste, swallowing and movement of the face, neck, shoulder and tongue muscles originate in the brainstem. The cranial nerves for smell and vision originate in the cerebrum. Meanings

The brain and spinal cord are covered and protected by three layers of tissue called meninges. From the outermost layer inward they are: the Dura mater, arachnoid mater, and pia mater.

The dura mater is a strong, thick membrane that closely lines the inside of the skull; its two layers, the periosteal and meningeal dura, are fused and separate only to form venous sinuses. The dura creates little folds or compartments. There are two special dural folds, the falx and the

tentorium. The falx separates the right and left hemispheres of the brain and the tentorium separates the cerebrum from the cerebellum.

The arachnoid mater is a thin, web-like membrane that covers the entire brain. The arachnoid is made of elastic tissue. The space between the dura and arachnoids membranes is called the subdural space.

The pia mater hugs the surface of the brain following its folds and grooves. The pia mater has many blood vessels that reach deep into the brain. The space between the arachnoid and pia is called the subarachnoid space. It is here where the cerebrospinal fluid bathes and cushions the brain.

### **2-1-10 Ventricles and cerebrospinal fluid**

The brain has hollow fluid-filled cavities called ventricles (Fig. 7). Inside the ventricles is a ribbon-like structure called the choroid plexus that makes clear colorless cerebrospinal fluid (CSF). CSF flows within and around the brain and spinal cord to help cushion it from injury. This circulating fluid is constantly being absorbed and replenished

### **2-1-11 Blood supply**

Blood is carried to the brain by two paired arteries, the internal carotid arteries and the vertebral arteries, The internal carotid arteries supply most of the cerebrum. The common carotid artery courses up the neck and divides into the internal and external carotid arteries. The brain's anterior circulation is fed by the internal carotid arteries (ICA) and the posterior circulation is fed by the vertebral arteries (VA). The two systems connect at the Circle of Willis (green circle).

Memory is a complex process that includes three phases: encoding (deciding what information is important), storing, and recalling. Different areas of the brain are involved in memory depending on the type of memory.

- Short-term memory, also called working memory, occurs in the prefrontal cortex. It stores information for about one minute and its capacity is limited to about 7 items. For example, it enables you to dial a phone number someone just told you. It also intervenes during reading, to memorize the sentence you have just read, so that the next one makes sense.
- Long-term memory is processed in the hippocampus of the temporal lobe and is activated when you want to memorize something for a longer time. This memory has unlimited content and duration capacity. It contains personal memories as well as facts and figures.
- Skill memory is processed in the cerebellum, which relays information to the basal ganglia. It stores automatic learned memories like tying a shoe, playing an instrument, or riding a bike.

## **2-1-12 Cells of the brain**

The brain is made up of two types of cells: nerve cells (neurons) and glia cells.

### **Nerve cells**

There are many sizes and shapes of neurons, but all consist of a cell body, dendrites and an axon. The neuron conveys information through electrical and chemical signals. Try to picture electrical wiring in your home. An electrical circuit is made up of numerous wires connected in such a way that when a light switch is turned on, a light bulb will beam. A neuron that is excited will transmit its energy to neurons within its vicinity.

Neurons transmit their energy, or “talk”, to each other across a tiny gap called a synapse. A neuron has many arms called dendrites, which act like antennae picking up messages from other nerve cells. These messages are passed to the cell body, which determines if the message should be

passed along. Important messages are passed to the end of the axon where sacs containing neurotransmitters open into the synapse. The neurotransmitter molecules cross the synapse and fit into special receptors on the receiving nerve cell, which stimulates that cell to pass on the message.

The vertebral arteries supply the cerebellum, brainstem, and the underside of the cerebrum. After passing through the skull, the right and left vertebral arteries join together to form the basilar artery. The basilar artery and the internal carotid arteries “communicate” with each other at the base of the brain called the Circle of Willis (Fig. 9). The communication between the internal carotid and vertebral-basilar systems is an important safety feature of the brain. If one of the major vessels becomes blocked, it is possible for collateral blood flow to come across the Circle of Willis and prevent brain damage.

### **2-1-13Head Injury:**

A head injury is any sort of injury to your brain, skull, or scalp. This can range from a mild bump or bruise to a traumatic brain injury. Common head injuries include concussions, skull fractures, and scalp wounds. The consequences and treatments vary greatly, depending on what caused your head injury and how severe it is

Head injuries may be either closed or open. A closed head injury is any injury that doesn't break your skull. An open, or penetrating, head injury is one in which something breaks your skull and enters your brain

#### **2.1.13.1Causes of Head Injuries:**

In general, head injuries can be divided into two categories based on what causes them. They can either be head injuries due to blows to the head or head injuries due to shaking.



Head injuries caused by shaking are most common in infants and small children, but they can occur any time you experience violent shaking.

Head injuries caused by a blow to the head are usually associated with:

- motor vehicle accidents
- falls
- physical assaults
- sports-related accidents

### **2.1.13.2 Types of Head Injuries:**

#### **Hematoma**

A hematoma is a collection, or clotting, of blood outside the blood vessels. It can be very serious if a hematoma occurs in the brain. The clotting can cause pressure to build inside your skull, which can cause you to lose consciousness.

A hematoma is a collection, or clotting, of blood outside the blood vessels. It can be very serious if a hematoma occurs in the brain. The clotting can cause pressure to build inside your skull, which can cause you to lose consciousness.

**Epidural hematoma:** With an epidural hematoma, the bleeding is located between the Dura mater and the skull (epi=outside). This injury often occurs along the side of the head where the middle meningeal artery runs in a groove along the temporal bone. This bone is relatively thin and offers less protection than other parts of the skull. As the bleeding continues, the hematoma or clot expands. There is little space in the skull for the hematoma to grow and as it expands, the adjacent brain tissue is compressed. With increased pressure the brain begins to shift and becomes compressed against the bones of the skull. The pressure tends to build quickly because the sutures that attach the Dura to the skull bones

create small spaces that trap blood. Symptoms of head injury and decreased level of consciousness occur as the pressure increases.

- Subdural hematoma: A subdural hematoma is located beneath the Dura mater (sub=below), between it and the arachnoids layer. Blood in this space is able to dissipate into a larger space because there are no space limiting the blood flow. However, after a period of time, the amount of bleeding may cause increased pressure and cause symptoms similar to those seen with an epidural hematoma.
- Subarachnoid bleed: Subarachnoid bleeding occurs in the space beneath the arachnoids layer where the cerebrospinal fluid is located. Often there is intense headache and vomiting with subarachnoid bleeding. Because this space connects with the spinal canal, pressure buildup tends not to occur. However, this injury often occurs in combination with the other types of bleeding in the brain and the symptoms may be compounded.
- Intracerebral bleed: Intracerebral bleeding occurs within the brain tissue itself. Sometimes the amount of bleeding is small, but like bruising in any other part of the body, swelling or edema may occur over a period of time, causing a progressive decrease in the level of consciousness and other symptoms of head injury

### **Hemorrhage**

A hemorrhage is uncontrolled bleeding. There can be bleeding in the space around your brain, which is a subarachnoid hemorrhage, or bleeding within your brain tissue, which is an intracerebral hemorrhage. Subarachnoid bleeds often cause headaches and vomiting. The severity of intracerebral hemorrhages depends on how much bleeding there is, but over time any amount of blood can cause pressure

Table (2-1) Type of hemorrhage:

	Epidural	Subdural
Location	Between the skull and the outer endosteal layer of the Dura mater	1-Between the Dura and the arachnoids
Involved vessel	Tempora parietal locus (most likely) - Middle meningeal artery Frontal locus - anterior ethmoidal artery Occipital locus - transverse or sigmoid sinuses Vertex locus - superior sagittal sinus	Bridging veins
Symptoms (dependent on severity)	3-Lucid interval followed by unconsciousness	Gradually increasing headache and confusion
CT appearance	Biconvex lens	Crescent-shaped

### **Concussion**

A concussion is a brain injury that occurs when your brain bounces against the hard walls of your skull. Generally speaking, the loss of function associated with concussions is temporary. However, repeated concussions can eventually lead to permanent damage.

### **Edema**

Any brain injury can lead to edema, or swelling. Many injuries cause swelling of the surrounding tissues, but it's more serious when it occurs in your brain. Your skull can't stretch to accommodate the swelling, which leads to a buildup of pressure in your brain. This can cause your brain to press against your skull.

## **Skull Fracture**

The bones of the skull are classified as flat bones, meaning that they do not have an inside marrow. It takes a significant amount of force to break the skull, and the skull does not absorb any of that impact. It is often transmitted directly to the brain

## **Diffuse Axonal Injury**

A diffuse axonal injury, or sheer injury, is an injury to the brain that doesn't cause bleeding but does damage your brain cells. Though it isn't as outwardly visible as other forms of brain injury, diffuse axonal injury is one of the most dangerous types of head injuries and can lead to permanent brain damage and even death

### **2.1.14 Pathological changes of brain trauma**

Besides brain contusion, extra Dural, subdural, subarachnoid and intracerebral hemorrhage, most of the brain trauma may cause tissue edema and vasogenic edema and have an infarction zone as well. This is a result in vasospasm which is caused by subarachnoid hemorrhage around the basal vascular. Above pathological changes are the source of the neural cell apoptosis and necrosis and the loss of the nerve cells are basic of persistent disability.

### **2.1.15 Symptoms of traumatic brain injury**

Symptoms of Persistent disability: movement disorders (paralysis), sensory disorder, aphasia, balance disorder, ataxia, epilepsy, dementia and so on.

Classification: awake patients; soon restored patients (headache and dizziness after mild head trauma); delayed syncope after head trauma; sleepiness; headache and trance; dementia; temporary traumatic paraplegia, blindness and migraine; traumatic permanent paralysis, delayed paralysis; persistent coma; post-traumatic epilepsy and

psychiatric disorders, post-traumatic extrapyramidal and cerebella disease; Boxing - drunk encephalopathy (boxer dementia), post-traumatic hydrocephalus; cognitive and psychiatric disorder after trauma etc; all of above may cause persistent symptoms.

**Management:**

Most head injury are of benign nature and require no treatment beyond analgesic and close monitoring complication such as intracranial bleeding. if brain has been severely damaged by trauma, neurosurgical evaluation may be useful. treatment may involve controlling elevated intracranial pressure this can include sedation, paralytics, cerebrospinal fluid diversion. second line alternative include decompressive craniectomy, barbiturate coma, hypertonic saline and hypothermia. although all of these method have potential benefits, there has been no randomized study that has shown unequivocal benefit

**2.1.16 Computed tomography:**

Computed tomography (CT) of the head uses special x-ray equipment to help assess head injuries, severe headaches, dizziness, and other symptoms of aneurysm, bleeding, stroke and brain tumors. It also helps your doctor to evaluate your face, sinuses, and skull or to plan radiation therapy for brain cancer. In emergency cases, it can reveal internal injuries and bleeding quickly enough to help save lives. You will be instructed not to eat or drink anything for a few hours beforehand. If you have a known allergy to contrast material, your doctor may prescribe medications to reduce the risk of an allergic reaction. These medications must be taken 12 hours prior to your exam. Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown.

The CT scanner is typically a large, box-like machine with a hole, or short tunnel, in the center. You will lie on a narrow examination table that

slides into and out of this tunnel. Rotating around you, the x-ray tube and electronic x-ray detectors are located opposite each other in a ring, called a gantry. The computer workstation that processes the imaging information is located in a separate control room, where the technologist operates the scanner and monitors your examination in direct visual contact and usually with the ability to hear and talk to you with the use of a speaker and microphone.

In many ways CT scanning works very much like other x-ray examinations. Different body parts absorb the x-rays in varying degrees. It is this crucial difference in absorption that allows the body parts to be distinguished from one another on an x-ray film or CT electronic image.

In a conventional x-ray exam, a small amount of radiation is aimed at and passes through the part of the body being examined, recording an image on a special electronic image recording plate. Bones appear white on the x-ray; soft tissue, such as organs like the heart or liver, shows up in shades of gray, and air appears black.

With CT scanning, numerous x-ray beams and a set of electronic x-ray detectors rotate around you, measuring the amount of radiation being absorbed throughout your body. Sometimes, the examination table will move during the scan, so that the x-ray beam follows a spiral path. A special computer program processes this large volume of data to create two-dimensional cross-sectional images of your body, which are then displayed on a monitor. CT imaging is sometimes compared to looking into a loaf of bread by cutting the loaf into thin slices. When the image slices are reassembled by computer software, the result is a very detailed multidimensional view of the body's interior.

Refinements in detector technology allow nearly all CT scanners to obtain multiple slices in a single rotation. These scanners, called multislice CT or multidetector CT, allow thinner slices to be obtained in

ashorter period of time, resulting in more detail and additional view capabilities.

Modern CT scanners are so fast that they can scan through large sections of the body in just a few seconds, and even faster in small children. Such speed is beneficial for all patients but especially children, the elderly and critically ill, all of whom may have difficulty in remaining still, even for the brief time necessary to obtain images.

For children, the CT scanner technique will be adjusted to their size and the area of interest to reduce the radiation dose.

For some CT exams, a contrast material is used to enhance visibility in the area of the body being studied.

The technologist begins by positioning you on the CT examination table, usually lying flat on your back. Straps and pillows may be used to help you maintain the correct position and to help you remain still during the exam.

Many scanners are fast enough that children can be scanned without sedation. In special cases, sedation may be needed for children who cannot hold still. Motion will cause blurring of the images and degrade the quality of the examination the same way that it affects photographs.

If contrast material is used, depending on the type of exam, it will be swallowed, injected through an intravenous line (IV) or, rarely, administered by enema.

Next, the table will move quickly through the scanner to determine the correct starting position for the scans. Then, the table will move slowly through the machine as the actual CT scanning is performed. Depending on the type of CT scan, the machine may make several passes.

A CT scan of the head is usually completed within 10 minutes. Computed tomography, more commonly known as a CT or CAT scan, is a

diagnostic medical test that, like traditional x-rays, produces multiple images or pictures of the inside of the body.

The cross-sectional images generated during a CT scan can be reformatted in multiple planes, and can even generate three-dimensional images. These images can be viewed on a computer monitor, printed on film or transferred to a CD or DVD.

CT images of internal organs, bones, soft tissue and blood vessels typically provide greater detail than traditional x-rays, particularly of soft tissues and blood vessels.

CT scanning provides more detailed information on head injuries, stroke, brain tumors and other brain diseases than regular radiographs (x-rays).

.CT scanning is also performed to:

- evaluate the extent of bone and soft tissue damage in patients with facial trauma, and planning surgical reconstruction.
- Diagnose diseases of the temporal bone on the side of the skull, which may be causing hearing problems.
- determine whether inflammation or other changes are present in the par nasal sinuses.
- plan radiation therapy for cancer of the brain or other tissues.
- Guide the passage of a needle used to obtain a tissue sample (biopsy) from the brain.
- Assess aneurysms or arteriovenous malformations through a technique called CT angiography.

You should wear comfortable, loose-fitting clothing to your exam. You may be given a gown to wear during the procedure.

Metal objects, including jewelry, eyeglasses, dentures and hairpins, may affect the CT images and should be left at home or removed prior to your exam. You may also be asked to remove hearing aids and removable



dental work. Women will be asked to remove bras containing metal underwire. You may be asked to remove any piercings, if possible.

You will be asked not to eat or drink anything for a few hours beforehand, as contrast material will be used in your exam. You should inform your physician of all medications you are taking and if you have any allergies. If you have a known allergy to contrast material, or "dye," your doctor may prescribe medications (usually a steroid) to reduce the risk of an allergic reaction. These medications generally need to be taken 12 hours prior to administration of contrast material. To avoid unnecessary delays, contact your doctor before the exact time of your exam.

Also inform your doctor of any recent illnesses or other medical conditions and whether you have a history of heart disease, asthma, diabetes, kidney disease or thyroid problems. Any of these conditions may increase the risk of an unusual adverse effect.

The radiologist also should know if you have asthma, multiple myeloma or any disorder of the heart, kidneys or thyroid gland, or if you have diabetes—particularly if you are taking Glucophage. Women should always inform their physician and the CT technologist if there is any possibility that they may be pregnant.

### **Benefits of the CT scan**

- CT scanning is painless, noninvasive and accurate.
- A major advantage of CT is its ability to image bone, soft tissue and blood vessels all at the same time.
- Unlike conventional x-rays, CT scanning provides very detailed images of many types of tissue as well as the lungs, bones, and blood vessels.
- CT examinations are fast and simple; in emergency cases, they can reveal internal injuries and bleeding quickly enough to help save lives.

- CT has been shown to be a cost-effective imaging tool for a wide range of clinical problems.
- CT is less sensitive to patient movement than MRI.
- CT can be performed if you have an implanted medical device of any kind.
- A diagnosis determined by CT scanning may eliminate the need for exploratory surgery and surgical biopsy.
- No radiation remains in a patient's body after a CT examination.
- X-rays used in CT scans should have no immediate side effects

## **2-2 Previous studies:**

The center for disease control and prevention estimates that have over 5million American have mental or physical disability due to such a braininjury,however this estimate is based only hospital admissions –and does not take into account the countless others who did not seek medical attention (<http://www.six wise.com,1-2021-american society>).

Unidentified traumaticbrain injuryis an unrecognized major source of social and vocational failure “says WayneA.Gordon,doctor,director of brain injuryResearch center at mount Sinai school of medicine in the wall street journal.(<http://www.six wise.com,2012-american society>).

According to research from mounts about 7-8percent of the U.S population has some from of traumatic brain injury-mild,moderate or sever.Some of these head injuries may have happened long ago,and even be completely forgotten, yetcould still be impacting your life(<http://www.six.com,1-2012-american society>).

Forinstance according to various studiesby MountSinai researcher.In a study of students with learning disabilities,50perecentahardblow to the head.According to one mount Sinai psychologist about 20 percent of children with learning disabilities or behavior problems have had a significant blow to the head prior to becoming homeless.And it may be affected by head injuries in the eventof a closed head injury,brain collides with the skull,bruising brain tissue and tearing blood vessels. The rapid movement of the head (such as occurs during a car crash) may also stretch orinjure the neuronal axons which are nerve cells that link parts of brain together. and link parts of the brain to other parts of your body. Such an injury tends to impact wide range of functioning.In an open – head injury,such as from a bullet wound,that damages tends to be more focused on one area of the brain (althoughit canbe more serious and diffuse,depending on the injury ).

Brain injuries, mild or severe all have the potential to impact the following:

Cognitive skills (concentration, learning to skill, attention span) speech and Language skills, personality (lethargy, aggression, mood swings dependent behaviors) a head injury long ago researchers are realizing that the blow may long be forgotten, but the impacts could linger on, for some the head injury leads to irritability or depression, which turns into substance abuse other have head time juggling tasks throughout the body and become disorganized, easily distracted or unable to hold a job. In fact according to the Brain Injury Association of America (BIAA) one study found that 40 percent of people hospitalized with traumatic brain injury had at least one problem that still lingered one year later. Most frequently this was:

- a. Improving memory and problem solving, managing stress and emotional upset.
- b. Controlling their temper, improving their job skill.

According to BIAA the most common causes of traumatic brain injuries are:

Falls (28%) motor/traffic crashes (20%) struck by /against something (19%), assaults (11%)

In general, the head injuries can be reduced by: Always wearing a seatbelt while driving, wearing a helmet on a motorcycle or bicycle, always wearing the proper equipment when taking part in sports protecting children and the elderly from sharp function corners using these inexpensive corner protocol.

# **Chapter Three**

Material and methods

## Chapter three

### Material and methods

#### 3.1Material:

##### 3.1.1 Patient

This study includes 50pts male and female for brain examination with indication of head injurers.

The following table and group show summary of the result with variation of gender,age and ct findingsincluding normal and abnormal findings.

Table(3-1):shows study group gender distribution

Gender	Frequency	%
Male	35	70
Female	15	30
Total	50	100

##### 3-1-1Machines:

**The machines used in this study are,Toshiba dual spiral CT,G E hi speed dual.**

**The major components of CTsystem are,gantry,table,operatorconsole and power distribution unit**

The CT scanner is typically a large, box-like machine with a hole, or short tunnel, in the center. Rotating around you, the x-ray tube and electronic x-ray detectors are located opposite each other in a ring, called a gantry. The computer workstation that processes the imaging information is located in a separate control room, where the technologist operates the scanner and monitors your examination in direct visual contact and usually with the ability to hear and talk to you with the use of a speaker and microphone.

Computed tomography (CT) of the head uses special x-ray equipment to help assess head injuries, severe headaches, dizziness, and other symptoms of aneurysm, bleeding, stroke and brain tumors. It also helps your doctor to evaluate your face, sinuses, and skull or to plan radiation therapy for brain cancer. In emergency cases, it can reveal internal injuries and bleeding quickly enough to help save lives.

The cross-sectional images generated during a CT scan can be reformatted in multiple planes, and can even generate three-dimensional images. These images can be viewed on a computer monitor, printed on film or transferred to a CD or DVD.

CT images of internal organs, bones, soft tissue and blood vessels typically provide greater detail than traditional x-rays, particularly of soft tissues and blood vessels. CT scanning provides more detailed information on head injuries, stroke, brain tumors and other brain diseases than regular radiographs (x-rays).

### **3.2 Methods:**

#### **3-2-1 Data collection:**

Data collected using data collection sheet, contain information s include: patient age sex, fracture incidence, cause of trauma and CT finding

#### **3.2.2 CT scan technique:**

All patients under CT study with following parameters KVP (120-140) ma (200). with time 0.1 second

Slice thickness: thin slice at the base of skull (3-5)ml. thick slice above to the base (7-10)ml.

imaging protocols in brain injury is suspected CT scan provide direct information about contusion or hematoma. Little patient preparation is required for CT scan but the following points should be noted:

- all metallic objects should be removed including such items as earrings, bobby pins and necklaces.
- the patient should be instructed to empty the bladder before the scan because use of IV contrast medium causes the bladder to fill rapidly and scan should not be interrupted to the bathroom. The reason for contrast medium should be explained to the patient and IV line started before scan
- The patient is comfortable on the table the result is less motion and there for less degradation of image quality.

### **3.2.3 Image interpretation**

All image done studies in soft tissue and bone window by senior radiologist for present of fracture, hemorrhage, or other finding.



# **Chapter four**

Result

## Chapter Four

### Result

This study include 50 pts male and female for brain examination with indication of head injurers.

The following table and group show summary of the result with variation of gender and CT findings including normal and abnormal findings.

Table(4-1): shows study group gender distribution

Gender	Frequency	%
Male	35	70
Female	15	30
Total	50	100

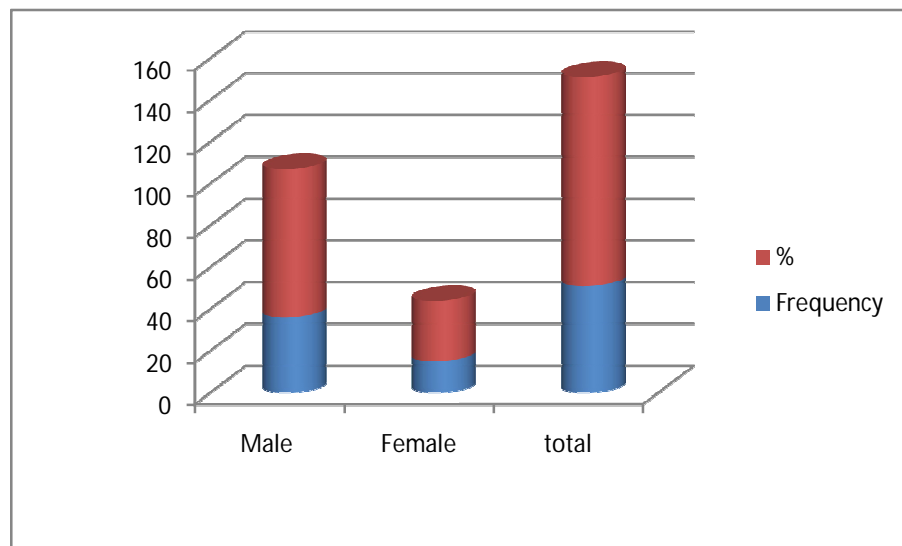


Figure (4-1) shows study group gender distribution

**Table (4-2): Show studygroups agedistribution:**

Interval	Frequency	%
1-10	8	16
10-20	7	14
20-30	10	20
30-40	7	14
40-50	6	12
50-60	5	10
60-70	3	6
70-80	4	8
Total	50	100

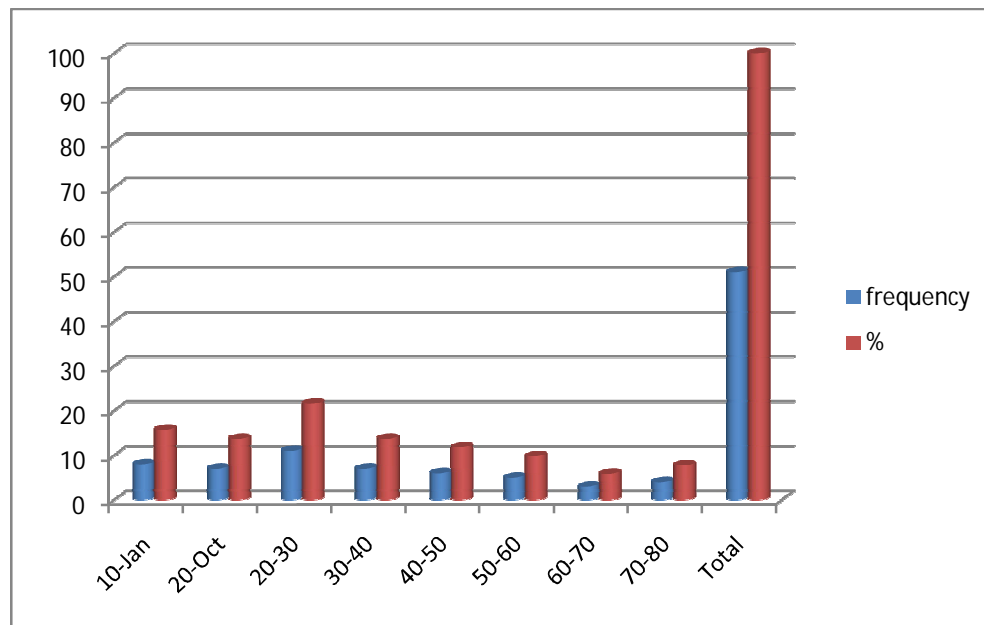


Figure (4-2) show studygroups agedistribution:

**Table (4-3) shows CT injures findings:**

CT findings	Patient	%
Positive	24	48
Negative	26	52
Total	50	100

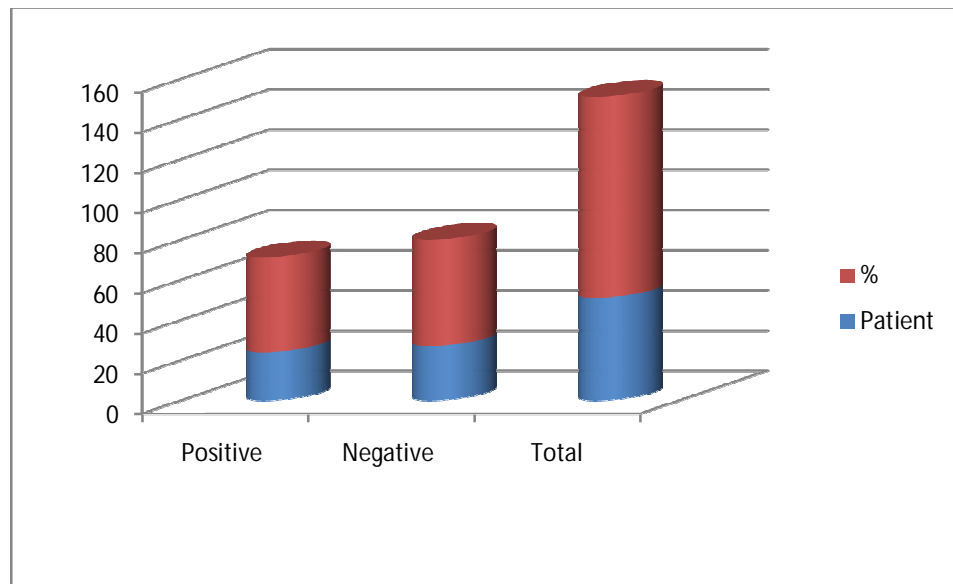
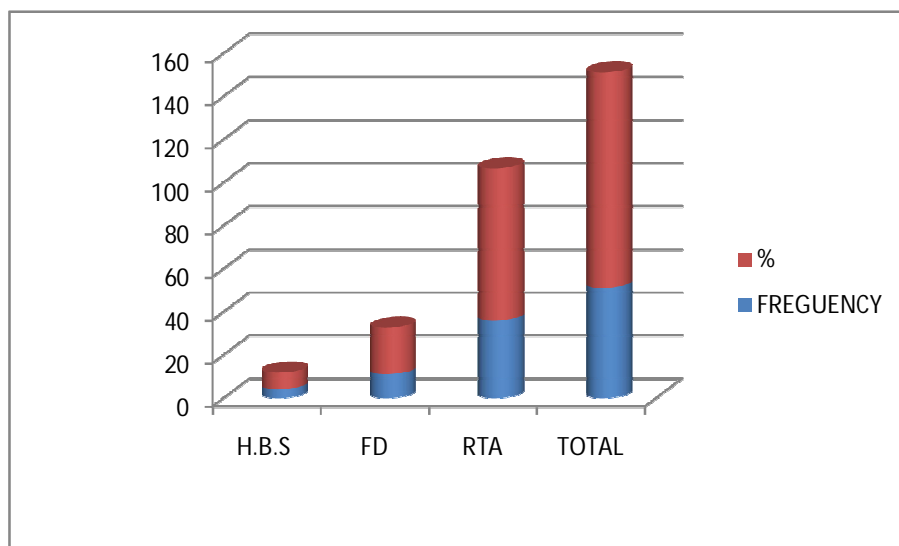


Figure (4-3) shows CT injures findings

**Table (4-4)Shows type of trauma:**

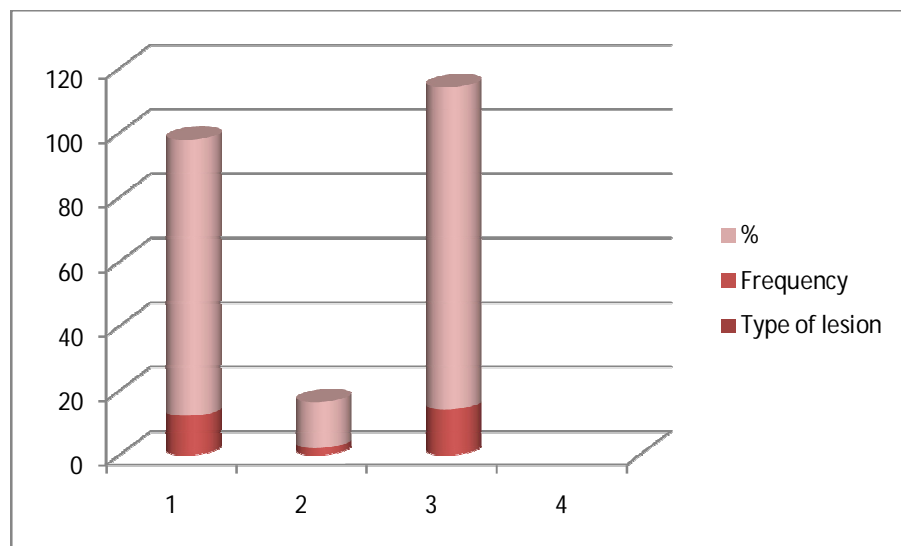
Type of trauma	FREGUENCY	%
<i>Head by stick</i>	4	8
Fall down	11	22
<i>Road traffic accident</i>	35	70
TOTAL	50	100



Figure(4-4) shows type of trauma

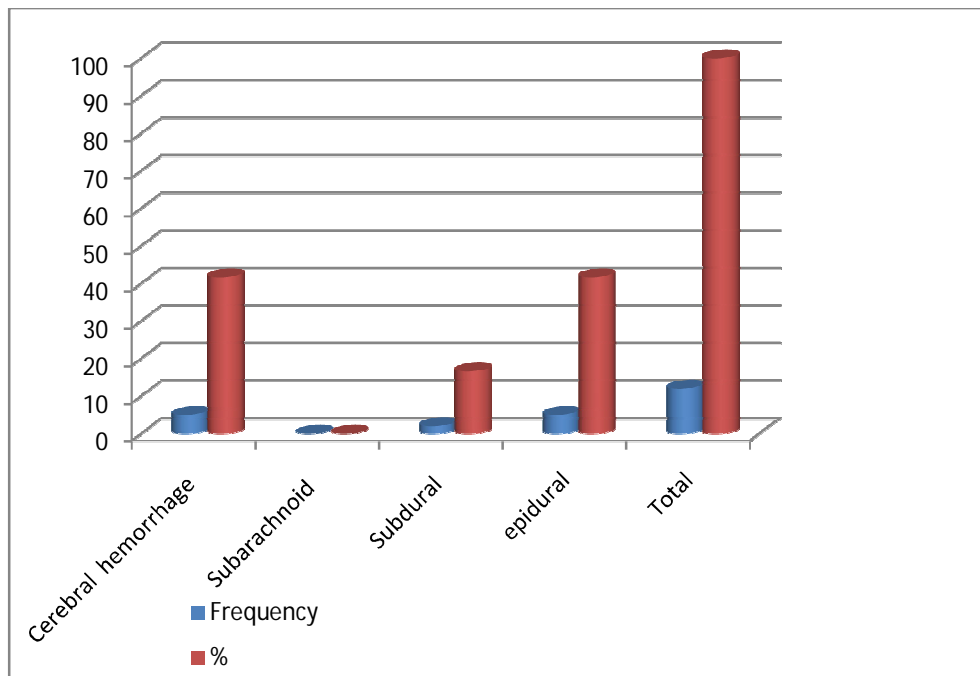
**Table (4-5) shows type of lesion:**

Type of lesion	Frequency	%
Hemorrhage	12	85.7
Contusion	2	14.3
total	14	100



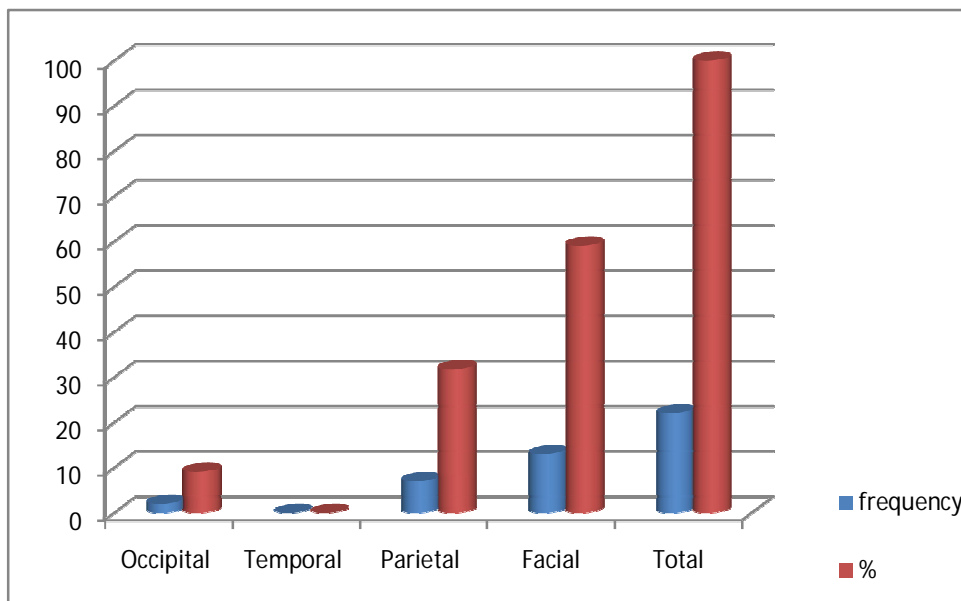
**Table (4-6) showstypesof hemorrhage**

Type of hemorrhage	Frequency	%
Cerebralhemorrhage	5	41.7
Subarachnoid	0	0
Subdural	2	16.6
epidural	5	41.7
Total	12	100



**Table (4-7) shows sites of fracture:**

Site of fracture	frequency	%
Occipital	2	9.1
Temporal	0	0
Parietal	7	31.8
Facial	13	59.1
Total	22	100





# **Chapter five**

Discussion, Conclusion and Recommendations

## Chapter five

### Discussion, Conclusion and Recommendations

#### 5-1 Discussion:

This study was done in Khartoum state in two CT centers. The study group was 50 patients, 35 males and 15 females with percentages 70% and 30% from the total sample which is expressed in table and graph (4-1). Patients' ages fall in the range of 10-60 years facing RTA because they are liable for travelling by car also most of these sample under 5 yrs expressed to injuries from fall down which is expressed in the table and graph (4-2).

24 patients of these study group is positive and 26 of these study is negative with CT finding with percentage 48% and 52% which is expressed in table and graph (4-3).

The cause of head trauma in these study were as follows RTA. H.B.S the main cause of head trauma by RTA with percent 70%

The main CT finding of head injury were hemorrhage, contusion but hemorrhage occur more than contusion with percent 7.8% and FD 21.6%.

and this hemorrhage it classified into main cerebral H, subarachnoid H, subdural H, and epidural H, most common type of hemorrhage cerebral and epidural the same percent, and fracture also complication of head injury the most common of these fracture is facial bone with percent 59.1%

## **5-2 Conclusion:**

Ct is the first choice diagnosis head injure compared with MRI because it takes short time 0.1 second per slice especially because traumatic patient were unconscious and need life saving instruments (e.g. oxygen cylinder ) which impossible to MRI scan room.

And time can be taken by two window bony and soft window and soft tissue window no need for contrast media injection and the hemorrhage appear bright and easily to need diagnose these hemorrhage and classification.

Through this study, we meant to reflect the high risks and impacts of the head injury and we put some recommendations must be use useful in trauma management and how can prevent or reduce the happening of the head injures.

### **5-3 Recommendations:**

Since Major cause of TBI OR RTA,their prevention or the amelioration of their consequences can both reduce the incidence of TBI. damage can be reduced by use of the seat belts,child safety seats and motorcycle helmets,and presence of airbags. Educationprograms exist to lower the number of Crashes.

In addition,changes to public and safety laws can be made: theseinclude speed limits seat beltand road engineering practices.

Changes to common the common practices in sports have also been discussed.an increase in use of helmets could reduce the incidence of (TBI).Due to possibility thatrepeatedly:heading:abllapracticing soccer could causecumulative brain injury the idea of inter of introducingprotective headgear for players has been proposed.improved equipment design can enhance safety; softer baseballs reduce head injury risk,fall can be avoided by installing grab bars in bathrooms and handrails on stairways; removing tripping hazards such as mulch or sand also prevent head injures,

.If this injuries occur I willsuggest availability many CT centerin the street of the accidental hospital to perform this image to the patient with head injury not stay along time because this criticalcase.

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# **Appendices**

## Appendices



Image (1) Axial image inCT scan shows cerebral hemorrhage



Image (2) Axial CT image epidural hematoma



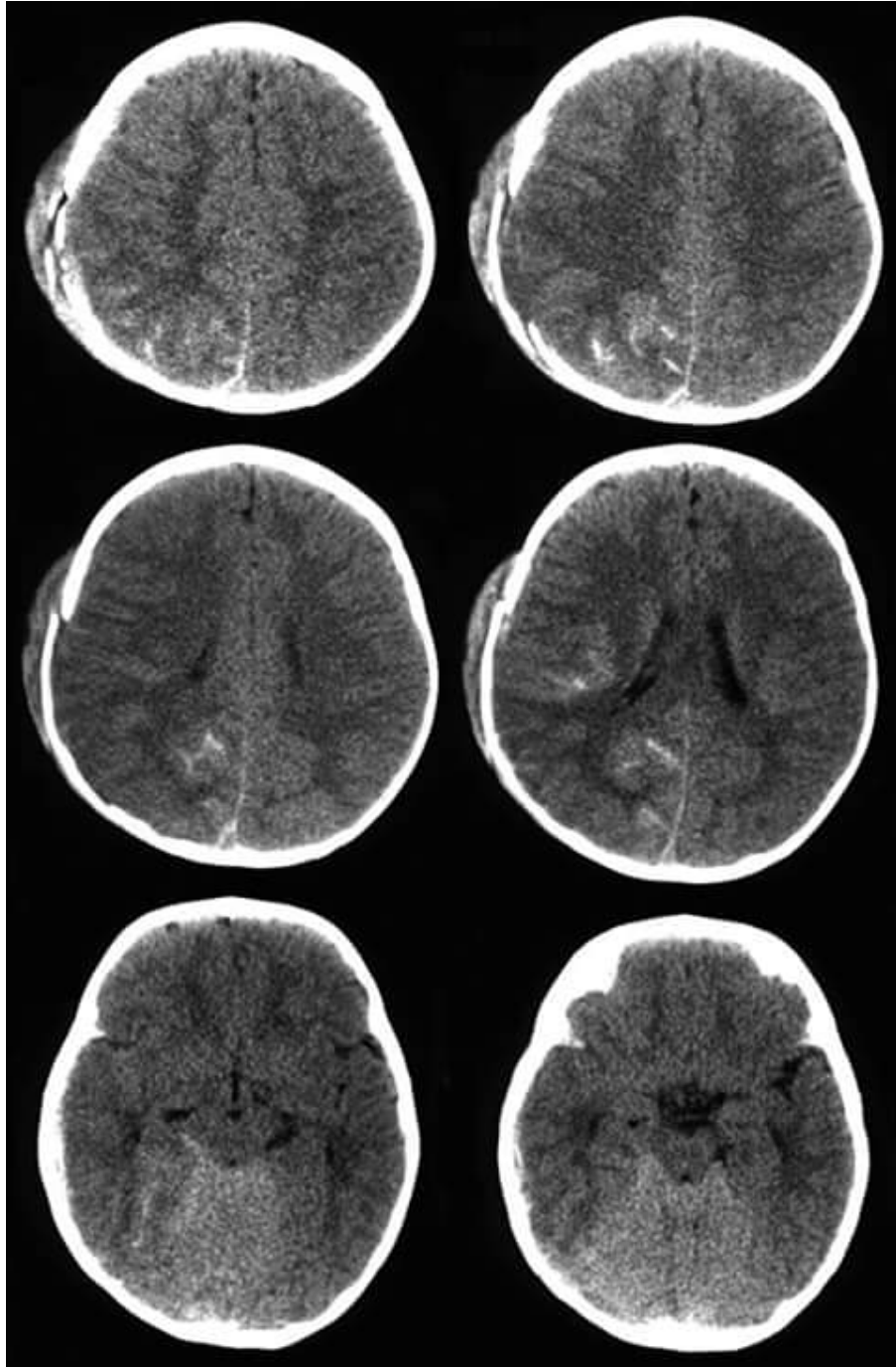
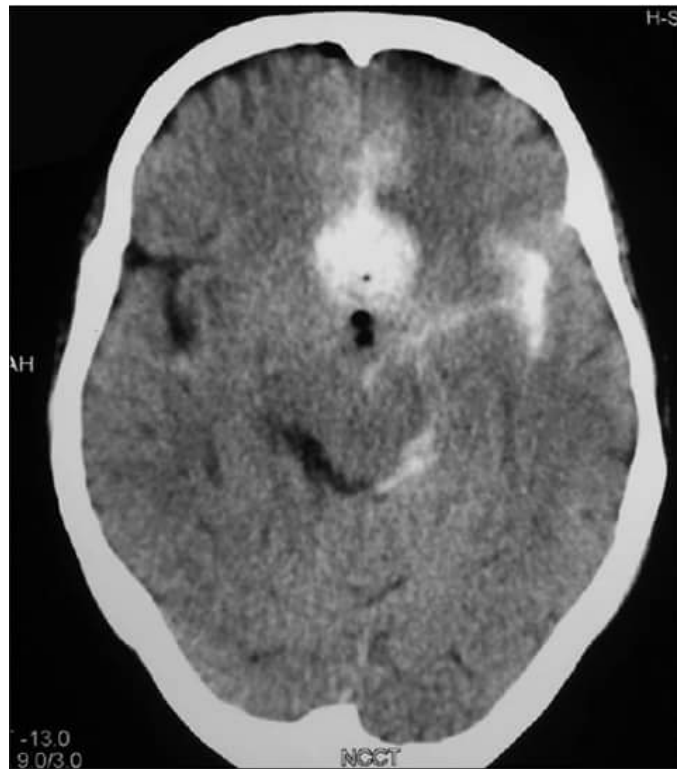
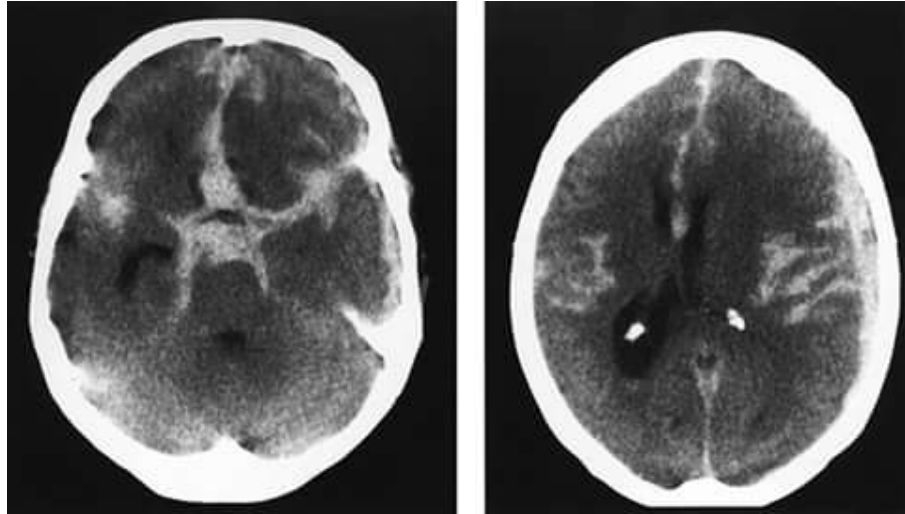


Image (3) Axial image in CT scan show cerebral contusion



Image(4) Axial image in CT SCAN show subarachnoid hematoma.

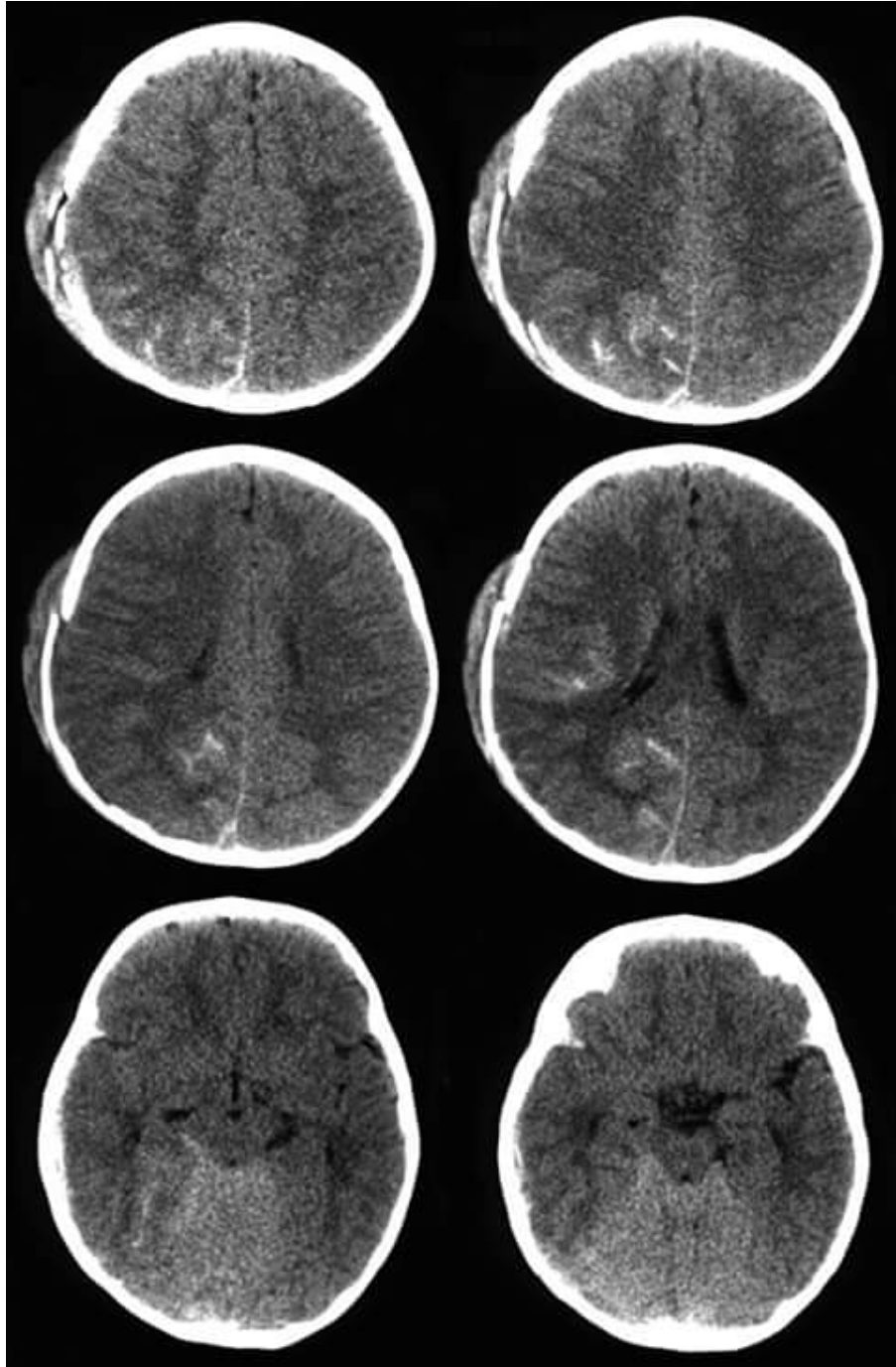


Image (5) Axial image in CT show skull fracture