Sudan University of Science and Technology

College Of Graduate Studies

Evaluation of Head Trauma for Sudanese Population using Computed Tomography

تقويم اصابات الرأس لدى السودانيين باستخدام الأشعة المقطعية

A Research Submitted for Partial Fulfillment of the Requirements of M.Sc. in Diagnostic Radiological Technology

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2017

بسم الله الرحمن الرحيم

الآية

قال تعالى:

(يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ ۚ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ)

سورة المجادلة الآية (11)

Dedication

Personally, I'd like to thank all those who have helped with their advice and efforts.

I'd like also to thank all the medical imaging staff, especially my supervisor, DR. Ikhlas Abdel Aziz Hassan Mohammed for his valuable advices.

For my parents, friends and everyone, I offer my research.

With love

Acknowledgments

I would like to express my gratitude and appreciation to all those who gave me the possibility to complete this Search. A special thanks to my Graduation Research supervisor, ***Dr.Ikhlas Abdel Aziz Hassan Mohammed*** *for his valuable advices, whose help us, stimulating suggestions and Encourage continuous, helped us to coordinate my project especially in writing this research.*

My thanks also to the staff of the radiology department in the Police hospital accident and emergency and Ibrahim Malik hospital.

I would to appreciate the guidance given by other supervisors that help us in collect data: Miss.Iman, Mr.Shehab .Mr.Ahmed Adel, Miss.Samera, Mr. Omar AND Mr.Mogtba

In the end, I can thank you from the bottom of our hearts, and remain an asset and to support the dissemination of science and knowledge.

Abstract

This was a cross sectional descriptive study done to evaluate the Head Trauma for Sudanese population using computed Tomography, classify types of traumas by the main mode of trauma and explain types of fractures and hemorrhage and the impact of these traumas on the mid shift line . This study was administrated in three radiological centers in Khartoum state: The police hospital for injuries and accidents, Ibrahim Malik hospital, and Al Zaytona Hospital.

The study information was collected by data collection sheet and analyzed using SPSS statistical analysis program for 50 patients. 80% were male and 20% were female. The study results showed that road accidents are the most cause of injuries with a percentage of 74%, most of the injuries were fractures with hemorrhage with a percentage of 66%, and the most happening of fractures is linear fracture with a percentage of 48.8%. The study findings also revealed that the most susceptible area to fractures and hemorrhages are frontal bone with a percentage of 37.2% for fractures and 28.6% for hemorrhages. The study results also found that subdural hemorrhage is most happening as a complication of fractures with a percentage of 27.9%. The study also showed that epidural hemorrhage most common of hemorrhage 57.1% of injuries in hemorrhage state

The study concluded that using non contrast computed tomography as initial investigation for diagnosing traumatic head trauma is necessary.

ملخص الدراسة

هـذه دراسـة مقطعيـه عرضـية اجريـت لتقيـيم إصـابات الـرأس عنـد السـودانيين بواسـطة اسـتخدام الأشـعة المقطعيـة وتصـنيف انـواع الإصـابات بنـاء علـى طريقـه الإصـابة وتتبيـين أنـواع الكسور والنزيف الموجود وتأثير هذه الاصابات على خط النصف.

هـذه الدراسـة انجـزت فـي ثـلاث مراكـز اشـعه فـي ولايـة الخرطـوم وهـي مستشـفى الشـرطة للإصابات والحوادث ومستشفى ابراهيم مالك ومستشفى الزيتونة.

المعلومات جمعت بواسطة استبيانه ثم حللت بواسطه برنامج التحليل الإحصائي ل 50 مريض
80% كانوا رجال و 20% كانوا نساء .

وجدت الدراسة ان حوادث الطرق هي المسبب الرئيسي للإصابات بنسبة 74% , معظم الاصابات كانت حدوث كسر مع نزيف بنسبة 66% , واكثر انواع الكسور الحاصلة هي الكسر الخطي بنسبة 48.8%. نتائج الدراسة كشف أن المنطقة الأكثر عرضة للكسور والنزيف هي عظمه المقدمة بنسبة 37.2% للكسور و 28.6% للنزيف .

نتائج الدراسة وجدت نزيف تحت الجافية هو أكثر نزيف يحدث كمضاعفات للكسور بنسبة 27.9%
وجدت الدراسة ايضا نزيف فوق الجافية أكثر نزيف يحدث بشكل منفصل بنسبة 57.1%
وخلصت الدراسة إلى أن استخدام فحص الأشعة المقطعية بدون صبغة كخيار اولي لتشخيص اصابات الرأس ضروري

List of contents

List of Tables

List of figures

List of Abbreviations

CT	Computed Tomography
CSF	Cerebro Spinal Fluid
TBI	Traumatic brain injury
RTA	Road traffic accident
CNS	Central nervous system
PNS	Peripheral nervous system
ADH	Antidiuretic hormone
GHRH	Growth hormone releasing hormone
GH	Growth hormone
ICA	Internal carotid arteries
DAI	Diffuse axonal inj

Chapter One

Introduction

Chapter one

1.1 Introduction:

Traumatic head injury is the leading cause of death and disability in children and young adults in the world As well; significant numbers of people suffer temporary and permanent disability due to head injury. (www.ninds.nih.gov accessed 2016)

It is a complex injury with a broad spectrum of symptoms and disabilities. It is defined as damage to the brain resulting from external mechanical force, such as rapid acceleration or deceleration impact, blast waves, or penetration by a projectile, leading to temporary or permanent impairment of brain function. Traumatic brain injury (TBI) has a dramatic impact on the health of the nation: it accounts for 15–20% of deaths in people aged 5–35 yr old, and is responsible for 1% of all adult deaths. TBI is a major cause of death and disability worldwide, especially in children and young adults. Males sustain traumatic brain injuries more frequently than do females. (S. K. Haldar, 2016)

Falls, vehicle accidents, and violence. The most common causes of TBI include violence, transportation accidents, construction, and sports. Motor bikes are major causes, increasing in significance in developing countries as other causes reduce. The estimates that between 1.6 and 3.8 million traumatic brain injuries each year are a result of sports and recreation activities. (S. K. Haldar, 2016) although the majority of TBIs are mild they can still have serious health implications. Of greatest concern are injuries that can quickly grow worse. All TBIs require immediate assessment by a professional who has experience evaluating head injuries. A neurological exam will assess motor and sensory skills and the functioning of one or more cranial nerves. It will also test hearing and speech, coordination and balance, mental status, and changes in mood or behavior, among other abilities, Medical providers will use brain scans to evaluate the extent of the primary brain injuries and determine if surgery will be needed to help repair any damage to the brain. The need for imaging is based on a physical examination by a doctor and a person's symptoms, Computed tomography (CT) is the most common imaging technology used to assess people with suspected moderate to severe TBI. CT scans create a series of cross-sectional x-ray images of the skull and brain and can show fractures, hemorrhage, hematomas, hydrocephalus, contusions, and brain tissue swelling. CT scans are often used to assess the damage of a TBI in emergency room settings. Currently, this is best performed by CT for several reasons: it is quick, widely available, and highly accurate in detection of acute intra-axial and extra-axial hemorrhage, as well as skull, temporal bone, facial, and orbital fractures. Monitoring equipment is easily accommodated. CT images must be reviewed using multiple windows. A narrow window width is used to evaluate the brain, whereas a slightly wider window width is used to exaggerate contrast between extra-axial collections and the adjacent skull itself. (www.ninds.nih.gov accessed 2016)

1.2Problem of the study:

Traumatic brain injuries have high risk of death among population so it is need accurate evaluation and CT is best accurate modalities of determining the complication which occurs and results of head injury.

1.3 Objectives of study:

1.3.1 General Objective:

- To evaluate the head trauma for Sudanese population using Computed Tomography.

1.3.2 Specific Objectives:

- To identify most common abnormality in head injuries patients.
- To determine relation of age and gender with type of head trauma.
- To assess the most common cause of head trauma (fighting, RTA, Falling down).
- To identify the relation between the cause and type of head trauma.

1.4 Significance of the study:

The study is important because it will appear the important to availability of CT in hospital and especially which located near to center of country is facilitating diagnoses of head injury and reducing time wasted in transporting patient from far areas.

1.5 The scope of the study:

The study will contain five chapters:

Chapter one: consisted of general introduction about this subject in addition to research problem, objectives and significance of the study. Chapter two: includes anatomy of the brain , skull fracture and type of head injury , radiographic appearance of head injuries also importance of CT in head trauma and injuries and previous studies .Chapter three describes the material and methods. Chapter four includes the results, and lastly chapter five includes the discussion, conclusion, recommendations, references and appendices at the end of the study.

Chapter Two

Literature review

Chapter Two

Literature review

2.1 Anatomy of the brain:

The brain is a spongy organ made up of nerve and supportive tissues. It is located in the head and is protected by a bony covering called the skull. The base, or lower part, of the brain is connected to the spinal cord. Together, the brain and spinal cord are known as the central nervous system (CNS). The spinal cord contains nerves that send information to and from the brain. The CNS works with the peripheral nervous system (PNS). The PNS is made up of nerves that branch out from the spinal cord to relay messages from the brain to different parts of the body. Together, the CNS and PNS allow a person to walk, talk, and throw a ball and so on. (www.cancer.ca)

2.1.1 Structure of the brain:

The brain consists of many parts that function as an integrated whole. The major parts are the medulla, pons, and midbrain (collectively called the brainstem), the cerebellum, the hypothalamus, the thalamus, and the cerebrum. These parts are shown in (Fig. 2-1). We will discuss each part separately, but keep in mind that they are all interconnected and work together. (Scanlon et-al 2007)

07 by F. A. Davis.

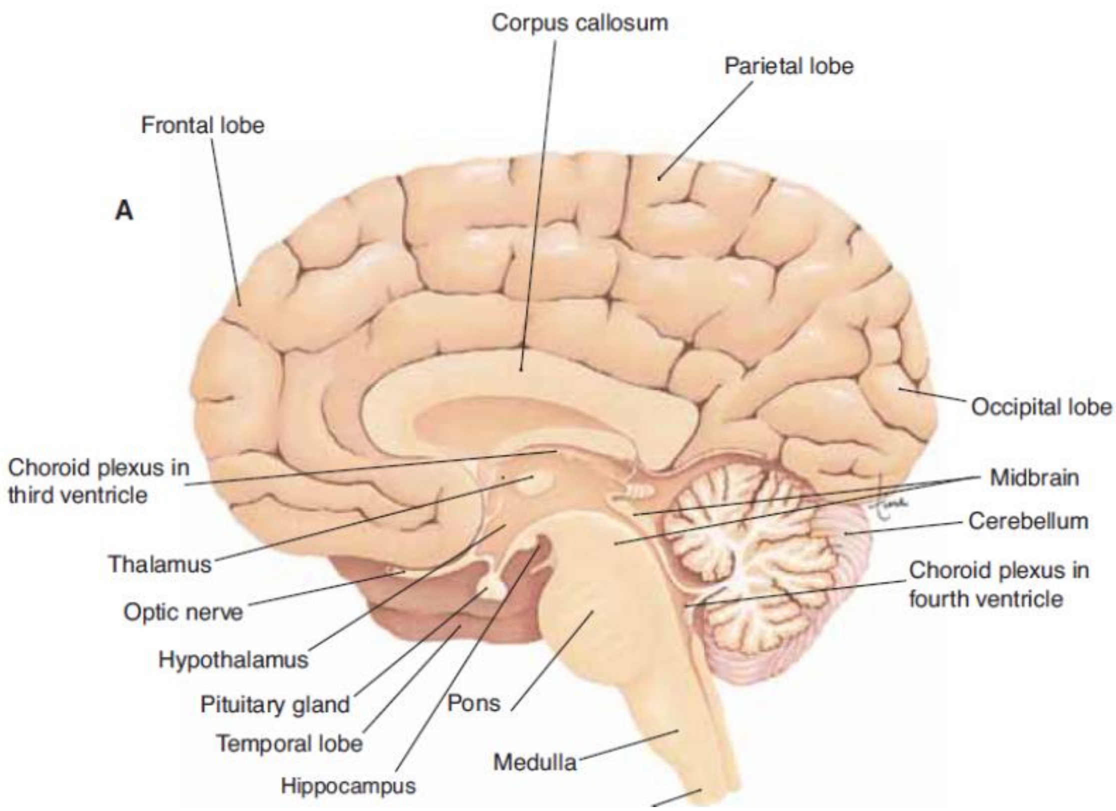


Fig (2-1) Shows mid sagittal section of the brain as seen from the left side .
(Scanlon et-al 2007)

2.1.1.1 Ventricles:

The ventricles are four cavities within the brain: two lateral ventricles, the third ventricle, and the fourth ventricle (Fig. 2-2). Each ventricle contains a capillary network called a choroid plexus, which forms cerebrospinal fluid (CSF) from blood plasma. Cerebrospinal fluid is the tissue fluid of the central nervous system; its circulation and functions will be discussed in the section on meninges. (Scanlon et-al 2007)

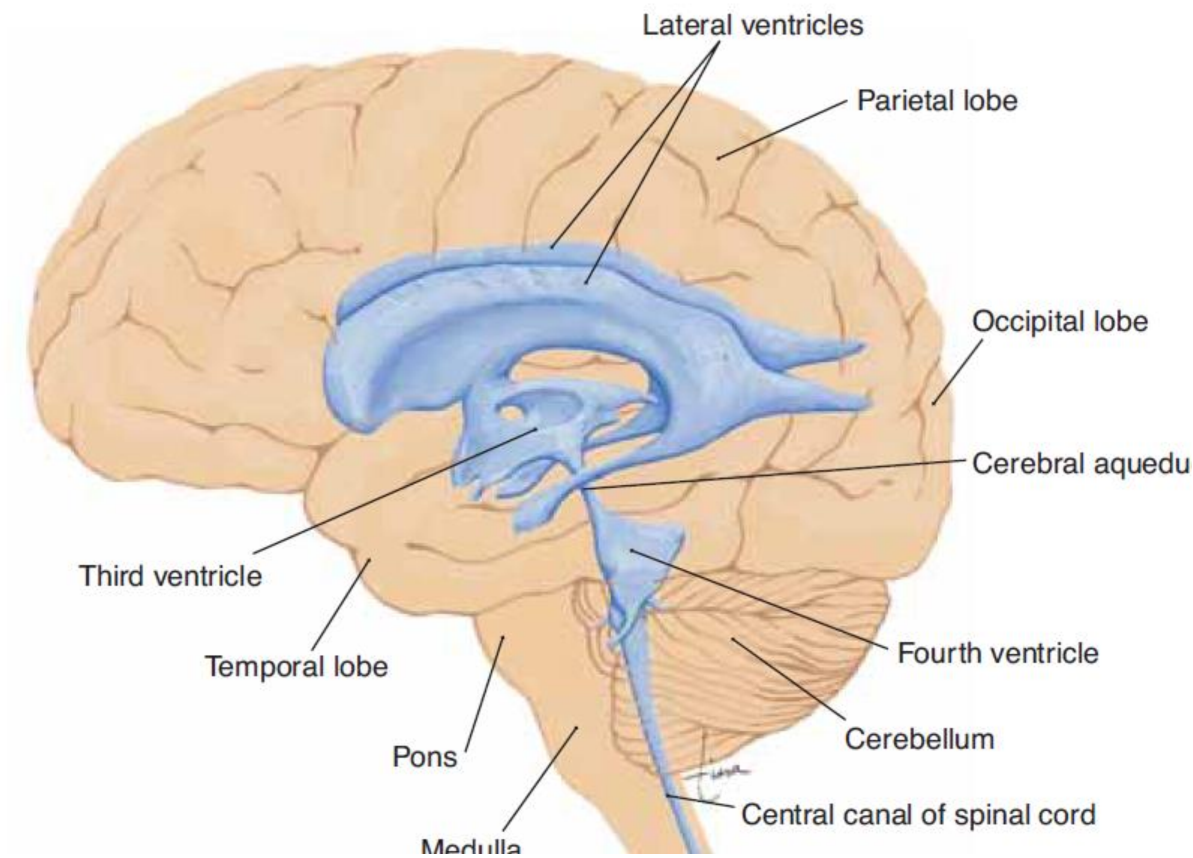


Fig (2-2) Shows Ventricles of the brain as projected into the interior of the brain, which is seen from the left side. (Scanlon et-al 2007)

2.1.1.2 Medulla:

The medulla extends from the spinal cord to the pons and is anterior to the cerebellum. (Scanlon et-al 2007) Its contains all fiber tracts between the brain and spinal cord, as well as vital centers that regulate internal activities of the body. The center of the anterior and posterior surfaces of the medulla oblongata are marked by the anterior and posterior median fissures .The two fissures divide the medulla oblongata into two symmetric halves. Located on either side of the anterior median fissure are two bundles of nerve fibers called pyramids. The pyramids contain the nerve tracts that contribute to voluntary motor control. At the lower end of the pyramids some of the nerve tracts cross decussate; to the opposite side.(Lorrie L 1997).

2.1.1.3 Pons:

The pons is situated on the anterior surface of the cerebellum below the midbrain and above the medulla oblongata. It is composed mainly of nerve fibers, which connect the two halves of the cerebellum. It also contains ascending and descending fibers connecting the forebrain, the midbrain, and the spinal cord. Some of the nerve cells within the pons serve as relay stations, whereas others form cranial nerve nuclei.(Richard.Snell 2012)

2.1.1.4 Midbrain:

The midbrain extends from the pons to the hypothalamus and encloses the cerebral aqueduct, a tunnel that connects the third and fourth ventricles. (Scanlon et-al 2007)

2.1.1.5 Cerebellum:

The cerebellum lies within the posterior cranial fossa beneath the tentorium cerebelli .It is situated posterior to the pons and the medulla oblongata. It consists of two hemispheres connected by a median portion, the vermis .The cerebellum is connected to the midbrain by the superior cerebellar peduncles**,** to the pons by the middle cerebellar peduncles, and to the medulla by the inferior cerebellar peduncles. The surface layer of each cerebellar hemisphere, called the cortex, is composed of gray matter. The cerebellar cortex is thrown into folds, or folia, separated by closely set transverse fissures. Certain masses of gray matter are found in the interior of the cerebellum, embedded in the white matter; the largest of these is known as the dentate nucleus. (Richard. Snell 2012)

2.1.1.6 Hypothalamus:

Located superior to the pituitary gland and inferior to the thalamus, the hypothalamus from the lower part of the lateral wall and floor of the third ventricle .The following structures are found in the floor of the third ventricle from before back ward ,the optic chiasma ,the tuber cinereum and the infundibulum ,the mammillary bodies ,and the posterior perforated substance. (Richard. Snell 2012)

2.1.1.7 Thalamus:

The thalamus is superior to the hypothalamus and inferior to the cerebrum. The third ventricle is a narrow cavity that passes through both the thalamus and hypothalamus. (Scanlon et-al 2007)

2.1.1.8 Cerebrum:

The largest part of the human brain is the cerebrum, which consists of two hemispheres separated by the longitudinal fissure. At the base of this deep groove is the corpus callosum, a band of 200 million neurons that connects the right and left hemispheres. Within each hemisphere is a lateral ventricle. The surface of the cerebrum is gray matter called the cerebral cortex. Gray matter consists of cell bodies of neurons, which carry out the many functions of the cerebrum. Internal to the gray matter is white matter, made of myelinated axons and dendrites that connect the lobes of the cerebrum to one another and to all other parts of the brain. In the human brain the cerebral cortex is folded extensively. The folds are called convolutions or gyri and the grooves between them are fissures or sulci (you can see the folding of the cortex in the frontal section of the brain in Fig. 2-3). This folding permits the presence of millions more neurons in the cerebral cortex. The cerebral cortex of an animal such as a dog or cat does not have this extensive folding. This difference enables us to read, speak, do long division, write poetry and songs, and do so many other "human" things that dogs and cats cannot do. The cerebral cortex is divided into lobes that have the same names as the cranial bones external to them. Therefore, each hemisphere has a frontal lobe, parietal lobe, temporal lobe, and occipital lobe (Fig2-4).These lobes have been mapped; that is, certain areas are known to be associated with specific functions. (Scanlon et-al 2007)

2.1.1.9 Association Areas:

As you can see in Fig .(2-4), many parts of the cerebral cortex are not concerned with movement or a particular sensation. These may be called association areas and perhaps are what truly make us individuals. It is probably these areas that give each of us a personality, a sense of humor, and the ability to reason and use logic. Learning and memory are also functions of these areas. Although much has been learned about the formation of memories, the processes are still incompletely understood and mostly beyond the scope of this book. Briefly, however, we can say that memories of things such as people or books or what you did last summer involve the hippocampus (from the Greek for "seahorse," because of its shape), part of the temporal lobe on the floor of the lateral ventricle. The two hippocampi seem to collect information from many areas of the cerebral cortex. When you meet a friend, for example, the memory emerges as a whole: "Here's Fred," not in pieces. People whose hippocampi are damaged cannot form new memories that last more than a few seconds. The right hippocampus is also believed to be involved in spatial cognition (literally: "space thinking"). For example, if you are in school and a friend asks you the shortest way to your home, you will probably quickly form a mental map. You can see how much memory that involves (streets, landmarks, and so on), but the hippocampus can take it a step further and make your memories three-dimensional and mentally visible. You can see your way home. That is spatial cognition. It is believed that most, if not all, of what we have experienced or learned is stored somewhere in the brain. Sometimes a trigger may bring back memories; a certain scent or a song could act as possible triggers. Then we find ourselves recalling something from the past and wondering where it came from.

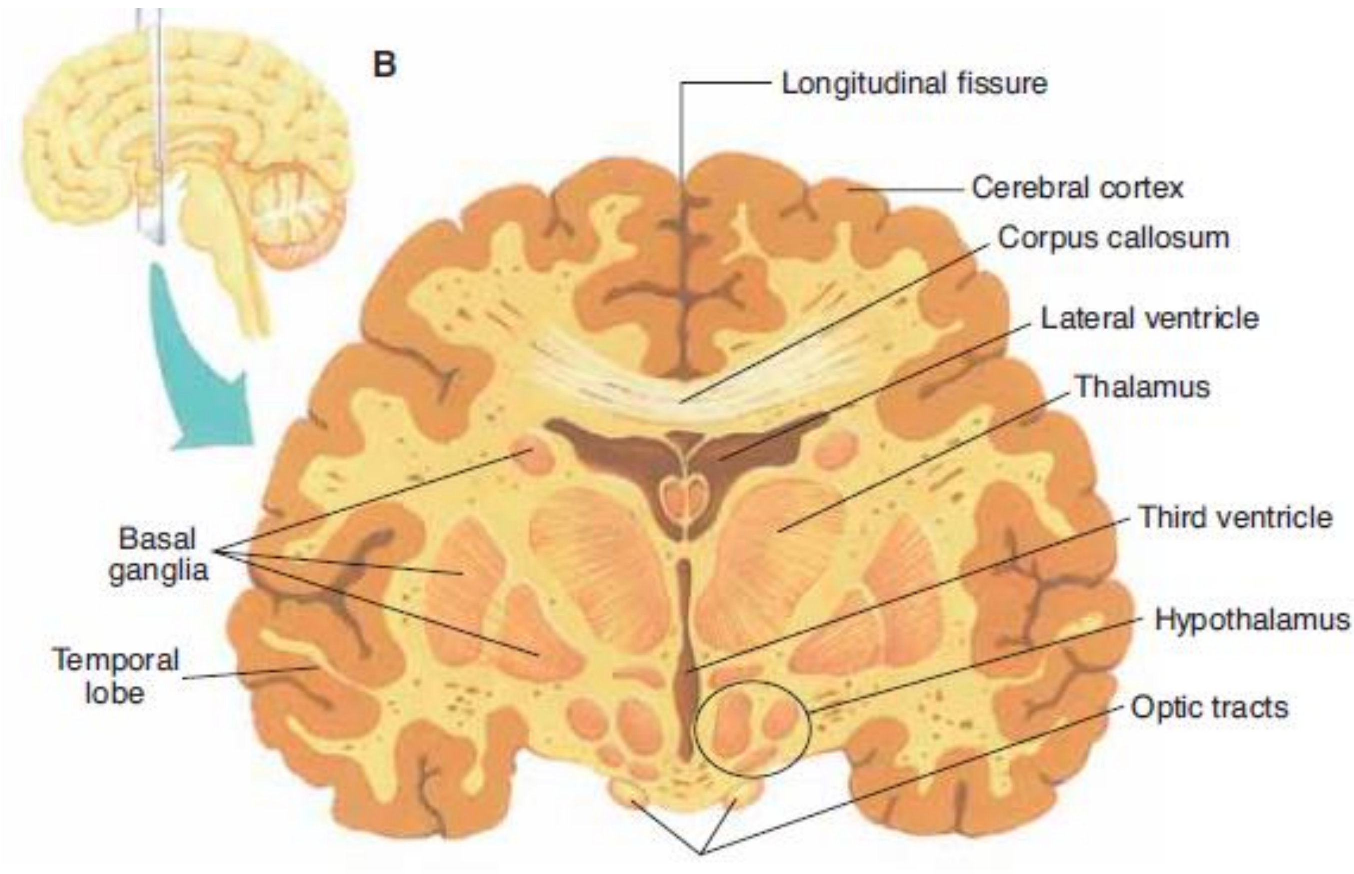
The loss of personality due to destruction of brain neurons is perhaps most dramatically seen in Alzheimer's disease. (Scanlon et-al 2007)

2.1.1.10 Basal Ganglia:

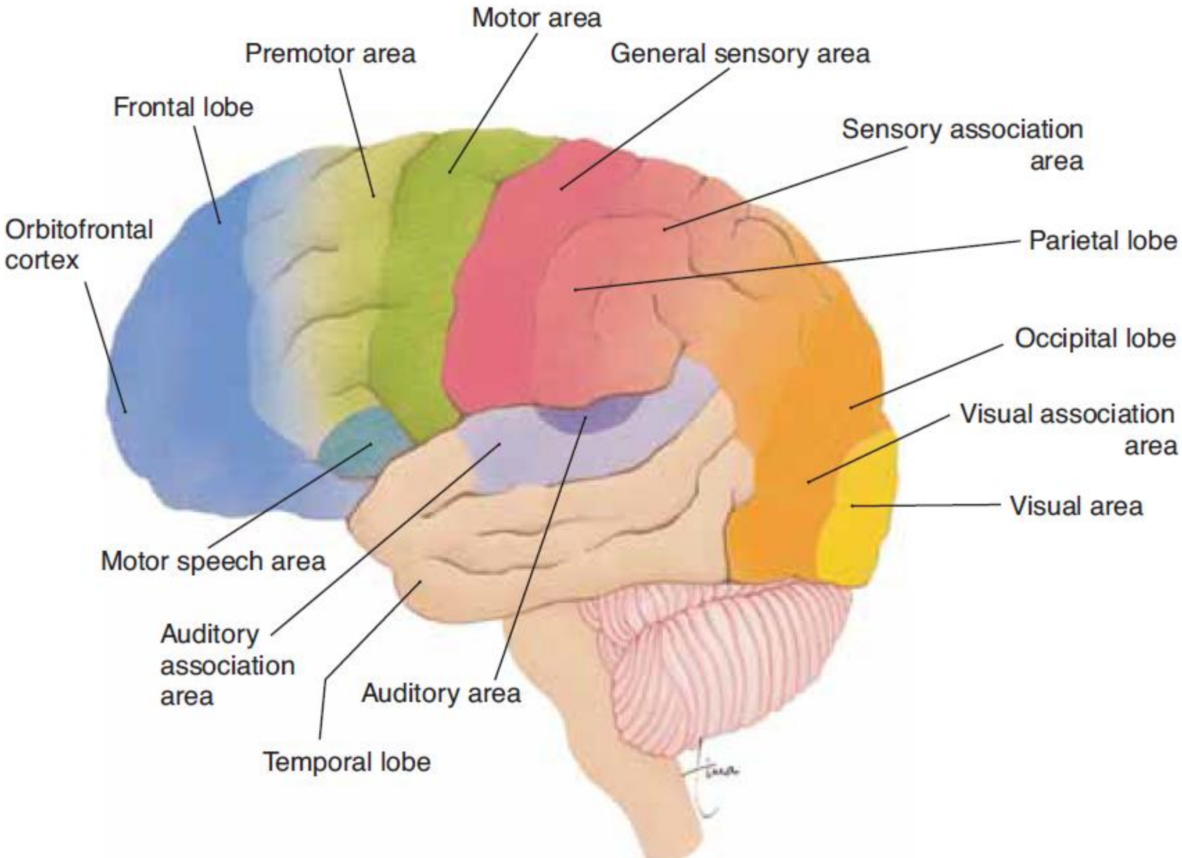
The basal ganglia are paired masses of gray matter within the white matter of the cerebral hemispheres (see Fig. 2-2).Their functions are certain subconscious aspects of voluntary movement, and they work with the cerebellum. The basal ganglia help regulate muscle tone, and they coordinate accessory movements such as swinging the arms when walking or gesturing while speaking. The most common disorder of the basal ganglia is Parkinson's disease. (Scanlon et-al 2007)

2.1.1.11 Corpus Callosum:

As mentioned previously, the corpus callosum is a band of nerve fibers that connects the left and right cerebral hemispheres. This enables each hemisphere to know of the activity of the other. This is especially important for people because for most of us, the left hemisphere contains speech areas and the right hemisphere does not. The corpus callosum, therefore, lets the left hemisphere know what the right hemisphere is thinking about, and the right hemisphere know what the left hemisphere is thinking and talking about. A brief example may be helpful. If you put your left hand behind your back and someone places a pencil in your hand (you are not looking at it) and asks you what it is, would you be able to say? Yes, you would. You would feel the shape and weight of the pencil; find the point and the eraser. The sensory impulses from your left hand are interpreted as "pencil" by the general sensory area in your right parietal lobe. Your right hemisphere probably cannot speak, but its thoughts can be conveyed by way of the corpus callosum to the left hemisphere, which does have speech areas. Your left hemisphere can say that you are holding a pencil. Other aspects of the "division of labor" of our cerebral hemispheres are beyond the scope of this book, but it is a fascinating subject that you may wish to explore further. (Scanlon et-al 2007)



Fig(2-3) Shows Frontal section of the brain in anterior view. (Scanlon et-al 2007)



Fig(2-4) Shows Left cerebral hemisphere showing some of the functional areas that have been mapped. (Scanlon et-al 2007)

2.2 Blood Supply of the Brain:

The brain is one of the most metabolically active organs in the body, receives 17% of the total cardiac output and about 20% of the oxygen available in the body.

2.2.1 Arterial Supply of the Brain:

Blood supply to the brain is derived from two arteries: (1) the internal carotid artery and (2) the vertebral artery. These arteries and their branches arise in pairs that supply blood to both sides of the brain. The basilar artery is a single artery located in the midline on the ventral side of the brain. The branches of the basilar artery also arise in pairs. The origin of the arteries supplying blood to the brain, their major branches, and the neural structures supplied by them are described in the following sections.(what-when-how.com, 2016)

2.2.1.1 Internal Carotid Arteries:

The internal carotid arteries (ICA) originate at the bifurcation of the left and right common carotid arteries, at the level of the fourth cervical vertebrae (C4).They move superiorly within the carotid sheath, and enter the brain via the carotid canal of the temporal bone. They do not supply any branches to the face or neck. Once in the cranial cavity, the internal carotids pass anteriorly through the cavernous sinus. Distal to the cavernous sinus, each ICA gives rise to: Ophthalmic artery – Supplies the structures of the orbit, Posterior communicating artery – Acts as an anastomotic ‘connecting vessel’ in the Circle of Willis (see ‘Circle of Willis’ below), Anterior cerebral artery – Supplies part of the cerebrum. (teachmeanatomy.info)

The internal carotids then continue as the middle cerebral artery, which supplies the lateral portions of the cerebrum. (teachmeanatomy.info)

2.2.1.2 Vertebral Arteries:

The right and left vertebral arteries arise from the subclavian arteries, medial to the anterior scalene muscle. They then ascend up the posterior side of the neck, through holes in the transverse processes of the cervical vertebrae, known as foramen transversarium. The vertebral arteries enter the cranial cavity via the foramen magnum**.** Within the cranial vault, some branches are given off:

- Meningeal branch – supplies the falx cerebelli, a sheet of dura mater.
- Anterior and posterior spinal arteries – supplies the spinal cord, spanning its entire length.
- Posterior inferior cerebellar artery – supplies the cerebellum.

After this, the two vertebral arteries converge to form the basilar artery. Several branches from the basilar artery originate here, and go onto supply the cerebellum and pons. The basilar artery terminates by bifurcating into the posterior cerebral arteries. (teachmeanatomy.info)

2.2.2 Arterial Circle of Willis:

The terminal branches of the vertebral and internal carotid arteries all anastomose to form a circular blood vessel, called the Circle of Willis.

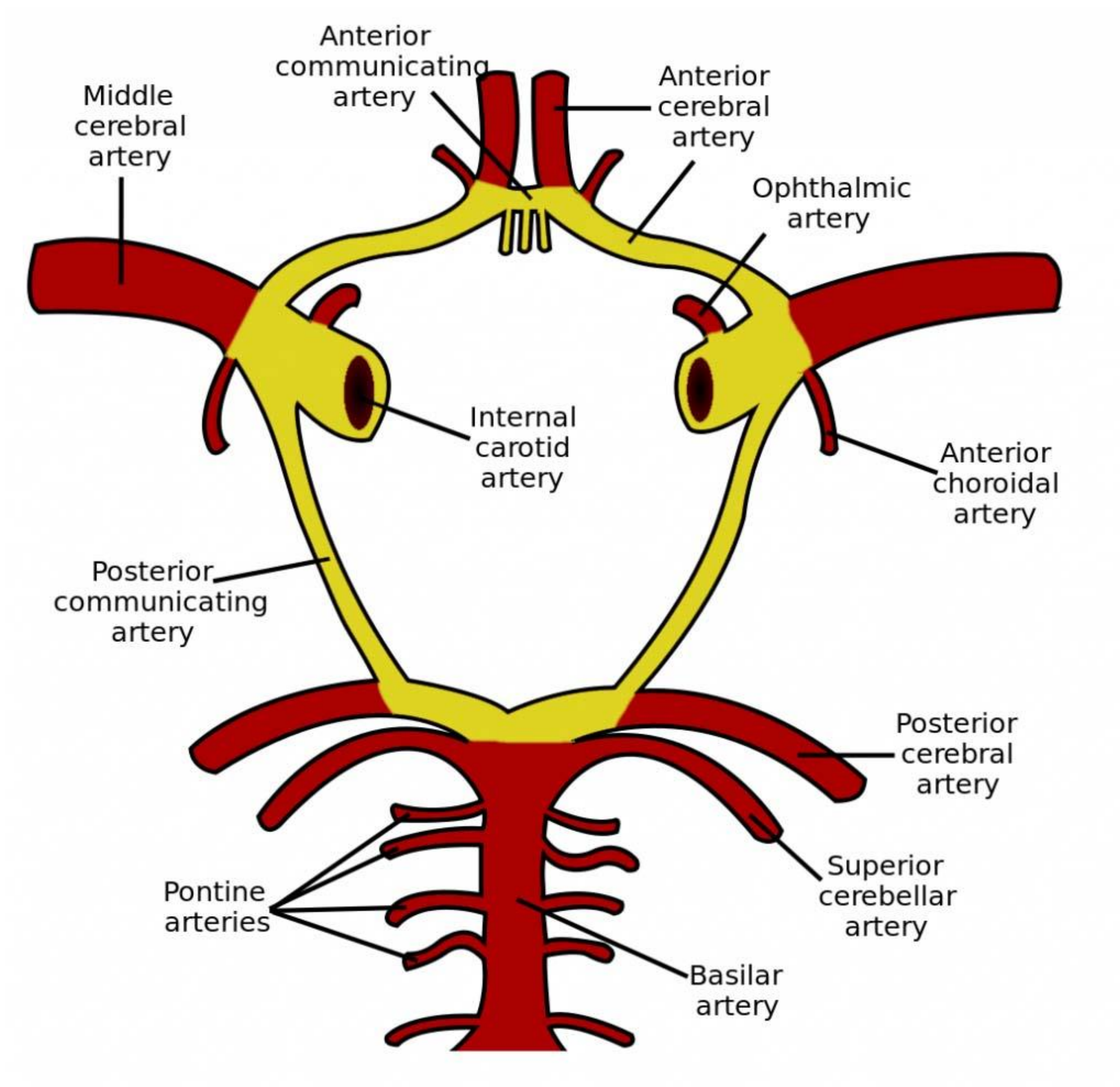
There are three main (paired) constituents of the Circle of Willis:

- Anterior cerebral arteries: These are terminal branches of the internal carotids.
- Internal carotid arteries: Present immediately proximal to the origin of the middle cerebral arteries.

- Posterior cerebral arteries: These are terminal branches of the vertebral arteries.

To complete the circle, two 'connecting vessels' are also present:

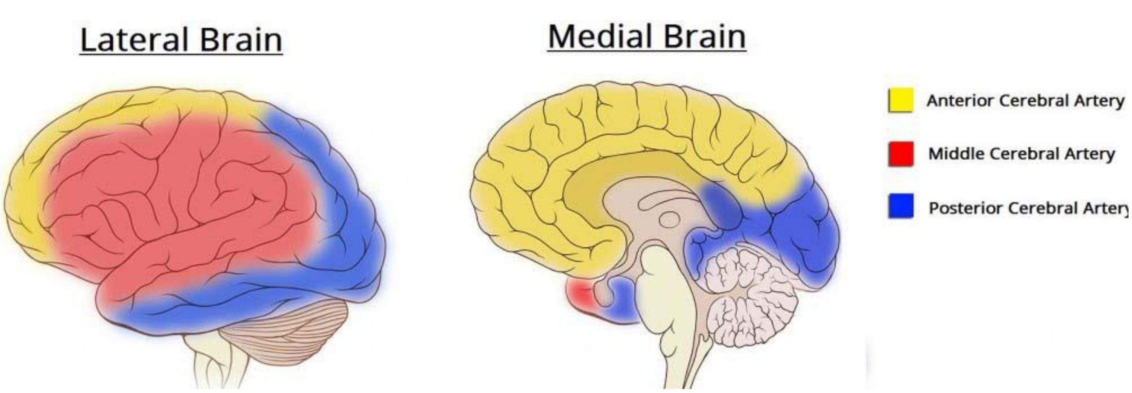
- Anterior communicating artery: This artery connects the two anterior cerebral arteries.
- Posterior communicating artery: A branch of the internal carotid, this artery connects the ICA to the posterior cerebral artery. (teachmeanatomy.info)



- **(Fig 2-5)** Shows Circle of Willis. (teachmeanatomy.info)

2.2.3 Regional Blood Supply to the Cerebrum:

There are three cerebral arteries; anterior, middle and posterior. They each supply a different portion of the cerebrum. The anterior cerebral arteries supply the anteromedial portion of the cerebrum. The middle cerebral arteries are situated laterally, supplying the majority of the lateral part of the brain. The posterior cerebral arteries supply both the medial and lateral parts of the posterior cerebrum. (teachmeanatomy.info)



- **Fig(2-6)**Shows the blood supply to the cerebrum. (teachmeanatomy.info)

2.3 Physiology of brain

2.3.1 Medulla:

Its functions are those we think of as vital (as in “vital signs”). The medulla contains cardiac centers that regulate heart rate, vasomotor centers that regulate the diameter of blood vessels and, thereby, blood pressure, and respiratory centers that regulate breathing. You can see why a crushing injury to the occipital bone may be rapidly fatal—we cannot survive without the medulla. Also in the medulla are reflex centers for coughing, sneezing, swallowing, and vomiting. (Scanlon et-al 2007)

2.3.2 Pons:

Within the pons are two respiratory centers that work with those in the medulla to produce a normal breathing rhythm. The many other neurons in the pons (pons is from the Latin for “bridge”) connect the medulla with other parts of the brain. (Scanlon et-al 2007)

2.3.3 Midbrain

Several different kinds of reflexes are integrated in the midbrain, including visual and auditory reflexes. If you see a wasp flying toward you, you automatically duck or twist away; this is a visual reflex, as is the coordinated movement of the eyeballs. Turning your head (ear) to a sound is an example of an auditory reflex. The mid brain is also concerned with what are called righting reflexes, those that keep the head upright and maintain balance or equilibrium. (Scanlon et-al 2007)

2.3.4 Cerebellum:

As you already know, many of the functions of the cerebellum are concerned with movement. These include coordination, regulation of muscle tone, the appropriate trajectory and end point of movements, and the maintenance of posture and equilibrium. Notice that these are all involuntary; that is, the cerebellum functions below the level of conscious thought. This is important to permit the conscious brain to work without being overburdened .If you decide to pick up a pencil, for example, the impulses for arm movement come from the cerebrum. The cerebellum then modifies these impulses so that your arm and finger movements are coordinated, and you don't reach past the pencil. The cerebellum seems also to be involved in certain sensory functions. For example, if you close your eyes and someone places a tennis ball in one hand and abase ball in the other, could you tell which was which? Certainly you could, by the "feel" of each: the texture and the weight or heft. If you pick up a plastic container of coffee (with a lid on it) could you tell if the cup is full, half-full, or empty? Again, you certainly could. Do you have to think about it? No. The cerebellum is, in part, responsible for this ability. To regulate equilibrium, the cerebellum (and midbrain) uses information about gravity and movement provided by receptors in the inner ears. (Scanlon et-al 2007)

2.3.5 Hypothalamus

Hypothalamus is a small area of the brain with many diverse functions include Production of antidiuretic hormone (ADH) and oxytocin; these hormones are then stored in the posterior pituitary gland. ADH enables the kidneys to reabsorb water back into the blood and thus helps maintain blood volume. Oxytocin causes contractions of the uterus to bring about labor and delivery, Production of releasing hormones (also called releasing factors) that stimulate the secretion of hormones by the anterior pituitary gland , a single example will be given here: The hypothalamus produces growth hormone releasing hormone(GHRH), which stimulates the anterior pituitary gland to secrete growth hormone (GH), Regulation of body temperature by promoting responses such as sweating in a warm environment or shivering in a cold environment, Regulation of food intake; the hypothalamus is believed to respond to changes in blood nutrient levels, to chemicals secreted by fat cells, and to hormones secreted by the gastrointestinal tract. For example, during a meal, after a certain duration of digestion, the small intestine produces a hormone that circulates to the hypothalamus and brings about a sensation of satiety, or fullness, and we tend to stop eating, Integration of the functioning of the autonomic nervous system, which in turn regulates the activity of organs such as the heart, blood vessels, and intestines, Stimulation of visceral responses during emotional situations. When we are angry, heart rate usually increases. Most of us, when embarrassed, will blush, which is vasodilation in the skin of the face. These responses are brought about by the autonomic nervous system when the hypothalamus perceives a change in emotional state. The neurologic basis of our emotions is not well understood, and the visceral responses to emotions are not something most of us can control , and Regulation of body rhythms such as secretion of hormones, sleep cycles, changes in mood, or mental alertness. This is often referred to as our biological clock, the rhythms as circadian rhythms, meaning “about a day.” If you have ever had to stay awake for 24 hours, you know how disorienting it can be, until the hypothalamic biological clock has been reset .(Scanlon et-al 2007)

2.3.6 Thalamus:

Many of the functions of the thalamus are concerned with sensation. Sensory impulses to the brain (except those for the sense of smell) follow neuron pathways that first enter the thalamus, which groups the impulses before relaying them to the cerebrum, where sensations are felt. For example, holding a cup of hot coffee generates impulses for heat, touch and texture, and the shape of the cup (muscle sense), but we do not experience these as separate sensations. The thalamus integrates the impulses from the cutaneous receptors and from the cerebellum, that is, puts them together in a sort of electrochemical package, so that the cerebrum feels the whole and is able to interpret the sensation quickly. Some sensations, especially unpleasant ones such as pain, are believed to be felt by the thalamus. However, the thalamus cannot localize the sensation; that is, it does not know where the painful sensation is. The sensory areas of the cerebrum are required for localization and precise awareness. The thalamus may also suppress un important sensations. If you are reading an enjoyable book, you may not notice someone coming into the room. By temporarily blocking minor sensations, the thalamus permits the cerebrum to concentrate on important tasks. Parts of the thalamus are also involved in alertness and awareness (being awake and knowing we are), and others contribute to memory. For these functions, as for others, the thalamus works very closely with the cerebrum .(Scanlon et-al 2007)

2.3.7 Cerebrum and its lobes:

The functions of the cerebrum according to lobes

2.3.7.1 Frontal Lobes:

Within the frontal lobes are the motor areas that generate the impulses for voluntary movement. The largest portions are for movement of the hands and face, those areas with many muscles capable of very fine or precise movements. It is the large size of the motor area devoted to them that gives these muscles their precision. The left motor area controls movement on the right side of the body, and the right motor area controls the left side of the body. This is why a patient who has had a cerebrovascular accident, or stroke, in the right frontal lobe will have paralysis of muscles on the left side .Anterior to the motor areas are the premotor areas, which are concerned with learned motor skills that require a sequence of movements. Tying shoelaces, for example, seems almost automatic to us; we forget having learned it. It is not a reflex, however; rather the premotor cortex has learned the sequence so well that we are able to repeat it without consciously thinking about it. The parts of the frontal lobes just behind the eyes are the prefrontal or orbitofrontal cortex. This area is concerned with things such as keeping emotional responses appropriate to the situation, realizing that there are standards of behavior (laws or rules of a game or simple courtesy) and following them, and anticipating and planning for the future. An example may be helpful to put all this together: Someone with damage to the prefrontal area might become enraged if his pen ran out of ink during class, might throw the pen at someone, and might not think that a pen will be needed tomorrow and that it is time to go buy one. As you can see, the prefrontal cortex is very important for social behavior, and greatly contributes to what makes us human. Also in the frontal lobe, usually only the left lobe for most right-handed people is Broca's motor speech area, which controls the movements of the mouth involved in speaking. (Scanlon et-al 2007)

2.3.7.2 Parietal Lobes:

The general sensory areas in the parietal lobes receive impulses from receptors in the skin and feel and interpret the cutaneous sensations. The left area is for the right side of the body and vice versa. These areas also receive impulses from stretch receptors in muscles for conscious muscle sense. The largest portions of these areas are for sensation in the hands and face, those parts of the body with the most cut aneous receptors and the most muscle receptors. The taste areas, which overlap the parietal and temporal lobes, receive impulses from taste buds on the tongue and elsewhere in the oral cavity. (Scanlon et-al 2007)

2.3.7.3 Temporal Lobes:

The olfactory areas in the temporal lobes receive impulses from receptors in the nasal cavities for the sense of smell. The olfactory association area learns the meaning of odors such as the smell of sour milk, or fire, or brownies baking in the oven, and enables the thinking cerebrum to use that information effectively. The auditory areas, as their name suggests, receive impulses from receptors in the inner ear for hearing. The auditory association area is quite large. Part of it is concerned with the meanings of words we hear, that is, with speech. Other parts are for the interpretation of sounds such as thunder during a storm, an ambulance siren, or a baby crying. Without proper interpretation, we would hear the sound but would not know what it meant, and could not respond appropriately. Also in the temporal and parietal lobes in the left hemisphere (for most of us) are other speech areas concerned with the thought that precedes speech. Each of us can probably recall (and regret) times when we have “spoken without thinking,” but in actuality that is not possible. The thinking takes place very rapidly and is essential in order to be able to speak .(Scanlon et-al 2007)

2.3.7.4 Occipital Lobes:

Impulses from the retinas of the eyes travel along the optic nerves to the visual areas in the occipital lobes. These areas “see.” The visual association areas interpret what is seen, and enable the thinking cerebrum to use the information. Imagine looking at a clock. Seeing the clock is far different from being able to interpret it. At one time we learned to interpret the Clock face and hands, and now we do not have to consciously decide what time the clock is reading. We can simply use that information, such as hurrying a bit so as not to be late to class. Other parts of the occipital lobes are concerned with spatial relationships; things such as judging distance and seeing in three dimensions, or the ability to read a map and relate it to the physical world. The cerebral cortex has the characteristic of neural plasticity, the ability to adapt to changing needs, to recruit different neurons for certain functions, as may occur during childhood or recovery from a stroke .Another example is the visual cortex of a person who is born blind. The neurons in the occipital lobes that would have been used for vision will often be used for another function; some may become part of an auditory area that is used to localize sounds and estimate their distance. Those of us who can see may not relyon hearing for localization; we simply look at where we think the sound came from. A blind person cannot do this, and may have an extensive mental catalogue of sounds, meanings of sounds, distances of sounds, and so on, some of these in the part of the cortex that normally is for vision.

The younger the person, the more plastic the brain .The brains of children are extraordinarily adaptable. As we get older, this ability diminishes, but is still present. (Scanlon et-al 2007)

2.3 Pathology of head:

2.3.1 Head injury:

Head injuries include both injuries to the brain and those to other parts of the head, such as the scalp and skull. Head injuries can be closed or open.

A- Closed Head injuries :-

Are the most common kind. The 'closed' means simply that there isn't a break in the skull, and the brain is not exposed. The skull can be fractured, but not necessarily. (Ratcliffe, J 2006)

B- Open Head Injuries :

A penetrating head injury or open head injury is a head injury in which the dura mater, the outer layer of the meninges, is breached. Penetrating injury can be caused by high-velocity projectiles or objects of lower velocity such as knives, or bone fragments from a skull fracture that are driven into the brain. (Ratcliffe, J 2006)

2.3.2 Skull fractures:

A head injury may cause skull fracture, which may or may not be associated with injury to the brain. There are four major types of skull fractures. (Wikipedia-2017)

2.3.2.1 Linear fractures:

Linear skull fractures are breaks in the bone that transverse the full thickness of the skull from the outer to inner table. They are usually fairly straight with no bone displacement. The common cause of injury is blunt force trauma where the impact energy transferred over a wide area of the skull.

Linear skull fractures are usually of little clinical significance unless they parallel in close proximity or transverse a suture, or they involve a venous sinus groove or vascular channel. The resulting complications may include suture diastasis, venous sinus thrombosis, and epidural hematoma. In young children, although rare, the possibility exists of developing a growing skull fracture especially if the fracture occurs in the parietal bone. (Haar FL-2017)

2.3.2.2 Depressed fractures:

A depressed skull fracture is a type of fracture usually resulting from blunt force trauma, such as getting struck with a hammer, rock or getting kicked in the head. These types of fractures—which occur in 11% of severe head injuries—are comminuted fractures in which broken bones displace inward. Depressed skull fractures present a high risk of increased pressure on the brain, or a hemorrhage to the brain that crushes the delicate tissue. (Singh J and Stock A. 2006)

2.3.2.3 Basilar skull fractures:

Basilar skull fractures are linear fractures that occur in the floor of the cranial vault (skull base), which require more force to cause than other areas of the neuron cranium. Thus they are rare, occurring as the only fracture in only 4% of severe head injury patients.

Basilar fractures have characteristic signs: blood in the sinuses; a clear fluid called cerebrospinal fluid (CSF) leaking from the nose (rhinorrhea) or ears (otorrhea); per orbital ecchymosis often called 'raccoon eyes (bruising of the orbits of the eyes that result from blood collecting there as it leaks from the fracture site); and retro auricular ecchymosis known as "Battle's sign" (bruising over the mastoid process). (Tubbs-2010)

2.3.3 Head Injury Classification:

Traumatic head injury can be divided into primary and secondary forms. Primary lesions are those that occur as a direct result of a blow to the head. Secondary lesions occur as consequence of primary lesions, usually as a result of mass effect or vascular compromise. Secondary lesions are often preventable; whereas primary injuries, by definition, have already occurred by the time the patient arrives in the emergency department.

Primary lesions include epidural, subdural, subarachnoid, and intra ventricular hemorrhage, as well as diffuse axonal injury (DAI), cortical contusions, intracerebral hematomas, and subcortical gray matter injury. Direct injury to the cerebral vasculature is another type of primary lesion.Secondary lesions include cerebral swelling, brain herniation, hydrocephalus, ischemia or infarction, CSF leak, leptomeningeal cyst, and encephalomalacia.(Brant et-al 2012)

2.3.3.1 Primary Head Injury:

Types of primary head injuries are roughly grouped into intra-axial and extra-axial.

2.3.3.1.1 Intra-axial hemorrhage:

Intra-axial hemorrhage is bleeding within the brain itself, or cerebral hemorrhage. This category includes intra parenchymal hemorrhage, or bleeding within the brain tissue, and intraventricular hemorrhage, bleeding within the brain's ventricles (particularly of premature infants). Intra-axial hemorrhages are more dangerous and harder to treat than extra-axial bleeds.

2.3.3.1.2 Extra-axial hemorrhage:

2.3.3.1.2.1 Epidural Hemorrhage:

Is a type of traumatic brain injury (TBI) in which a buildup of blood occurs between the dura mater (the tough outer membrane of the central nervous system) and the skull. Are usually arterial in origin and often result from a skull fracture that disrupts the middle meningeal artery. The developing hematoma strips the dura from the inner table of the skull, forming an ovoid mass that displaces the adjacent brain. They may occur from stretching or tearing of meningeal arteries without an associated fracture, especially in children. Overall, skull fractures are seen in 85% to 95% of cases. In approximately a third of patients with an epidural hematoma, neurologic deterioration occurs after a lucid interval. Most epidural hematomas are temporal or temporoparietal in location, though frontal and occipital hematomas can also occur. On CT, acute epidural hematomas appear as well-defined, high-attenuation lenticular or biconvex extra-axial collections. Associated mass effect with sulcal effacement and midline shift is frequently seen. Bone windows usually demonstrate an overlying linear skull fracture. Because epidural hematomas exist in the potential space between the dura and inner table of the skull, they usually will not cross cranial sutures, where the periosteal layer of the dura is firmly attached. (Brant et-al 2012)

2.3.3.1.2.2 Subdural Hematoma:

Is a type of hematoma, usually associated with traumatic brain injury. Are typically venous in origin, resulting from stretching or tearing of cortical veins that traverse the subdural space en route to the dural sinuses. They may also result from disruption of penetrating branches of superficial cerebral arteries. Because the inner dural layer and arachnoid are not as firmly attached as the structures that make up the epidural space, the subdural hematoma typically extends over a much larger area than the epidural hematoma. Patients with a subdural hematoma commonly present after acute deceleration injury from a motor vehicle accident or fall. The same mechanism can cause cortical contusions and DAI, which are frequently seen in association with acute subdural hematomas. Subdural hematomas are divided into acute, subacute, and chronic, depending on the speed of their onset. Acute subdural hematomas that are due to trauma are the most lethal of all head injuries and have a high mortality rate if they are not rapidly treated with surgical decompression. Acute bleeds often develop after high speed acceleration or deceleration injuries and are increasingly severe with larger hematomas. They are most severe if associated with cerebral contusions. Though much faster than chronic subdural bleeds, acute subdural bleeding is usually venous and therefore slower than the typically arterial bleeding of an epidural hemorrhage. Acute subdural bleeds have a high mortality rate, higher even than epidural hematomas and diffuse brain injuries, because the force (acceleration/deceleration) required to cause them causes other severe injuries as well. The mortality rate associated with acute subdural hematoma is around 60 to 80%.Chronic subdural bleeds develop over a period of days to weeks, often after minor head trauma, though such a cause is not identifiable in 50% of patients. They may not be discovered until they present clinically months or years after a head injury. The bleeding from a chronic bleed is slow, probably from repeated minor bleeds, and usually stops by itself. Since these bleeds progress slowly, they present the chance of being stopped before they cause significant damage. Small chronic subdural hematomas, those less than a centimeter wide, have much better outcomes than acute subdural bleeds: in one study, only 22% of patients with chronic subdural bleeds had outcomes worse than "good" or "complete recovery". Chronic subdural hematomas are common in the elderly. On axial CT, acute subdural hematomas appear as crescent shaped extra-axial collections of high attenuation. Small subdural hematomas may be masked by adjacent cortical bone when viewed on a narrow window width but will be seen with an intermediate window width. Most subdural hematomas are supratentorial, located along the convexity. They are also frequently seen along the flax and tentorium. Because dural reflections form the falx cerebri and tentorium, subdural collections will not cross these structures. Unlike epidural hematomas, subdural hematomas can cross sutural margins and, in fact, are frequently seen layering along the entire hemispheric convexity from the anterior falx to the posterior falx. Diffuse swelling of the underlying hemisphere is common with subdural hematomas. Because of this, there may be more mass effect than would be expected by the size of the collection and there may be little or no reduction in midline shift after evacuation of a hemispheric subdural hematoma. The CT appearance of subdural hematomas changes with time. The density of an acute subdural hematoma initially increases because of clot retraction. By the time most acute subdural hematomas are imaged, the collection is hyper dense, measuring 50 to 60 H, relative to normal brain, which measures18 to 30 H. The density wills then progressively decreases protein degradation occurs within the hematoma. Occasionally, acute subdural blood may be isodense or hypo dense in patients with severe anemia or active extravasation (“hyperacute”subdural hematoma).Chronic subdural hematomas have low attenuation values similar to CSF. (Brant et-al 2012)

2.3.3.1.2.3 Subarachnoid hemorrhage (SAH)

Is bleeding into the subarachnoid space the area between the arachnoid membrane and the pia mater surrounding the brain.Is common in head injury but is rarely large enough to cause a significant mass effect. It results from the disruption of small subarachnoid vessels or direct extension into the subarachnoid space by a contusion or hematoma. On CT, subarachnoid hemorrhage appears as linear areas of high attenuation within the cisterns and sulci. Subarachnoid collections along the convexity or tentorium can be differentiated from subdural hematomas by their extension into adjacent sulci. Occasionally, the only finding is apparent effacement of sulci when the sulci are filled with small amounts of blood. In patients who are found unconscious after an un witnessed event, detection of subarachnoid hemorrhage may indicate a ruptured aneurysm, rather than trauma, as the primary cause. In such cases, contrast-enhanced CT angiography and/or conventional catheter angiography needs to be considered. (Brant et-al 2012)

2.3.3.1.2.4 Intraventricular hemorrhage:

Is a bleeding into the brain's ventricular system, where the cerebrospinal fluid is produced and circulates through towards the subarachnoid space. It can result from physical trauma or from hemorrhaging in stroke. Commonly seen in patients with head injuries and can occur by several mechanisms. First, it can result from rotationally induced tearing of sub ependymal veins on the surface of the ventricles. Another mechanism is by direct extension of a parenchymal hematoma into the ventricular system. Third, intraventricular blood can result from retrograde flow of subarachnoid hemorrhage into the ventricular system through the fourth ventricular out flow foramina. Patients with intraventricular hemorrhage are at risk for subsequent hydrocephalus by obstruction either at the level of the aqueduct or arachnoid villi. On CT, intraventricular hemorrhage appears as hyper dense material, layering dependently within the ventricular system. Tiny collections of increased density layering in the occipital horns may be the only clue to intraventricular hemorrhage. (Brant et-al 2012)

2.4 Previous studies:

Ghada Mohammed (2012) Studied of Head Injuries by Using CT Scan, In this study 51 Pt. ,71% male and 29% female with variable age are grouped into 8 groups. The main findings of this 24 were positive and 27 were negative with percent 47.1% and 52.9% and most common cause of trauma is RTA with percent 70,6%. The most type of lesion occur is H occur is extradural and cerebral H with same percent 41.7%, 41.7% and site of fracture is most common in facial bone with percent 59.1% than the other site and then study mid line shift at epidural from total sample in 4 Pts and subdural 2 Pts. cerebral contusion is one Pt.

Nasr Mohammed (2008) Studied CT Findings of Head Injuries,100 patients were selected randomly; those with clinical diagnosis of head trauma, and their CT report were collected to evaluate them. The study was carried out in four diagnostic computed tomography centers in Khartoum state .in a period extended From May 2008 to August 2008. The results of the study explain that , males have high incidence of head trauma , about 67% of the full group , and the females about 33% . RTA is the main cause of head injury is about 46% of full group.

Afrah Osman ALI (2016) Studied Evaluation of Extra Axial Brain Hemorrhage Using Computed Tomography, 60 patients with different age and gender diagnosed as extra axial brain hemorrhage. In this study peak incidence was among the age between (41-50 year),(63.3%) of patients complain of headache as common clinical indication. Found the Right side was common in (51.7%) ,and the Subdural hemorrhage (48.4%) was common in final diagnosing . A percentages of male (80%) was greater than the female (20%), and the Road traffic accident was common causes of brain injury in (81.7%).Related to the nature of the hemorrhage (case) found the acute was common in (68.3 %) . The acute Epidural hemorrhage was common (91.3%) in correlation between nature and location of hemorrhage.

Samuel C et-al 2011 done this is study of all the head injury patients who presented for CT scan at Memfys Hospital for Neurosurgery, Enugu, Nigeria. 204 including (33) follow up cases were done for trauma .The male to female ratio 3.5:1 .In this study (33.9%)of the patients were in the third and fourth decades of life. The major causes of head injury were Road traffic accidents

(RTAs 59%). In this series (19.9%) of patients had abnormal CT finding, while(80.1%)had abnormal CT finding . The most common CT findings due to head injury were Cerebral contusion and edema in(30.7%),SDH in (27%) ,skull fractures in(23.4%) and extradural hematoma in(8%) .Samuel C et-al 2011.

Brown CV et-al 2004 Blunt traumatic patients with an abnormal head CT admitted to an urban, level1trauma center over the 9 months period, here were100 patients admitted with an abnormal head CT after trauma. Abnormal head CT findings were SAH (47%), SDH(28%) ,EDH (11%), and diffuse axonal injury (2%). CT of the head is the current standard for diagnosing intracranial pathology following blunt head trauma and it is common practice to repeat the head CT to evaluate any progression of injury.

Chapter Three

Materials and Methods

Chapter Three

Materials and Methods

This was a cross sectional descriptive study done to evaluate the Head Trauma for Sudanese population using computed Tomography.

The study was collected from radiology department of police hospital for injuries and accidents, Ibrahim Malik hospital, and Al Zaitona Hospital. The study was carried out within 2 months.

3.1 Materials:

3.1.1 Machine Used

The machine used is CT scan 64 slice (Toshiba)

3.1.2 Study population

The study include Sudanese group of patients with brain traumas

Study includes 50 traumatic patients visiting the emergency department with different ages. Exclusion criteria patients whom have non traumatic brain traumas and normal patients.

3.2 Methods:

3.2.1 CT Brain Protocol Used

All patients under CT study with the following parameters KVP (120-140) MA (150-300), with time .75-1.5 second.

Slice thickness: thin slice at the base of skull (2-4)ml , thick slice above to the base (5-10)ml.

Breath hold: None

I.V Contrast: None

Patient position: Supine Head first .Arms along the side of

The body and head immobilized in the head holder.

Scout: Lateral

Start location and end: From foramen magnum to vertex.

Slice plane: Axial

3.2.2 Image Interpretation

All images done studies in soft tissue and bone window by radiologist for diagnoses

3.2.3 Data collection

Data collection according to work sheet include; the patient age, gender, mode of trauma, abnormality which seen by CT, type of fracture, site of fracture, complication and site of complication.

3.2.4 Data Analysis

SPSSprogram

Chapter Four

Results

Chapter four

Results

Table (4.1) Demonstrates the frequency distribution of gender in head injury patients

Sex	Frequency	Percent	Valid Percent	Cumulative Percent
Female	10	20.0	20.0	20.0
Male	40	80.0	80.0	100.0
Total	50	100.0	100.0	

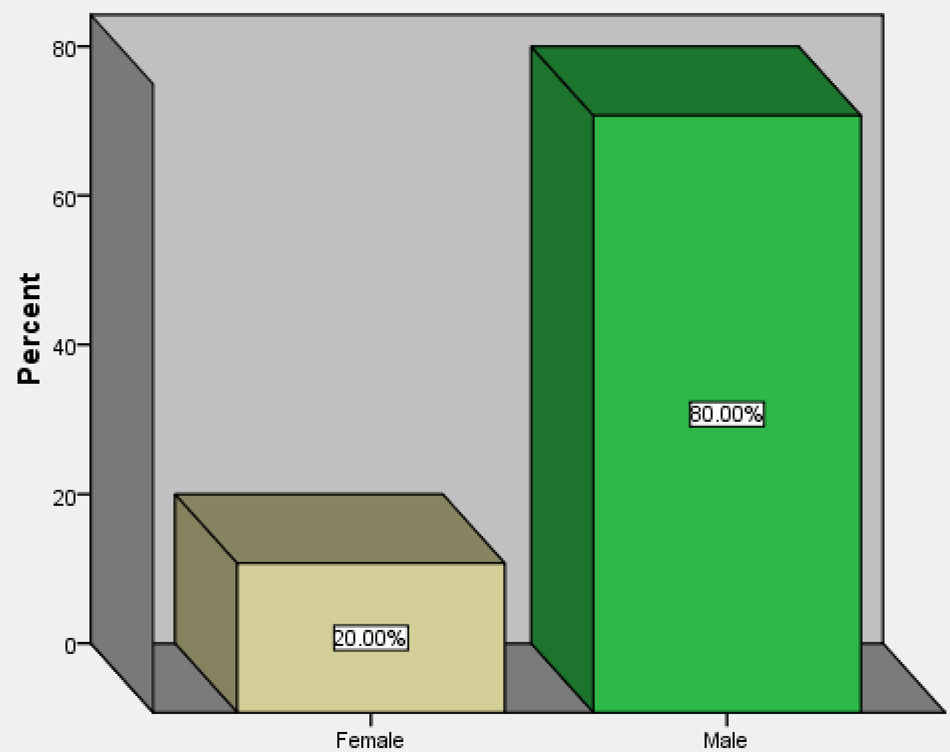


Figure (4.1) shows frequency distribution of gender in head injury patient,s

Figure (4.1) shows frequency distribution of gender in head injury patient's

Table (4.2) Demonstrates the frequency distribution of age group in head injury patients

Age group	Frequency	Percent	Valid Percent	Cumulative Percent
1-15 years	10	20.0	20.0	20.0
16-30 years	22	44.0	44.0	64.0
31-45 years	9	18.0	18.0	82.0
46- 60 years	3	6.0	6.0	88.0
61- 75 years	5	10.0	10.0	98.0
more than 75 years	1	2.0	2.0	100.0
Total	50	100.0	100.0	
Minimum = 1,maximum =80 years, mean= 30.32, std. Deviation= 19.468				

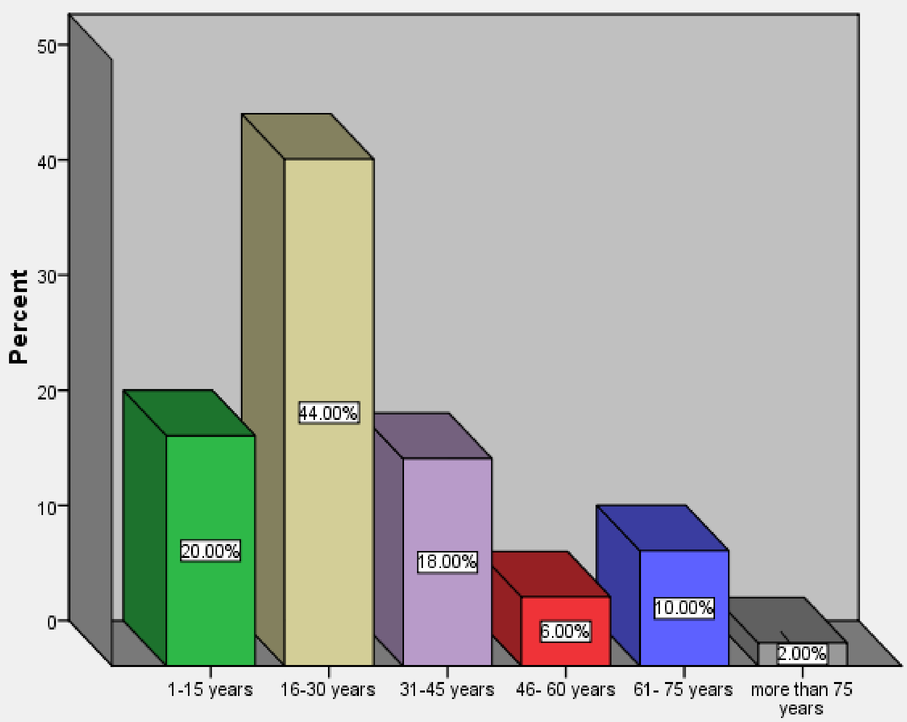


Figure (4.2) shows frequency distribution of age group in head injury patient,s

Figure (4.2) shows frequency distribution of age group in head injury patients

Table (4.3) Demonstrates the frequency distribution of mode of trauma

Mode of trauma	Frequency	Percent	Valid Percent	Cumulative Percent
Falling down	4	8.0	8.0	8.0
Hit by stick	9	18.0	18.0	26.0
RTA	37	74.0	74.0	100.0
Total	50	100.0	100.0	

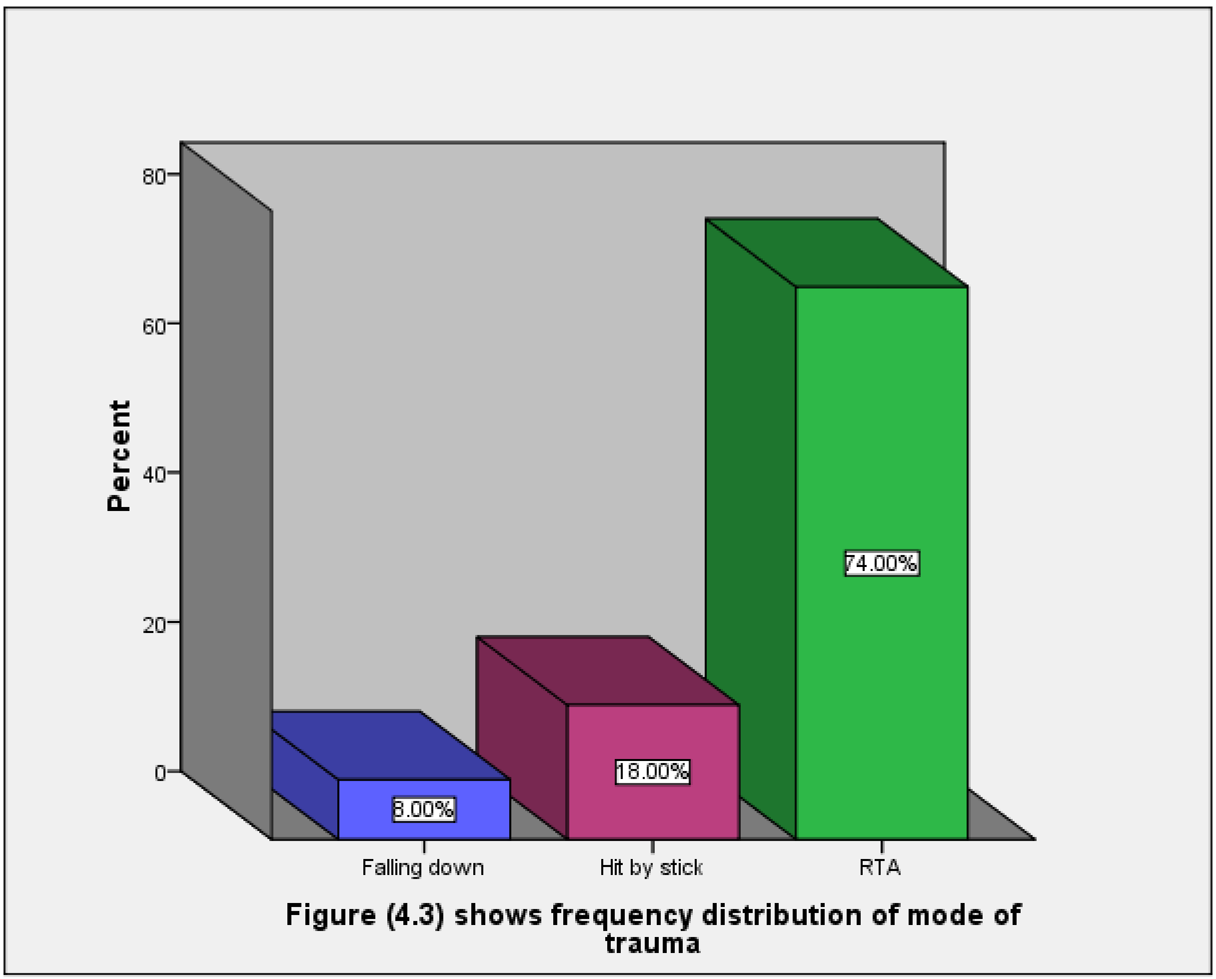


Figure (4.3) shows frequency distribution of mode of trauma

Table (4.4) Demonstrates the frequency distribution of abnormality which detected on CT

Abnormality seen	Frequency	Percent	Valid Percent	Cumulative Percent
Fracture	10	20.0	20.0	20.0
Fracture+ hemorrhage	33	66.0	66.0	86.0
Hemorrhage.	7	14.0	14.0	100.0
Total	50	100.0	100.0	

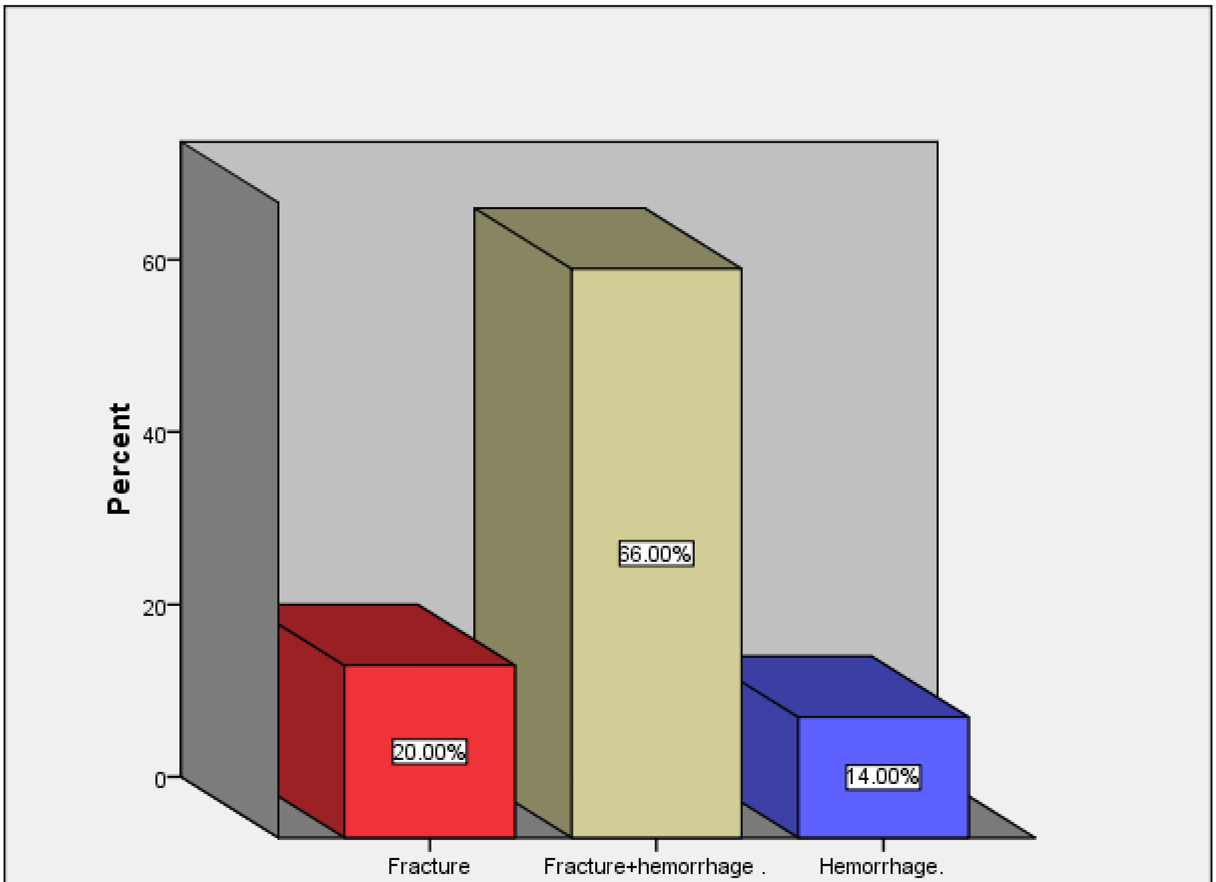


Figure (4.4) shows frequency distribution of abnormality which seen in CT

Figure (4.4) shows frequency distribution of abnormality which detected on CT

Table (4.5) Demonstrates the frequency distribution of type of fracture which diagnose by CT

Type of fracture	Frequency	Percent	Valid Percent	Cumulative Percent
Basilar	9	20.9	20.9	20.9
Comminuted	8	18.6	18.6	39.5
Depressed	5	11.6	11.6	51.2
Linear	21	48.8	48.8	100.0
Total	43	100.0	100.0	

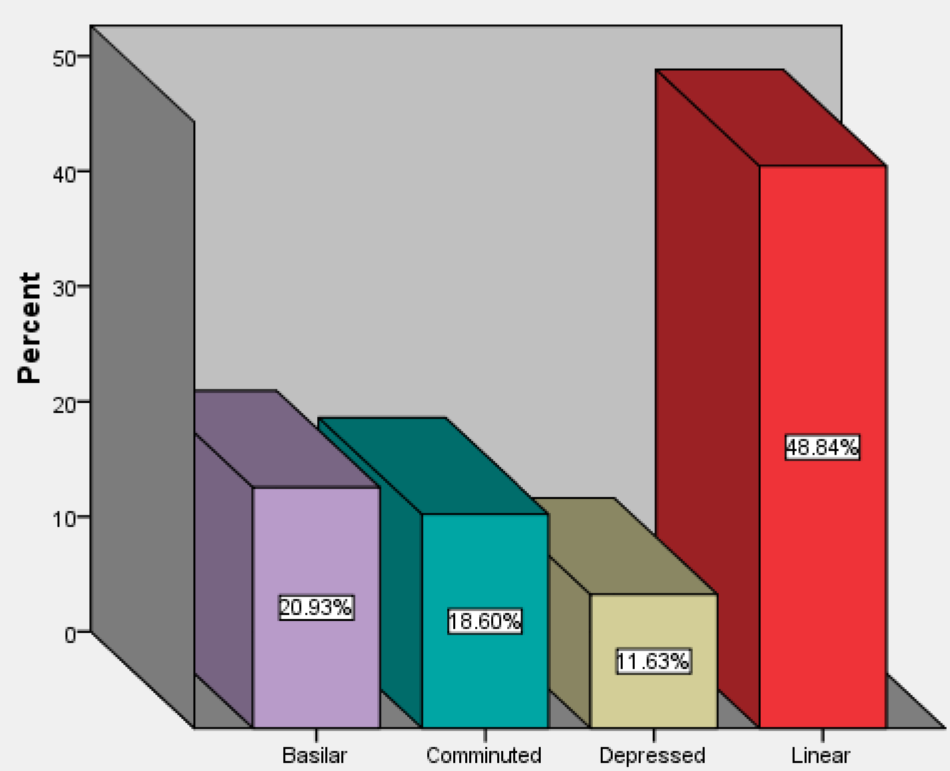


Figure (4.5) shows frequency distribution of type of fracture

Figure (4.5) shows frequency distribution of type of fracture which diagnose by CT

Table (4.6) Demonstrates the frequency distribution of site of fracture which diagnose by CT

Site of fracture	Frequency	Percent	Valid Percent	Cumulative Percent
Frontal	16	37.2	37.2	37.2
Lt temporal	6	14.0	14.0	51.2
Occipital	10	23.3	23.3	74.4
Parietal	2	4.7	4.7	79.1
Rt temporal	9	20.9	20.9	100.0
Total	43	100.0	100.0	

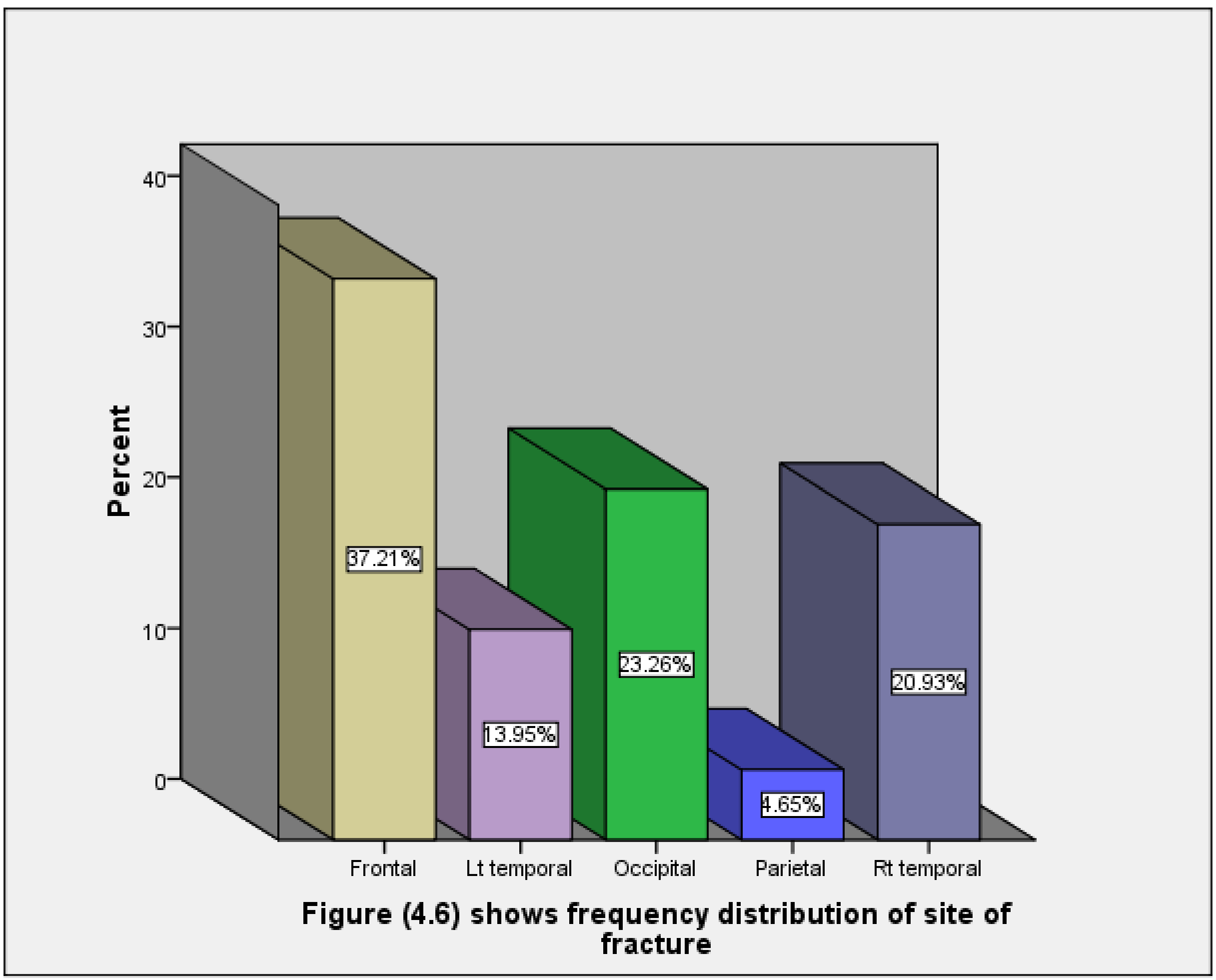


Figure (4.6) shows frequency distribution of site of fracture which diagnose by CT.

Table (4.7) Demonstrates the frequency distribution of complication of fracture which Diagnose by CT

Complication of fracture	Frequency	Percent	Valid Percent	Cumulative Percent
Epidural hemorrhage	10	23.3	23.3	23.3
Contusion	11	25.6	25.6	48.8
No complication	10	23.3	23.3	72.1
Subdural hemorrhage	12	27.9	27.9	100.0
Total	43	100.0	100.0	

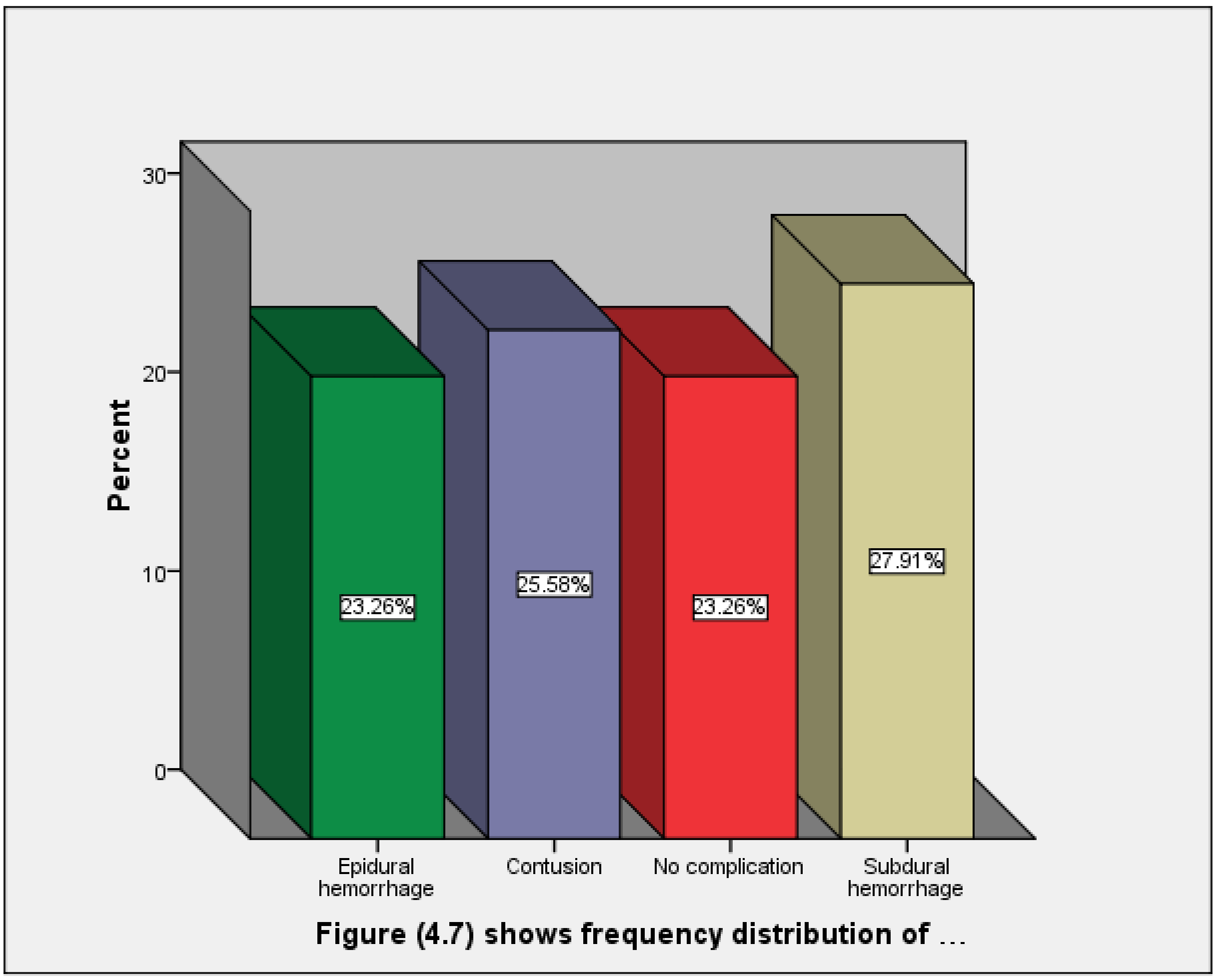


Figure (4.7) shows frequency distribution of complication of fracture which diagnose by CT

Table (4.8) Demonstrates the frequency distribution of site of complication of fracture which diagnose by CT

Site of complication	Frequency	Percent	Valid Percent	Cumulative Percent
Frontal	6	28.6	28.6	28.6
Lt temporal	5	23.8	23.8	52.4
Occipital	5	23.8	23.8	76.2
Rt temporal	5	23.8	23.8	100.0
Total	20	100.0	100.0	

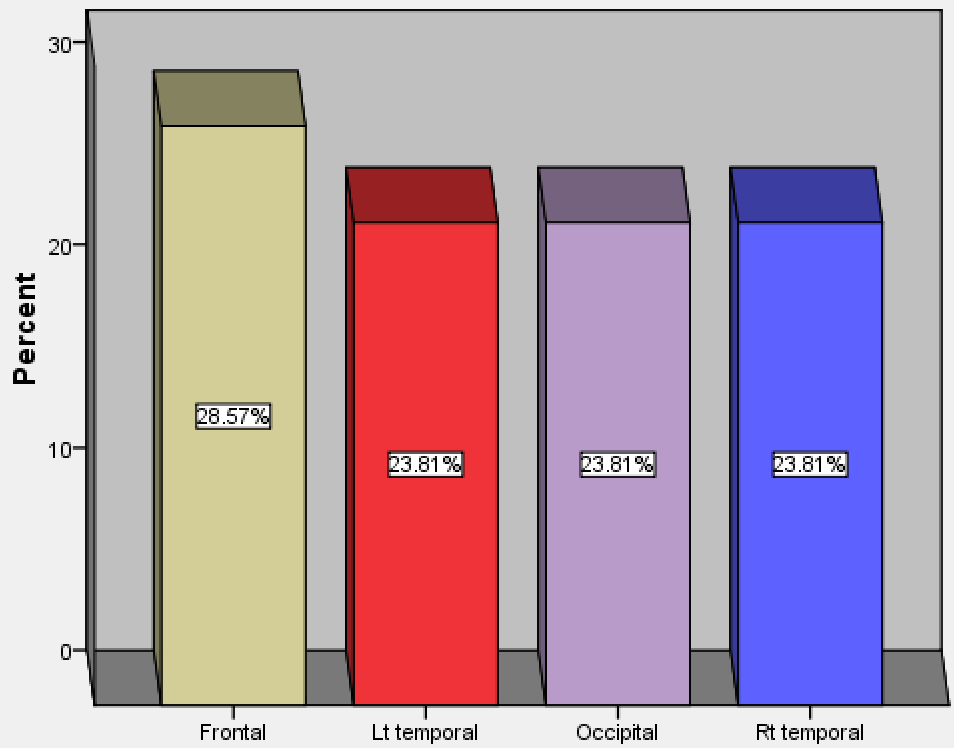


Figure (4.8)shows frequency distribution of site of complication of fracture which diagnose by CT

Figure (4.8) shows frequency distribution of site of complication of fracture which diagnose by CT

Table (4.9) Demonstrates the frequency distribution of site of hemorrhage in patients with no fracture

Type of hemorrhage	Frequency	Percent	Valid Percent	Cumulative Percent
Epidural hemorrhage	4	57.1	57.1	57.1
Subdural hemorrhage	3	42.9	42.9	100.0
Total	7	100.0	100.0	

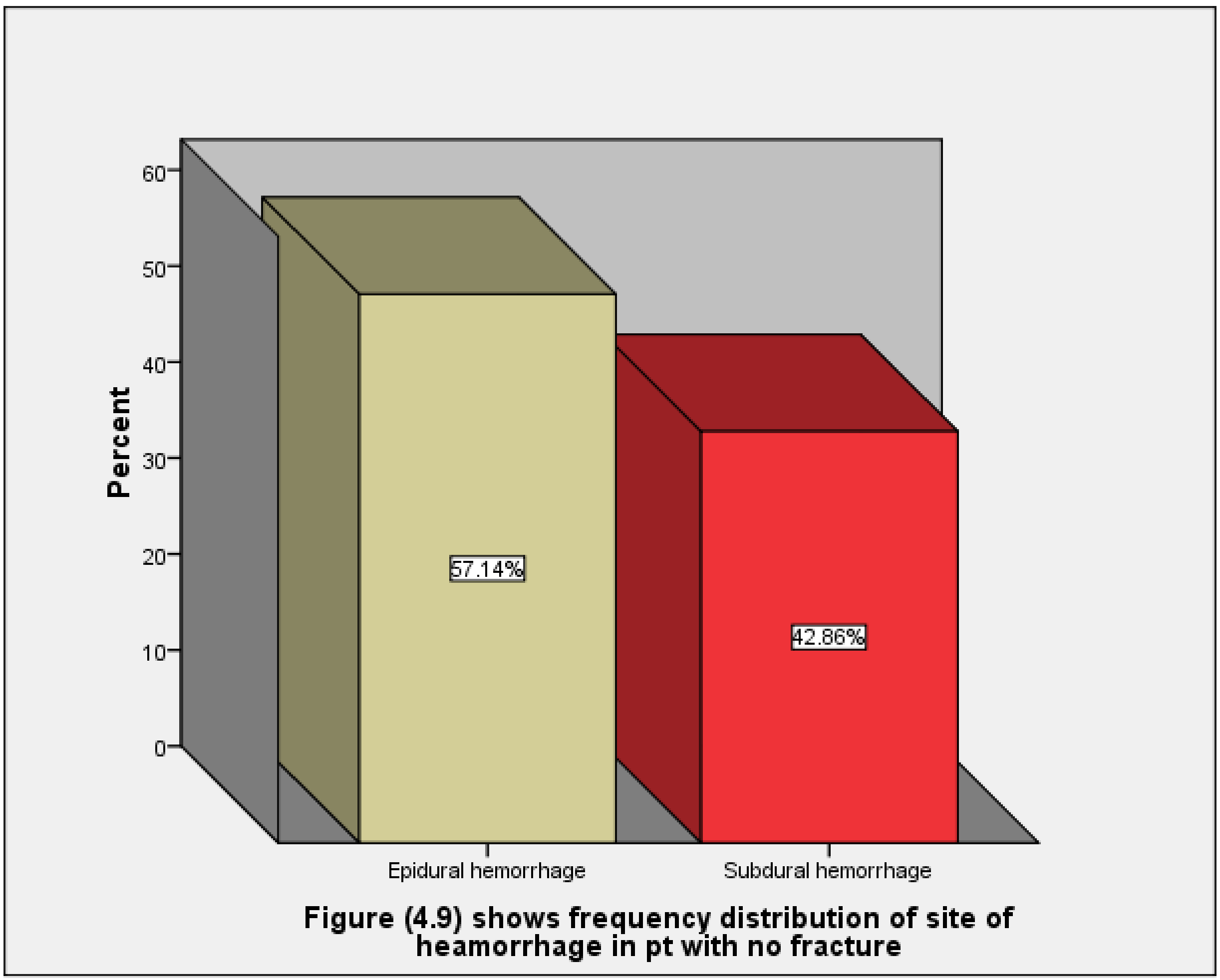


Figure (4.9) shows frequency distribution of site of hemorrhage in patients with no fracture

Table (4.10) Demonstrates the frequency distribution of presence of shifting of the midline which cause by injury to the skull

Shifting of the midline	Frequency	Percent	Valid Percent	Cumulative Percent
No	48	96.0	96.0	96.0
Yes	2	4.0	4.0	100.0
Total	50	100.0	100.0	

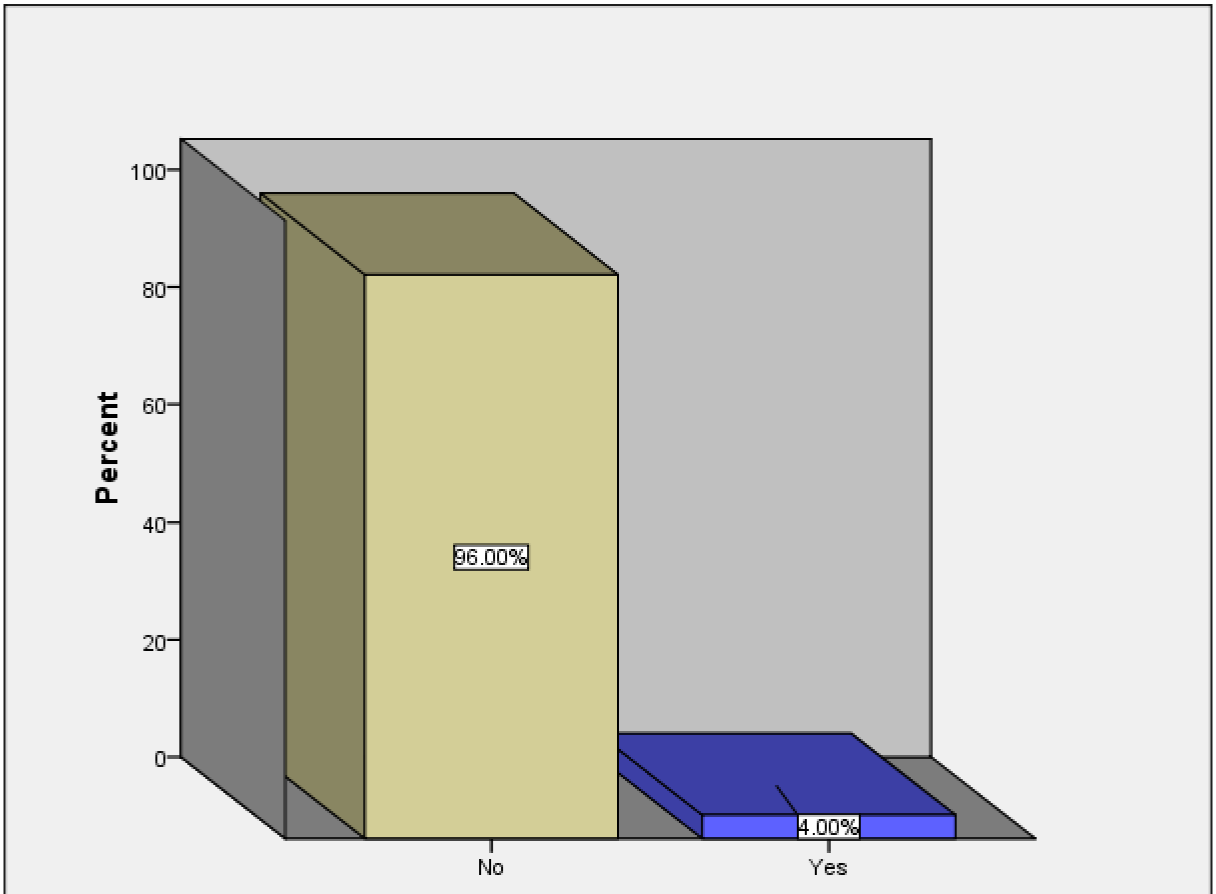


Figure (4.10) shows frequency distribution of presence of shifting of the midline

Figure (4.10) shows frequency distribution of presence of shifting of the midline which cause by injury to the skull

Table (4.11) Demonstrates the cross tabulation site of fracture and type of fracture

Site of fracture	Type of fracture				No
	Basilar	Comminuted	Depressed	Linear	
Frontal	0	4	2	10	16
Lt temporal	0	0	1	5	6
Occipital	9	0	1	0	10
Parietal	0	1	1	0	2
Rt temporal	0	3	0	6	9
Total	9	8	5	21	43
P value = 0.000					

Table (4.12) Demonstrates the cross tabulation site of fracture and complication of fracture

Site of fracture	Complication of fracture				Total
	No	Epidural hemorrhage	Contusion	Subdural hemorrhage	
Frontal	6	4	3	3	16
Lt temporal	1	3	0	2	6
Occipital	2	2	3	3	10
Parietal	1	0	1	0	2
Rt temporal	0	1	4	4	9
Total	10	10	11	12	43
P value =0.381					

Table (4.13) Demonstrates the cross tabulation site of fracture and site of complication of fracture

Site of fracture	site of complication					Total
	Frontal	Lt temporal	Occipital	Rt temporal	no	
Frontal	6	0	1	0	9	16
Lt temporal	0	5	0	0	1	6
Occipital	0	0	4	0	6	10
Parietal	0	0	0	0	2	2
Rt temporal	0	0	0	5	4	9
Total	6	5	5	5	22	43
P value = 0.000						

Table (4.14) Demonstrates the cross tabulation mode of trauma and abnormalities which seen by CT

Mode of trauma	abnormality which seen by CT			Total
	Fracture	Fracture+ hemorrhage	Hemorrhage.	
Falling down	3	1	0	4
Hit by stick	2	6	1	9
RTA	5	26	6	37
Total	10	33	7	50
P value = 0.069				

Table (4.15) Demonstrates the cross tabulation gender and abnormalities which seen by CT

Age group	abnormality which seen by CT			Total
	Fracture	Fracture+ hemorrhage .	Hemorrhage.	
1-15 years	5	5	0	10
16-30 years	5	14	3	22
31-45 years	0	9	0	9
46- 60 years	0	2	1	3
61- 75 years	0	2	3	5
more than 75 years	0	1	0	1
Total	10	33	7	50
P value = 0.015				

Table (4.16) Demonstrates the cross tabulation age and abnormalities which seen by CT

Gender	abnormality which seen by CT			Total
	Fracture	Fracture+ hemorrhage	Hemorrhage.	
Female	2	7	1	10
Male	8	26	6	40
Total	10	33	7	50
P value = 0.917				

Chapter Five

Discussion, Conclusion and Recommendations

CHAPTRE FIVE

Discussion, Conclusion and Recommendations

5.1 Discussion:

This study done in Khartoum state into three CT centers for 50 patients with head trauma and the study group were 50 patients 40 of them were males and 10 patients were females with percentage 80% and 20% from the total sample as it appear in Table 4.1 This result was consent with the previous study showed that most of the study were men in the study of (Ghada Mohammed 2012) (Nasr Mohammed 2008) (Samuel C 2011)

According to age as it appear in Table 4.2 found that the most common group affected were (16-30 year) which was 44% (1-15 year) which was 20% , (31-45 year) which was 18% , (61-75 year) which was 10% , (46-60 year) which was 6% , more 75 year 2%. This result differentiates to the study of (Afrah Osman ALI 2016) and (Samuel C 2011).

Road traffic accident it is the main cause for head trauma 74%, then hit by stick 18% and falling down 8% as it appear in Table 4.3. This result similar to the studies showed that the Road traffic accident accounted (RTA) were common in the study of (Ghada Mohammed 2012), (Nasr Mohammed 2008), (Afrah Osman ALI 2016) and study of (Samuel C 2011)

Fracture+ hemorrhage is the most common of abnormality with percent 66% , fracture 20% and lastly hemorrhage 14% This result doesn’t agree with studies of (Samuel C 2011) and (Brown 2004) . as shown in table 4.4

Linear fracture was the most common with percent 48.8 %, basilar with percent 20.9%, Comminuted 18.6% and lastly depressed 11.6% . As shown in table 4.5.

Frontal was the most site of fracture 37.2% , occipital 23.3% , Rt temporal 20.9% , temporal 14% and lastly parietal 4.7% . This result similar to the study of (Ghada Mohammed 2012) as shown in table 4.6

Subdural hemorrhage is the most common 27.9%, Contusion 25.6% , Epidural hemorrhage and No complication 23.3% .This result similar to the study of (Afrah Osman ALI 2016) and differentiates to the study (Samuel C 2011) as shown in table 4.7

Frontal was the most site of complication 28.6% , LT,RT temporal and occipital 23.8% . This result similar to the study of (Ghada Mohammed 2012) as shown in table 4.8

Epidural hemorrhage was the most common 57.1%, then subdural hemorrhage 42.9%. This result not similar to the studies (Brown 2004), (Samuel C 2011) and agree with (Afrah 2016) and (Ghada 2012) as shown in table 4.9

According to table 4.10 that distribution of presence of shifting of the midline which cause by injury to the skull , show that no Shifting of the midline is the most common 96% , then there are Shifting of the midline 4%

Frontal bone is the most common 16 pt. occipital bone 10 pt. RT temporal 9 pt. Lt temporal 6 pt. and lastly Parietal 2 pt. and P value = 0.000 . as shown in table 4.11

Frontal bone the total 16 causes of pt. the total of complication 10 pt., epidural hemorrhage 4 pt. contusion 3pt and subdural hemorrhage 3pt , occipital bone the total 10 pt, the total of complication 8 pt, epidural hemorrhage 2 pt. contusion 3pt and subdural hemorrhage 3pt, RT temporal bone the total 9 pt. the total of complication 9 pt, epidural hemorrhage 1 pt. contusion 4pt and subdural hemorrhage 4pt, LT temporal bone the total 6 pt. the total of complication 5 pt, epidural hemorrhage 3 pt. contusion 0pt and subdural hemorrhage 2pt, Parietal bone the total 2 pt. the total of complication 1 pt, epidural hemorrhage 0 pt. contusion 1pt and subdural hemorrhage 0pt, and P value =0.381. As shown in table 4.12

Frontal site of fracture, site of complication in frontal 6 pt, lt temporal 0pt , occipital 1pt , Rt temporal 0 and no complication 9 pt, in LT temporal site of fracture, site of complication in frontal 0 pt., lt temporal 5pt , occipital 0pt , Rt temporal and no complication 1 pt, in occipital site of fracture, site of complication in frontal 0 pt, lt temporal 0pt , occipital 4pt , Rt temporal 0 and no complication 6 pt, in partial site of fracture, site of complication in frontal 0 pt, lt temporal 0pt , occipital 0pt , Rt temporal 0 and no complication 2 pt, in RT temporal site of fracture, site of complication in frontal 0 pt, lt temporal 0pt , occipital 0pt , Rt temporal 5 and no complication 4 pt, and P value = 0.000 . As shown in table 4.13

According to table 4.14 that distribution mode of trauma and abnormalities which seen by CT, show that in RTA the relation of RTA with Fracture+ hemorrhage is the most common 26pt. then hemorrhage 6 pt. lastly fracture 5pt. then in Hit by stick the relation of Hit by stick with Fracture+ hemorrhage is the most common 6pt. then fracture 2 pt. lastly hemorrhage 1 pt. and in falling down the relation of falling down with Fracture is the most common 3 pt. then Fracture+ hemorrhage 1 pt. and P value = 0.069

5.2 Conclusion:

The study concluded that : CT is first choice compared with other modality due to many advantages it have such as need short time for procedure and accurately identifies the brain abnormalities such as fractures and hemorrhage .

The study concludes that most of head injuries were caused by RTA.

The fracture and hemorrhage most common injuries ,followed by fracture then hemorrhage

The study found that CT can determine the site, type and complication of fractures

The study concludes that there are relation between site of fracture and type of fracture.

The study concludes that there are relation between site of fracture and site of complication of fracture.

The study concludes that there are relation between mode of trauma and abnormalities which seen by CT.

5.3 Recommendations

More research should be done using a large sample of patients for further assessment.

Patient with head trauma should be directed to do CT scan examination firstly, and it should be done as quickly as possible.

The governmental hospitals should be provided by CT scanning machine. The facilities for the treatment of the patients should be available in the emergency departments.

The RTA is the major cause of TBI, so that their prevention or reduce of causes can reduce of RTA , and it can reduce by use seat belts, child safety seats and motorcycle helmets. Education programs exist to lower the number of crashes. In addition, change to public policy and safety laws can be made, these include speed limits, seat belt and helmet laws.

Future studies should include site of trauma and site of complication for large number of patient

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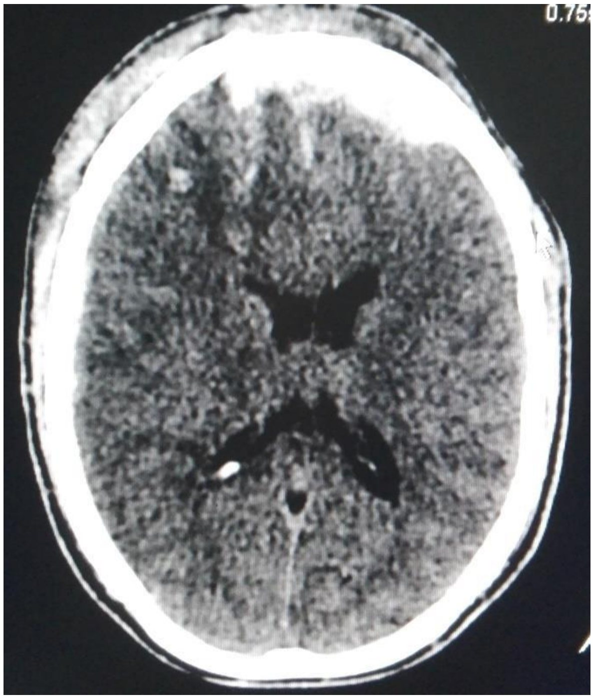
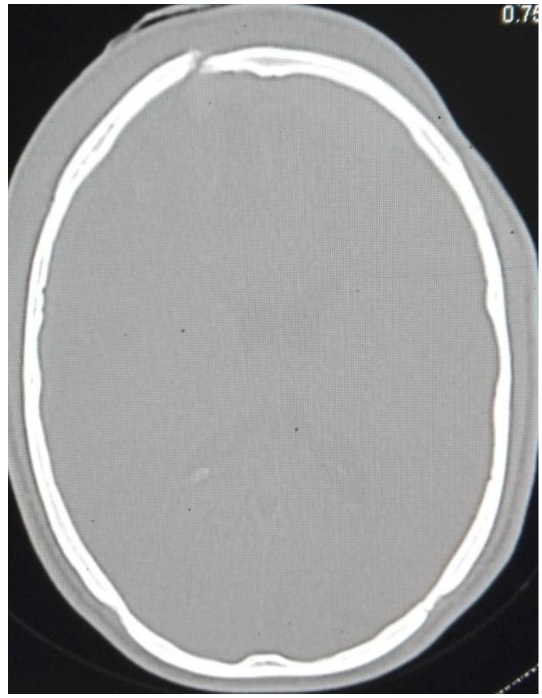
Appendices

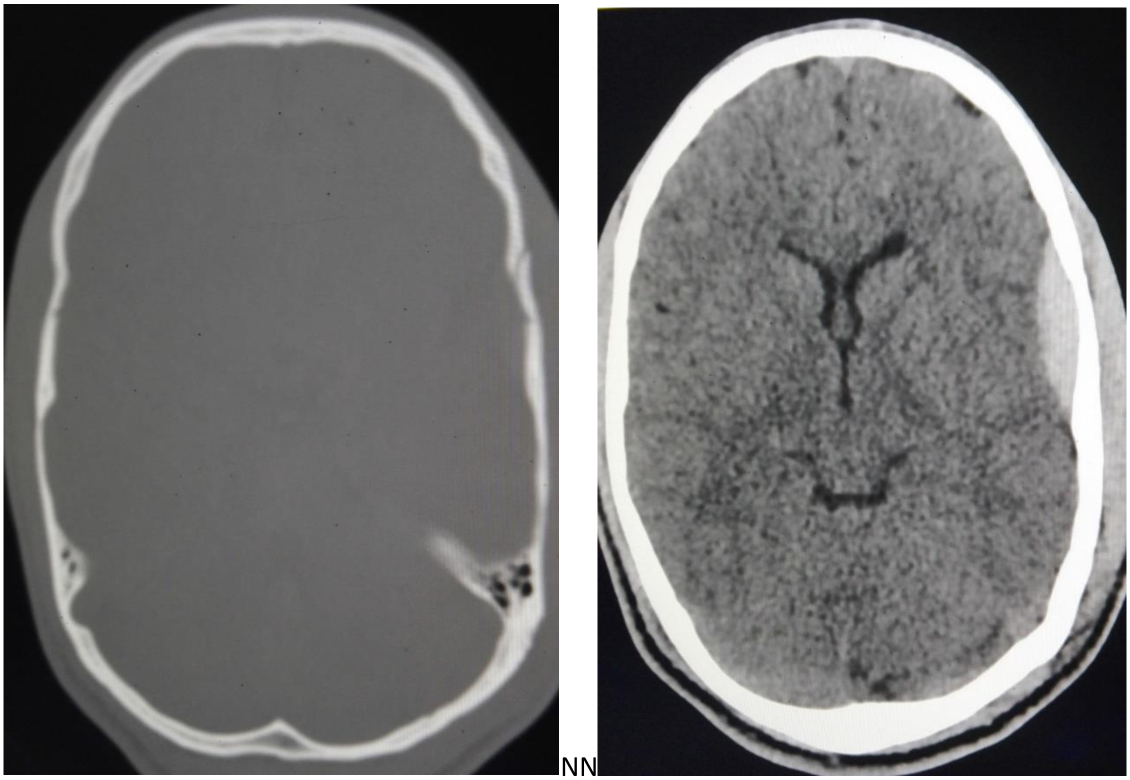
Appendix NO 1:- images of the research





(A) **(B)**

Image (1): A- show Axial Soft tissue window for 33 year old Man diagnosed as Contusion. B- Axial Bone window for 33 year old Man diagnosed as linear fracture in frontal bone



(A) **(B)**

Image (2): A- Axial Bone window for 25 year old Female diagnosed as linear fracture in RT. Temporal bone. (B) Axial Soft tissue window for 25 year old Female diagnosed as Epidural hemorrhage RT. Temporal bone.

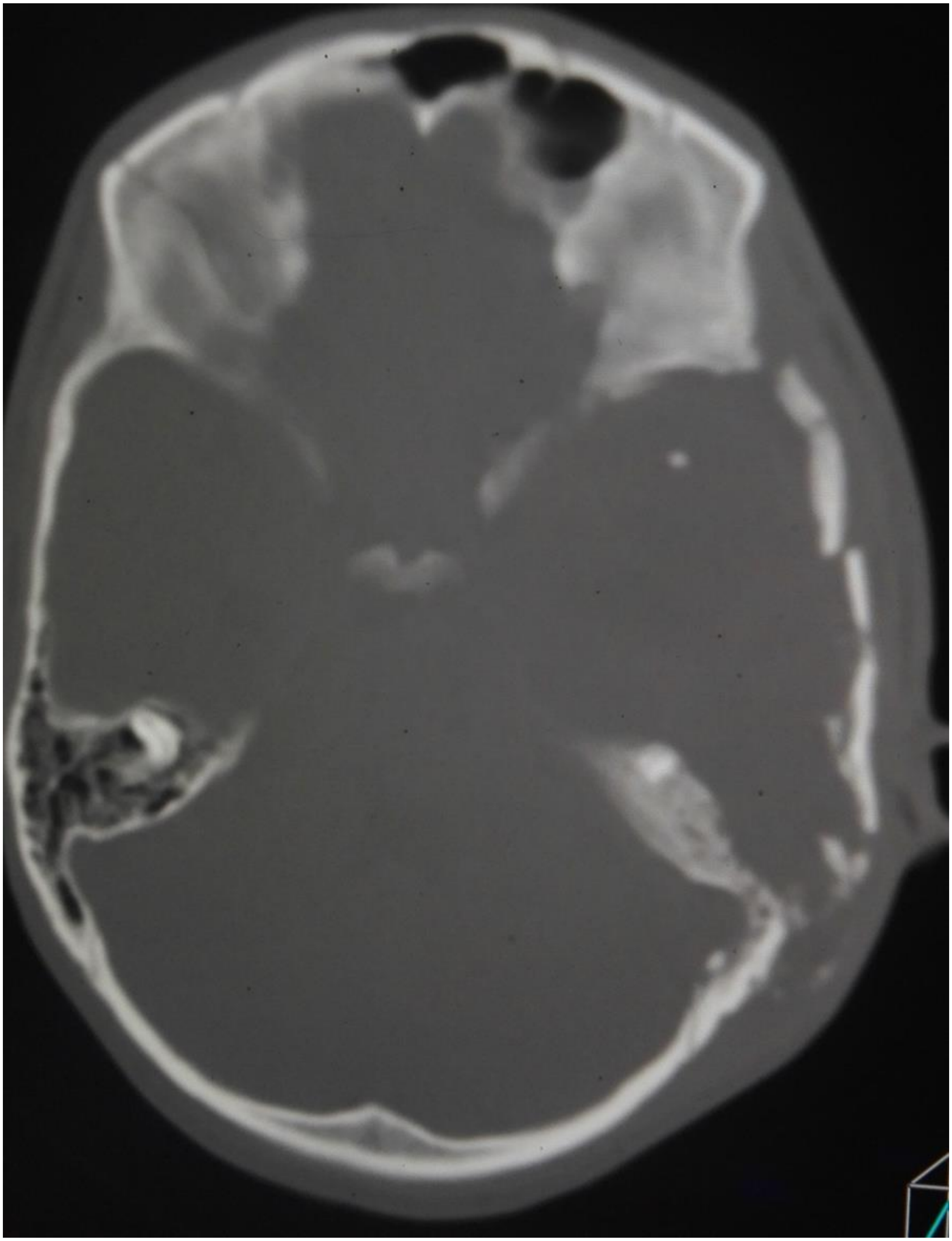


Image (3) : Axial Bone window for 30 year old male diagnosed as Comminuted fracture

Appendix NO 2:

Data Sheet Collection

sex	age	mode of trauma	abnormality which seen by CT	type of fracture	site of fracture	complication	site of complication	Shift