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Frequency of Negative of Computed Tomography Scan Findings in Head Trauma

تردد النتائج السلبية في مسح الأشعة المقطعية لأصحاب إصابات الدماغ

A thesis Submitted For Fulfillment of partial Requirements of the M.Sc Degree in Diagnostic Radiologic Technology

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2018

الآيـــــــــــــة

قَالَ تَعَالَىٰ: ﴿ يَٰٓأَيُّهَا ٱلَّذِينَ ءَامَنُواْ ٱتَّقُواْ ٱللَّهَ وَلۡتَنظُرۡ نَفۡسٞ مَّا قَدَّمَتۡ لِغَدٖۖ وَٱتَّقُواْ ٱللَّهَۚ إِنَّ ٱللَّهَ خَبِيرُۢ بِمَا تَعۡمَلُونَ ١٨ ﴾

الحشر: ١٨

صدق الله العظيم

Dedication

To my kind father Ahmed suliman who taught me best kind of knowledge to have is that which is learned for its own sake

To my kind husband Mohamed Galal who supported and encouraged me

To my mother Eglal Saied Ahmed who taught me that even the large task can be accomplish if it is done one step at time

To my supporting sisters and brother Samahier Nora Reem and Hassan

To the spirit of my grandfather Saied Ahmed Abuzied Albasheer

To my friends and my colleagues Tagreed Salah Awatif Bin Owf and Moram Ali

I dedicate this work

Acknowledgment

There are a number of people without whom this research might not have been written and to whom I greatly indebted I wish to express my special thanks to my supervisor DR IKHLAS ABDELAZIZ for her kind assistance, patient helpful, useful advance and continuous encourage, I would like all my teachers and all my colleagues

Abstract

The objectives of this study to assess the Frequency of negative CT scan findings in head trauma, to review our practice and decrease the un necessary CT exams and to study the causes of increasing CT scan for with negative findings in head trauma, the Study carried out in Sudan at three hospitals in the period from the first of march to the first of may 2018the study included 153,102(66.7%) were males and 51(33.75%)were females had head trauma requested by CT scan the ages was between 11and 89 years old the mean of ages was 44 years the study found that there were 106(69.3%) patients without clinical history 47(30.7%)patients with clinical history, the negative CT findings were 91(59.5%) the positive CT scan findings were 62(40.5%), the relation between clinical findings and clinical history (81.3%)from the total of negative CT scan findings had no clinical history 17(18.7%) of the negative CTscan had clinical history, in the positive CT scan there were 32(51.2%) without clinical history ,the study found that the unnecessary ct scan examinations were(48.8%) from the total they were without clinical history and without clinical findings I suggest that good practice means good request form ruled by NICE guidelines lead to good diagnosis , reduce number of unnecessary CT scans and reduce the exposure to radiation,

ملخص الدراسة

هدف هذة الدراسة احصاء تردد مرضي اصابات الدماغ ذوي النتائج السالبة في ثلاثة من المراكز التشخيصية في السودان (ولاية الخرطوم) وقد اجريت علي 153 مريض اصابة جائوا الي اقسام الاشعة في ثلاثة من مستشفيات ولاية الخرطوم في الفترة من الاول من مارس وحتي الاول من مايوا سنة 2018 لاجراء فحص الاشعة المقطعية للرأس , النتائج اظهرت ان عدد المرضي سلبيي النتائج 59.5% وان 81.3% من هذى النسبة كانت دون تاريخ مرضي او دواعي الفحص , وان نسبة الفحوصات الغير لازمة 48.4% من العدد الكلي غير لازمة وغير مبررة, هذة الممارسات دون قواعد ارشادية تزيد من معدل عمل فحوضات الاشعة المقطعية وبالتالي زيادة عدد مرات كمية التعرض للاشعة وهي مكلفة للمريض وغير ذات جدوي في التشخيص اظن ان اتباع القواعد الارشادية التابعة للمعهد الوطني لتميز الرعاية الصحية تقلل من نسبة استخدام فحوصات الاشعة المقطعية وبتالي تقليل التعرض للاشعاع

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List of abbreviations

Abbreviations	Full name
CCHR	Canadian CT head rule
CNS	Central nervous system
CSF	Cerebro spinal fluid
CT	Computed tomography
GCS	Glasgow coma scale
NICE	National institute for health And care excellent
NOC	New olerans criteria
PNS	Peripheral nervous system
UHCT	Un necessary CT scan

Chapter one

1.1 Introduction

CT scan is revolutionized diagnostic imaging modality that allow three dimensional visualization of region of body in different planes, besides its advantages, CT scan has disadvantages as well .The radiations used in ct scan are ionizing x-ray radiations which increase the risk of cancer progression the rate of unnecessary CT scan has increase over the past few years which has resulted in increased exposure to the patient and increased health care cost as will, using of CT scan must be measured by guide lines NICE guide line is very important to assessment and measurement head injuries clinical guide line polished date January 2014 last update June 2017 (Nice guideline 2014)

CT brain one of the request has high frequency for Head trauma, is include any sort of injury to your brain, skull or scalp, this can range from mild bump or bruise to traumatic brain injury, common head injury include concussions, skull fracture and scalp wound the consequence and treatment depending on the causes and severity . Brain injuries has two types minor brain injuries Concussion is most common types o f minor injury to the brain ,many people who go to emergency department of hospital with head injury will have concussion (they were knocked out)for short time after word s appear to back normal .people with concussion might not remember what happened just before or after accede, test such as CT scans may not show any problem but can still be tiny area of damage ,these can cause symptoms in the weeks or months after injuries for example headache ,dizziness and problems in concentration and memory. Sever brain injuries the second type when ahead injuries causes severe injury to the brain it's known as traumatic brain injuries. Signs of traumatic brain injuries usually appear in the first few hours and may lead to serious complications that need immediate treatment. The main complications are, Bleeding inside the skull call intracranial hemorrhage or an extra Dural or subdural hematoma – which put pressure on the brain and needs to be treated quickly sometime Through operation General Bruising and swelling in the brain which may need treatment investigation care. (NICE .guideline.2014).

The Glasgow coma scale Here are many levels of consciousness, ranging from normal consciousness to a deep coma. A person is in a coma if they are unconscious and unaware of what is going on around them and they do not open their eyes even in response to pain. Doctors, nurses, ambulance crews and others looking after people with head injuries use the Glasgow Coma Scale (GCS) to assess a person's level of consciousness after a head injury. The scale measures 3 aspects of consciousness: eye-opening, verbal response (for example, speaking) and the responsiveness of the body (for example, the response to pain). The person's score in each area is added up to give a maximum score of 15 (normal consciousness) and a lowest level of 3 (severe coma),a special scale is used for babies and children. If a person has a condition such as dementia or a learning disability that may affect their GCS score, the professionals assessing the person should take this into account.(NICE .guideline.2014**)**.

1.2 Problem of the study

Increasing the frequency of CT scan with negative findings in head trauma, CT scan is expensive procedure and high radiation does exams

1.3 Objectives:

1.3.1 General objective

Measurement the frequency of negative CT scan findings in head trauma

1.3.2 Specific objectives

To assess number of negative versus positive ct scan in head trauma

To assess the guide line for requested ct brain for traumatic patient due to NICE guide line

To review our practice and decrease un necessary ct exams

To assess the indication for requested ct brain for traumatic patient

To study the causes of increasing ct scan for head with negative findings in trauma

1.5.3 Overview

The research will be consisting of five chapters, chapter one will deal with introduction, problem of the study and the over view, chapter two will highlight the theoretical background, chapter three will show the methodology, chapter four will show the result and discussion and chapter five will show conclusion, recommendations, references and appendices

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CHAPTER TWO

Theoretical background

2.1 Anatomy and physiology

The human 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. (Tonya.2018)

2.1.1. Nervous system

The nervous system is divided into central and peripheral systems, the central nervous system (CNS) are 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 hormones. (Tonya.2018)

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 (2), temporal (2), sphenoid, occipital and ethnocide .The face is formed from 14 paired bones: the maxilla, zygoma, nasal, palatine,lacrima inferior nasal conchae, mandible, and vomer

Inside the skull are three distinct areas: anterior fossa, middle fossa, and posterior fossa. Doctors sometimes refer to a tumor's location by these terms, e.g., middle fosse meningioma. Similar to cables coming out the back of a computer, all the arteries, veins and nerves exit the base of the skull through holes, called foramina. The big hole in the middle (foramen magnum) is where the spinal cord exits. (Tonya.2018)

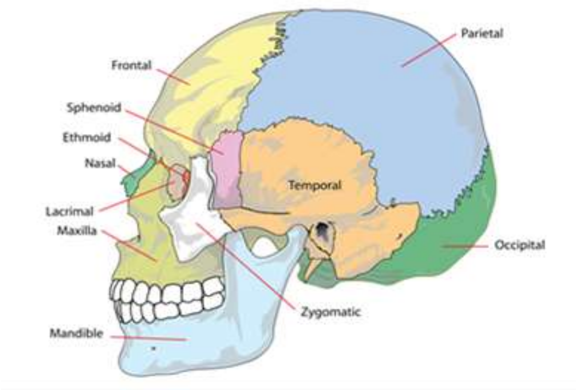
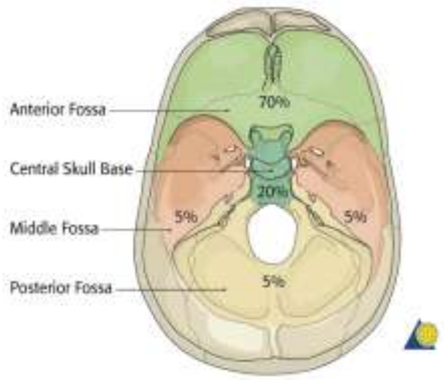


Figure (2 .1.) show eight bones form the skull and fourteen bones form the face (Wellness Advocate 2018)



Figure(2. 2)show The inside of the skull is divided into three areas called the anterior, middle, and posterior fossa(Wellness Advocate 2018)

2.1.3. Brain

The brain is composed of the cerebrum; cerebellum, and brainstem, 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, cerebellum located under the cerebrum Its function is to coordinate muscle movements, maintain posture, and balance, 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 beneath the cortex are long connecting fibers between neurons, called axons, which make up the white matter, the folding of the cortex increases the brain’s surface area allowing more neurons to fit inside the skull and enabling higher functions. Each fold is called a gyrus, and each groove between folds is called a sulcus there are names for the folds and grooves that help define specific brain regions. (Tonya.2018)

2.2.4. Right and left brain

The right and left hemispheres of the brain are joined by a bundle of fibers called the corpus callosum that delivers messages from one side to the other; each hemisphere controls the opposite side of the body, if a brain tumor is located on the right side of the brain, your left arm or leg may be weak or paralyzed, not all functions of the hemispheres are shared. In general, the left hemisphere controls speech, comprehension, arithmetic, and writing. The right hemisphere controls creativity, spatial ability, artistic, and musical skills. The left hemisphere is dominant in hand use and language in about 92% of people . (Tonya.2018)

2.1.5. The 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, 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. 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).

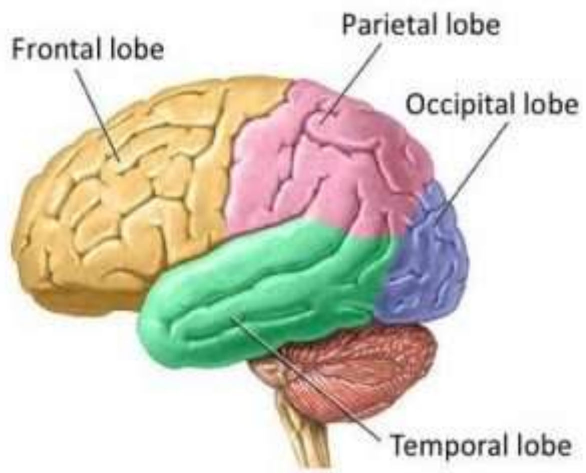


Figure (2. 3.)show lobes of the brain(Wellness Advocate 2018)

Frontal lobe personality, behavior, emotions judgment, planning, problem solving speech: speaking and writing (Boca's area) body movement (motor strip) intelligence, concentration, self awareness, parietal lobe interprets language, words sense of touch, pain, temperature (Sensory strip) interprets vision, hearing, sensory and memory spatial and occipital lobe interprets vision (color, light, movement temporal lobe understanding language (Warnock's area) memory, hearing sequencing and organization. (Tonya.2018)

2.1.6. 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, 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, pineal glands 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, thalamus serves as a relay station for almost all information that comes and goes to the cortex it plays a role in pain sensation, attention alertness and memory, basal ganglia include the caudate, put amen and globes pallidus these nuclei work with the cerebellum to coordinate fine motions, such as fingertip movements limbic system the center of our emotions, learning, and memory. Included in this system are the cingulated gyri, hypothalamus, amygdala (emotional Reactions) and hippocampus (memory) . (Tonya.2018)

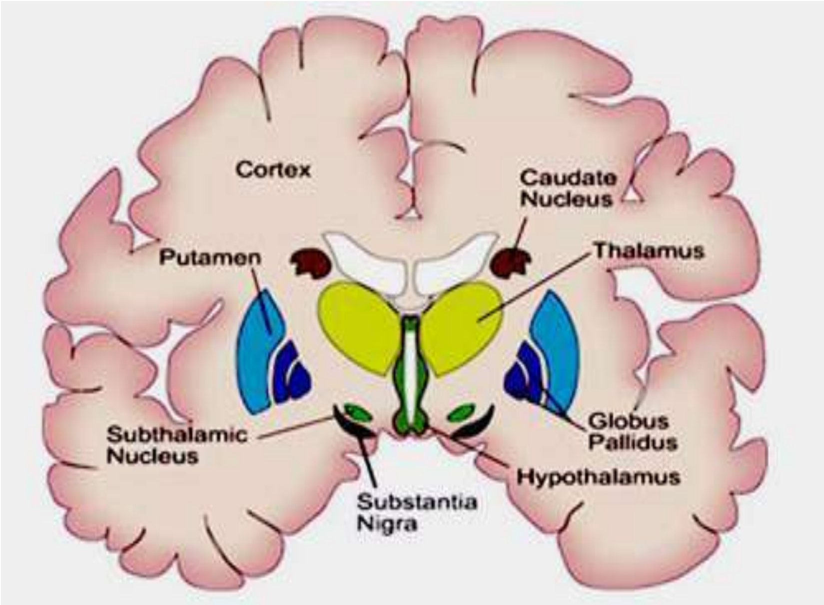
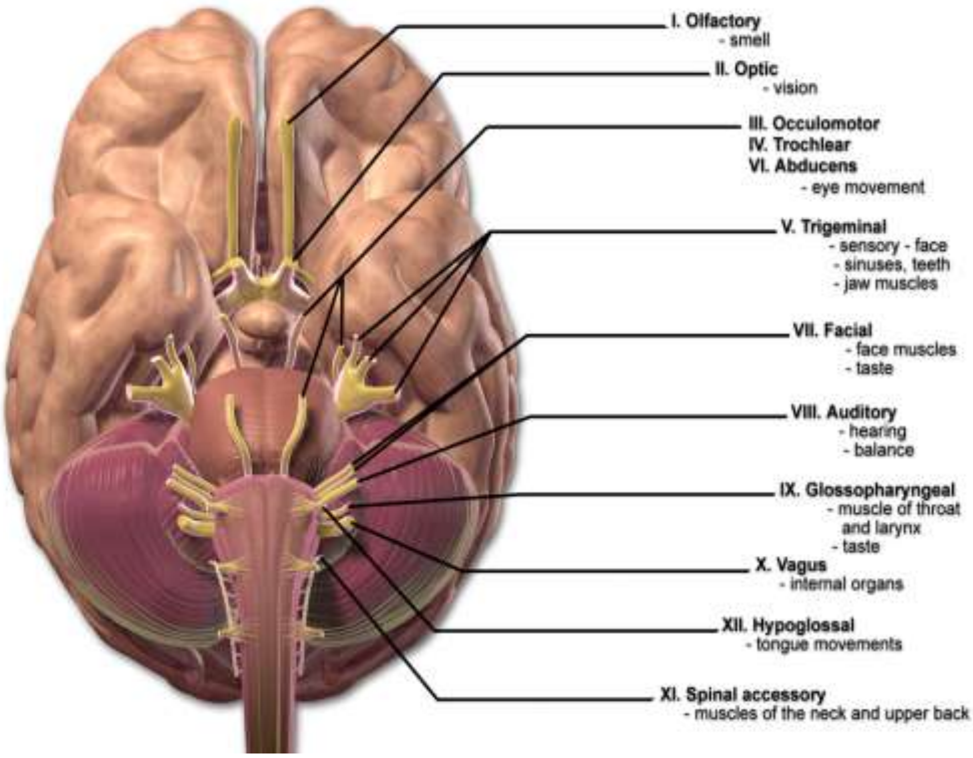


Figure (2. 4) show Coronal cross-section showing the basal ganglia(Wellness Advocate 2018)

2.1.7. Cranial nerves

The brain communicates with the body through the spinal cord and twelve pairs of cranial nerves, 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 . (Tonya.2018)



Figure(2. 5)show cranial nerve (Wellness Advocate 2018)

2.1.8. Menengs

The brain and spinal cord are covered and protected by three layers of tissue called meanings, from the outermost layer inward they are: the durra mater, arachnid mater, and pia mater.dura matters 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, 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 arachnoid ,membranes are called the subdural space,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 spaceit is here where the cerebrospinal fluid bathes and cushions the brain. (Tonya.2018)

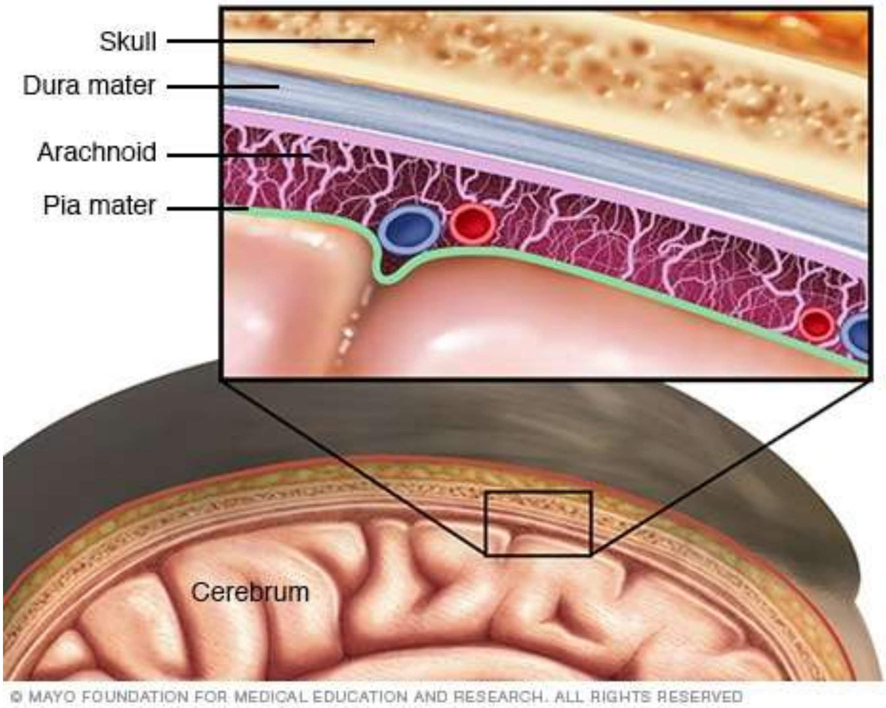


Figure (2. 6) show Menegs of the brain(Wellness Advocate 2018)

2.1.9. Ventricles and cerebrospinal fluid

The brain has hollow fluid filled cavities called ventricles inside the ventricles is a ribbon like structure called the choroid plexus that makes clear colorless ,cerebrospinal fluid (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, there are two ventricles deep within the cerebral ,Hemispheres called the lateral ventricles they both connect with the third ventricle through a separate opening called the foramen of Monro, the third ventricle connects with the fourth ventricle through a long narrow tube called the aqueduct of Sylvius. From the fourth ventricle, CSF flows into the subarachnoid space where it bathes and cushions the brain, CSF is recycled (or absorbed) by special structures in the superior sagittal sinus called arachnoid villi,a balance is maintained between the amount of CSF that is absorbed and the amount that isproduced. a disruption or blockage in the system can cause a buildup of CSF, which can cause enlargement of the ventricles (hydrocephalus) or cause a collection of fluid in the spinal cord (syringomyelia). . (Tonya.2018)

2.1.10. 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 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 , 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,the venous circulation of the brain is very different than the rest of the body ,usually arteries and veins run together as they supply and drain specific areas of the body, so one would think there would be a pair of vertebral veins and internal carotid veins. However, this is not the case, the major vein collectors are integrated into the dura to form venous sinuses not to be confused with the air sinuses in the face and nasal region, the venous sinuses collect the blood from the brain and pass it to the internal jugular veins the superior and inferior sagittal sinuses drain the cerebrum, the cavernous sinuses drains the anterior skull base, all sinuses eventually drain to the sigmoid sinuses, which exit the skull as the jugular veins, the two jugular veins are the only drainage of the brain. (Tonya..2018)

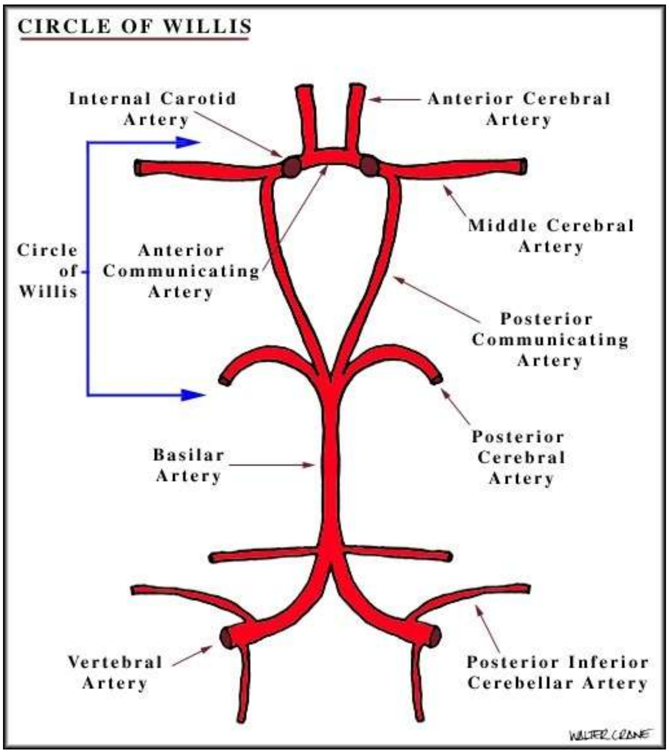


Figure (2. 7) show circle of wills (Wellness Advocate 2018)

2.1.11. Language

In general, the left hemisphere of the brain is responsible for language and speech and is called the "dominant" hemisphere. The right hemisphere plays a large part in interpreting visual information and spatial processing, in about one third of individuals who are left-handed, speech function may be located on the right side of the brain, left handed individuals may need special testing to determine if their speech center is on the left or right side prior to any surgery in that area, aphasia is a disturbance of language affecting production, comprehension, reading or writing, due to brain injury most commonly from stroke or trauma, the type of aphasia depends on the brain area affected,Broca’s area lies in the left frontal lobe If this area is damaged, one may have difficulty moving the tongue or facial muscles to produce the sounds of speech. The individual can still read and understand spoken language but has difficulty in speaking and writing (i.e. forming letters and words, doesn't write within lines) Called Broca's aphasia.,wernicke's arealies in the left temporal lobe, damage to this area causes wernicke's aphasia, the individual may speak in long sentences that have no meaning, add unnecessary words, and even create new words, they can make speech sounds, however they have difficulty understanding speech and are therefore unaware of their mistakes . (Tonya.2018)

2.1.12 Memory

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 . (Tonya.2018)

2.1.13. 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, glia cells glia (Greek word meaning glue) are the cells of the brain that provide neurons with nourishment, protection, and structural support, there are about 10 to 50 times more glia than nerve cells and are the most common type of cells involved in brain tumors, astroglia or astrocytes transport nutrients to neurons, hold neurons in place, digest parts of dead neurons, and regulate the blood brain barrier,oligodendroglia cells provide insulation (myelin) to neurons, ependymal cells line the ventricles and secrete ,cerebrospinal fluid (CSF) microglia digest dead neurons and pathogens. (Tonya.2018)

2.2. Pathology

Metabolic (conditions relating to metabolism, biochemistry, and the like, endocrinological conditions relating to the various secretary systems within the body, degenerative conditions relating to age-related destruction of tissue, or stress-related destruction of tissue, inflammatory/infective conditions that primarily present in a way that involves the profane activation of the immune system ,Congenital conditions present at birth,hematological conditions relating to the blood system, in one way or another,autoimmune conditions relating to the inappropriate activation of the immune system, in one of many ways,traumatic conditions relating to a physical response between two or more objects ,psychological/neurological conditions relating to the nervous system, in one way or another – whether that be the CNS or the PNS),idiopathic/iatrogenic conditions without a known cause or without a known cause outside of medical intervention,neoplastic conditions relating to cancers, environmental conditions relating to exposures, and dose-response relationships thereof, traumatic injury, a body wound or shock produced by sudden physical collision or movement, Blast injury ,Bone fracture Internal bleeding subdural, epidural.intaventrcularheamorage.(wikipedia2018)

2.3. NICE guide line ct brain injuries

For the purposes of this guideline, head injury is defined as any trauma to the head other than superficial injuries to the face. Head injury is the commonest cause of death and disability in people aged 1–40 years in the UK. Each year, 1.4 million people attend emergency departments in England and Wales with a recent head injury between 33% and 50% of these are children aged under 15years. Annually, about 200,000 people are admitted to hospital with head injury. Of these, one-fifth have features suggesting skull fracture have evidence of brain damage. Most patients recover without specific or specialist intention, but others experience long-term disability or even die from the effects of complications that could potentially be minimized or avoided with early detection and appropriate treatment.

The incidence of death from head injury is low, with as few as 0.2% of all patients attending emergency departments with a head injury dying as a result of this injury. Ninety five per cent of people who have sustained a head injury present with a normal or minimally impaired conscious level (Glasgow Coma Scale [GCS] greater than 12) but the majority of fatal outcomes are in the

Moderate (GCS 9–12) or severe (GCS 8 or less) head injury groups, which account for only 5% of at tenders. Therefore, emergency departments see a large number of patients with minor or mild head injuries and need to identify the very small number who will go on to have serious acute intracranial complications. It is estimated that 25–30% of children aged under 2 years who are hospitalized with head injury have an abusive head injury.

This guideline has updated some of the terminology used in relation to safeguarding of children and also of vulnerable adults. The previous head injury guideline produced by NICE in 2003 (NICE clinical guideline 4) and updated in 2007 (NICE clinical guideline 56) resulted in CT scanning replacing skull radiography as the primary imaging modality for assessing head injury.

It also led to an increase in the proportion of people with severe head injury having their care managed in specialist centers. This has been associated with a decline in fatality among patients with severe head injury. This update is needed

2.3.1. Transport to hospital

Transport patients who have sustained a head injury directly to a hospital that has the resources to further resuscitate them and to investigate and initially manage multiple injuries. All acute hospitals receiving patients with head injury directly from an incident should have these resources, which should be appropriate for a patient's age [new 2014]

2.3.2 Assessment in the emergency department

A clinician with training in safeguarding should be involved in the initial assessment of any patient with a head injury presenting to the emergency department. If there are any concerns identified, document these and follow local safeguarding procedures appropriate to the patient's age. [2003, amended 2014]

2.3.3 Criteria for performing a CT head scan

For adults who have sustained a head injury and have any of the following risk factors, Performa CT head scan within 1hour of the risk factor being identified:GCS less than 13 on initial assessment in the emergency department.,GCS less than 15 at 2hours after the injury on assessment in the emergency department, suspected open or depressed skull fracture, any sign of basal skull fracture (haemotympanum, 'panda' eyes cerebrospinal fluid leakage from the ear or nose, Battle's sign),more than 1 episode of vomiting ,focal neurological deficit ,post-traumatic seizure and a provisional written radiology report should be made available within 1hour of the scan being performed.[NICE guide lines 2014]

For children who have sustained a head injury and have any of the following risk factors, perform a CT head scan within 1hour of the risk factor being identified: ,suspicion of non-accidental injury ,post-traumatic seizure but no history of epilepsy ,on initial emergency department assessment, GCS less than 14, or for children under1year GCS (pediatrics) less than 15,at 2 hours after the injury, GCS less than 15,suspected open or depressed skull fracture or tense fontanels ,any sign of basal skull fracture (haemotympanum, 'panda' eyes, cerebrospinal fluid leakage from the ear or nose, Battle's sign) and focal neurological deficit.[NICE guide lines 2014]

For children under 1year, presence of bruise, swelling or laceration of more than 5cmon the head, a provisional written radiology report should be made available within 1hour of the scan being performed ,for children who have sustained a head injury and have more than one more than one of the following risk factors performs a CT head scan within 1hour of the risk factors being identified.[NICE guide lines 2014]

Loss of consciousness lasting more than 5 minutes (witnessed)., Abnormal drowsiness, Three or more discrete episodes of vomiting,-Dangerous mechanism of injury (high-speed road traffic accident either as pedestrian, cyclist or vehicle occupant, fall from height of greater than 3metres, high-speed injury from a projectile or other object).,Amnesia (antitrade or retrograde) lasting more than 5minutes,A provisional written radiology report should be made available within 1 hour of the scan being performed.[NICE guide lines 2014]

Children who have sustained a head injury and have only 1only 1of the risk factors in should be observed for a minimum of 4 hours after the head injury, if during observation any of the risk factors below are identified, perform a CT head scan within 1hour, GCS less than 15., Further vomiting, a further episode of abnormal drowsiness, Provisional written radiology report should be made available within 1hour of the scan being performed, If none of these risk factors occur during observation, use clinical judgment to determine whether a longer period of observation is needed.[NICE guide lines 2014]

For patients (adults and children) who have sustained a head injury with no other indications for a CT head scan and who are having warfare treatment, perform a CT head scan within8 hours of the injury A provisional written radiology report should be made available within1hour of the scan being performed.(nice guide line 2014)

2.3.4 good requested form

Computed tomography is required for patients with minor head injury with any 1 of the following findings, the criteria apply only to patients who also have a Glasgow Coma Scale score of 15. Headache, vomiting, older than 60 years drug or alcohol intoxication persistent intergraded amnesia (deficits in short-term memory), visible trauma above the clavicle and Seizure(NICE guide lines 2014)

2.3.5. Canadian CT Head Rule

Computed tomography is only required for patients with minor head injury with any 1 of the following findings: patients with minor head injury who present with a Glasgow Coma Scale score of 13 to 15 after witnessed loss of consciousness, amnesia, or confusion. High Risk for neurosurgical intervention, Glasgow Coma Scale score lower than 15 at 2 hours after injury, suspected open or depressed skull fracture ,any sign of basal skull fracture, two or more episodes of vomiting,65 years or older medium risk for Brain injury detection by CT homographic Imaging, amnesia before impact of 30 or more minutes dangerous mechanism ,the rule is not applicable if the patient did not experience a trauma, has a Glasgow Coma Scale score lower than 13, is younger than 16 years, is taking warfarin or has a bleeding disorder, or has an obvious open skull fracture. Signs of basal skull fracture include hem tympanum, raccoon eyes, cerebrospinal fluidotorrhea or rhino rhea, Battle's sign, dangerous mechanism is a pedestrian struck by a motor vehicle, an occupant ejected from a motor vehicle, or a fall from an elevation of 3 or more feet or 5 stairs(jam ,September .2015)

2.4. using of CT scan and MRI in brain

Magnetic resonance imaging (MRI) is generally thought to be better than computed tomography (CT) for the diagnosis of acute stroke, but this belief has never been substantiated for the full range of patients in whom this diagnosis is suspected, patients who present to the emergency room with stroke-like symptoms might have cerebrovascular disease (ischemic or hemorrhagic) or various other non-vascular disorders, the ideal imaging modality for assessment of patients with acute stroke should accurately detect both cerebral ischemia and intracranial hemorrhage, and discriminate cerebrovascular causes from other causes, CT is the most common imaging modality used to assess patients with suspected stroke, this method is widely available, fast, easy, and less expensive than MRI however, although CT is sensitive to acute intracranial hemorrhage, it is not sensitive to acute ischemic stroke studies suggest that CT is insufficiently sensitive for the diagnosis of acute ischemia, is subject to substantial inter-rater variability in interpretation, and might not be better than MRI for detection of acute (Gurvinder. R.13 Jun 2014_).

Intracranial hemorrhage.MRI offers advantages for the assessment of acute Stroke changes of acute ischemic injury are detectable sooner with MRI than with CT, especially with diffusion-weighted imaging, and ischemic stroke diagnosis with MRI has greater interobserver and intraobserver reliability than

CT, even in readers with little experience.5–8Historical concerns that MRI is not sufficiently sensitive to detect acute intracranial hemorrhage in the earliest hours from onset have been addressed by studies that show gradient-echo MRI is as accurate as CT in patients with focal stroke symptoms within 6 h of symptom onset.1,3However, the relative diagnostic yield of MRI and CT for routine emergency assessment of possible stroke, irrespective of time from onset, severity of symptoms, or ultimate diagnosis (cerebrovascular or otherwise), had not been investigated. We aimed to prospectively compare CT and MRI for the detection of acute stroke in the full range of patients who present for emergency assessment of stroke-like symptoms.(Julio A .C, 2007)

2.5. Radiation Safety in Imaging

Radiologists, medical physicists, registered radiologist assistants, radiologic technologists, and all supervising physicians have a responsibility for safety in the workplace by keeping radiation exposure to staff, and to society as a whole, “as low as reasonably achievable” (ALARA) and to assure that radiation doses to individual patients are appropriate, taking into account the possible risk from radiation exposure and the diagnostic image quality necessary to achieve the clinical objective all personnel that work with ionizing radiation must understand the key principles of occupational and public radiation protection (justification, optimization of protection and application of dose limits) and the principles of proper management of radiation dose to patients (justification, optimization and the use of dose reference levels) (Timothy .N,B.2007)

2.6. protocol for traumatic head CT

Check the request form before beginning CT scan ct request must include the date of exam ,patient name, age , gender, clinical history or clinical diagnosis and indication for the exam the physician name and signature prepare the patient by removing any metal from the head

2.6.1 Patient positioning

Patient supine on head holder with 5 help lizard localizer the middle one with mid sagittal plane two with sagittal right and left two are transfer one from inferior of the skull and the other in superior OML start point from base of skull end point at vertex

Slice thickness 5-10 mm

WL35 WW100

Bony window

WL400 WW3000

e 

8 .Figure 2 Patient position for CT brain(scielo2014)

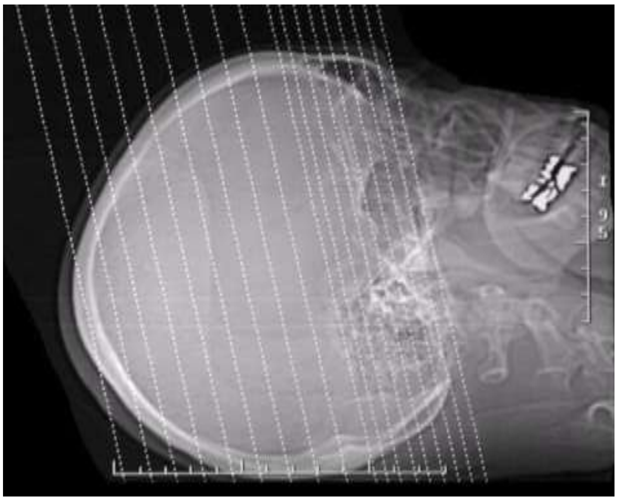


Figure 2. 9 scout view(radipedia)

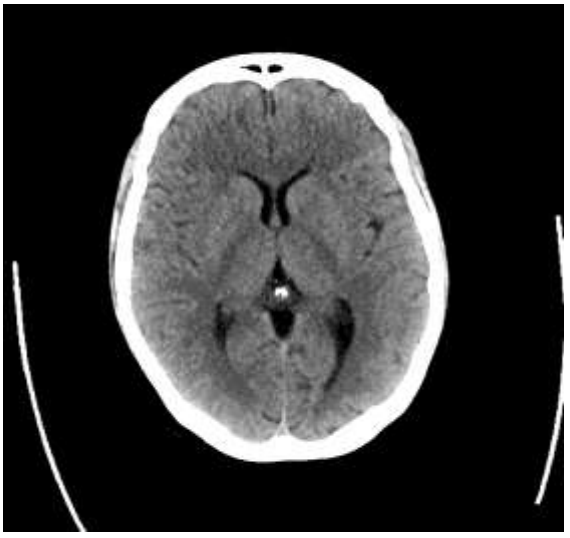


Figure 2. 10 normal axial section of CT brain(radiopedia)

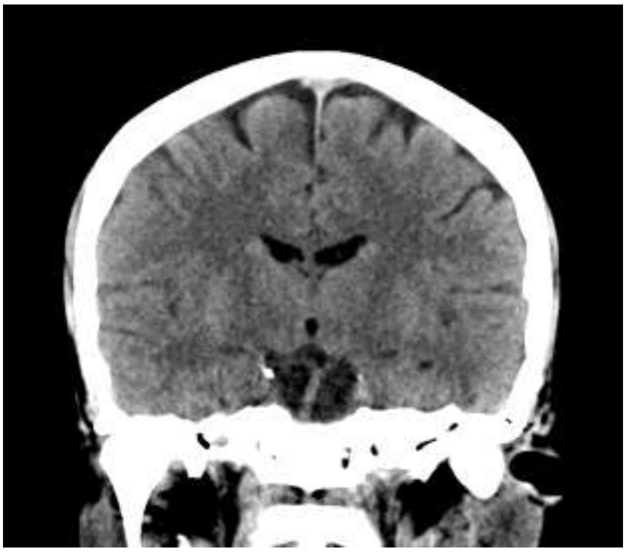


Figure 2. 11.normal CT brain in coronal section(radiopedia)

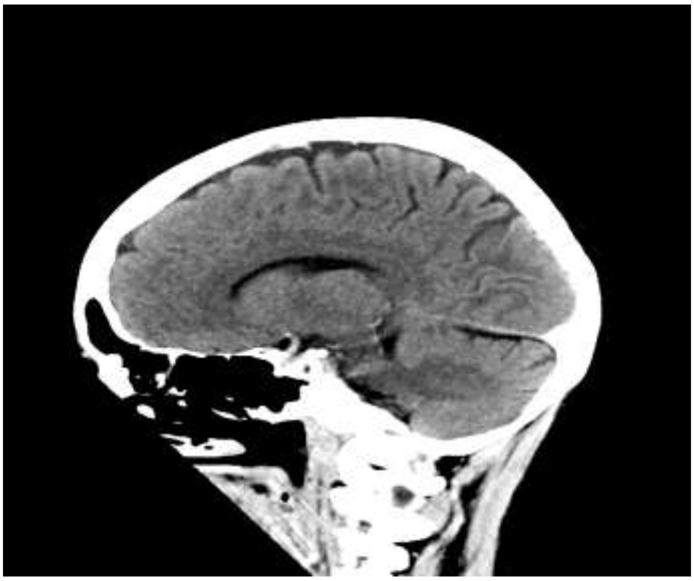


Figure 2. 12 CT normal brain on sagittal section(radiopedia)

2.7. Previous studies

Parma et al in june (2014) They published study titled unnecessary head ct scan level 1 trauma teaching experience ,they Saied that the Canadian CT Head Rule attempts to standardize the practice of obtaining head computed tomography (CT) scans in patients with minor head injury. Previous research indicates 10 to 35 per cent of CT scans performed do not meet these guidelines. The purpose of this study was to review theier use of CT scans in the evaluation of mild traumatic brain injury and to identify unnecessary head CT scans (UHCT), inclusion criteria were age older than 18 years, Glasgow Coma Scale of 15, and at least one head CT scan. UHCTs were those without head injury, loss of consciousness, amnesia, or neurologic complaint. The proportion of patients meeting the criteria for UHCT was 24.2 per cent univariate analyses revealed ages 41 to 64 years, this study suggests that current practices at our Level I trauma center result in UHCT, Further investigation into best practices would benefit our center by reducing costs and providing quality patient,care.good examination means good practice and reducing CT scan

Erik .C.M. and et al in 1997 published study titled utilized clinical factor to reduce CT scan the objective of their study was to determine simple clinical criteria can be save and reduce number of CT scans for minor head trauma patient they Saied that awake patient (GCS15)were presented in ER with head injury the risk factors are sever head each nausea vomiting ,depress fracture or neurological symptoms in clinical examinations they carry out their study in 2143 requested for CT scan they found that 1302(61%) normal has no risk factors and no clinical significant 841(39%) with risk factor and clinical significant (6%)of this percentage need interventional surgery they Saied that CT scans performed and still identify all patients who require neurosurgical intervention and the majority of patients with an abnormal CT scan. This method could lead to a large savings in patient charges nationwide. Further studies may be helpful in confirming these findings.

Gimbel RW **and et al in march (2018) publishes study titled Effect of clinical decision rules patient cost and malpractice information on clinician brain CT image ordering: a randomized controlled trial, they Saied that The frequency of head computed tomography (CT) imaging for mild head trauma patients has raised safety and cost concerns, validated clinical decision rules exist in the published literature and on-line sources to guide medical image ordering but are often not used by emergency department (ED) clinicians. Using simulation, we explored whether the presentation of a clinical decision rule (i.e. Canadian CT Head Rule - CCHR), findings from malpractice cases related to clinicians not ordering CT imaging in mild head trauma cases, and estimated patient out-of-pocket cost might influence clinician brain CT ordering. Understanding what type and how information may influence clinical decision making in the ordering advanced medical imaging is important in shaping the optimal design and implementation of related clinical decision support systems they following standardized clinical vignette presentation, clinicians made an initial imaging decision and many informations on decision support rules ,the result decreasing of using ct scan from167 (66.9%) to 76(45.1%)**

Chapter three

Materials and method

3.1Materials

3.1.1Ptients

The study carries out at three hospitals, Ibrahim malik hospital Police hospital and Alfisal at Khartoum state in March 2018 in 153 patients in ages between 11-89 years old Bothe males and females included, the included criteria the traumatic patient requested for CT brain , the excluded criteria not traumatic patient requested by CT brain

31.2Machines

CT scan (Toshiba 4 slice) Ibrahim malik hospital

CT scan (new soft 16 slices) police hospital

CT scan (Toshiba 16 slice) Alfisal hospital

3.2Method

3.21 Technique

After received the request form traumatic patient I recorded the data from the request then the patent lied supine head first the started point from base of skull to the vertex slice thickness 5 mm after finished the exam the radiologist writ the report and I write the result

3.2.2 Image interpretation

All patient reported by radiologist

3.2.3 Statistical used

Descriptive analysis was performed in all patients in the study by using SPSS version 20 The result was showed in cross tabulations and figure

3.2.4Ethical considerations

The permission from the hospitals was taken, , the permission was taken from all patent before taken or collected the data

Chapter four

Result

This chapter showed the statistical analysis result of the study in tables and descriptive figure

Table 4. 1 the involved data

		Sex	history	FINDINGS
N	Valid	153	153	153
	Missing	0	0	0

Table 4. 2 gender distribution and presentage

Sex

		Frequency	Percent
Valid	Female	51	33.3
	Male	102	66.7
	Total	153	100.0

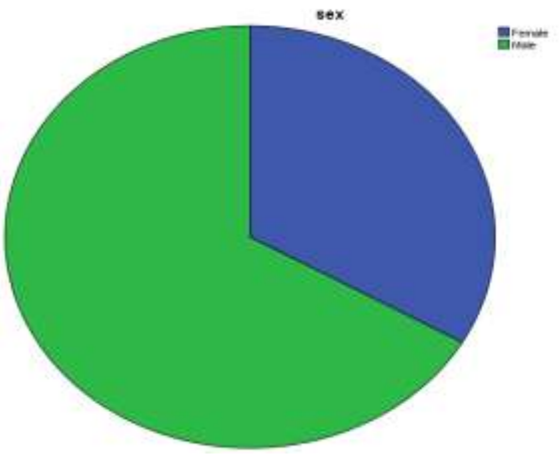


Figure (4. 1)show gender distribution

Table (4. 3)show clinical history found distribution and percentage

History		Frequency	Percent
Valid	clinical data history not found	106	69.3
	clinical data history found	47	30.7
	Total	153	100.0

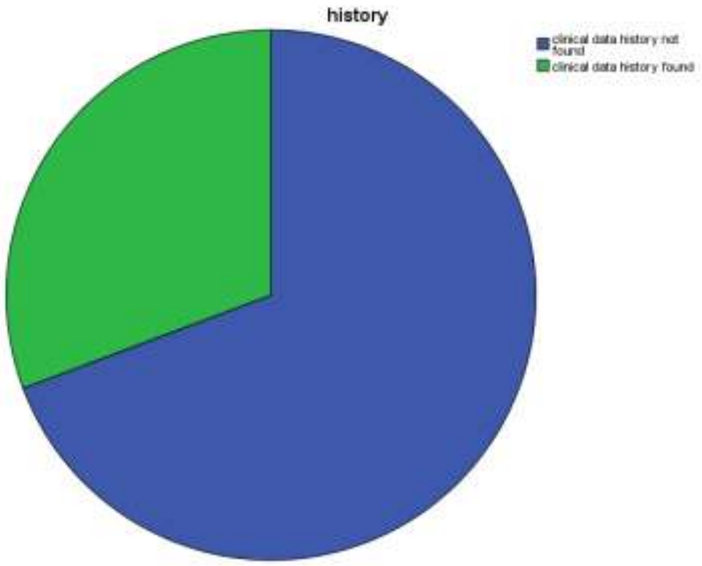


Figure (4. 2) show clinical history distribution

Table(4. 4)show distribution of the clinical findings

FINDINGS

		Frequency	Percent
Valid	Negative	91	59.5
	Positive	62	40.5
	Total	153	100.0

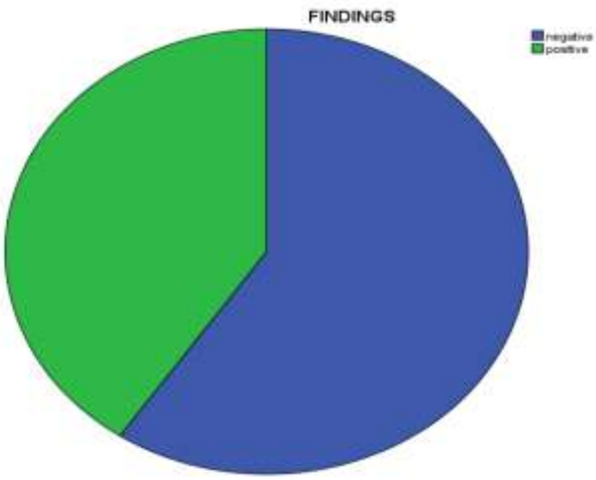


Figure (4. 3) show clinical findings distribution

Table 4. 5 show age distribution

	N	Minimum	Maximum	Mean	Std. Deviation
Age	153	11	89	44.44	18.753
Valid N (list wise)	153				

Table (4. 6) show distribution founded clinical history versus sex

			Sex		Total
			Female	Male	
History	clinical data history not found	Count	40	66	106
		% within history	37.7%	62.3%	100.0%
		% within sex	78.4%	64.7%	69.3%
		% of Total	26.1%	43.1%	69.3%
	clinical data history found	Count	11	36	47
		% within history	23.4%	76.6%	100.0%
		% within sex	21.6%	35.3%	30.7%
		% of Total	7.2%	23.5%	30.7%
Total		Count	51	102	153
		% within history	33.3%	66.7%	100.0%
		% within sex	100.0%	100.0%	100.0%
		% of Total	33.3%	66.7%	100.0%

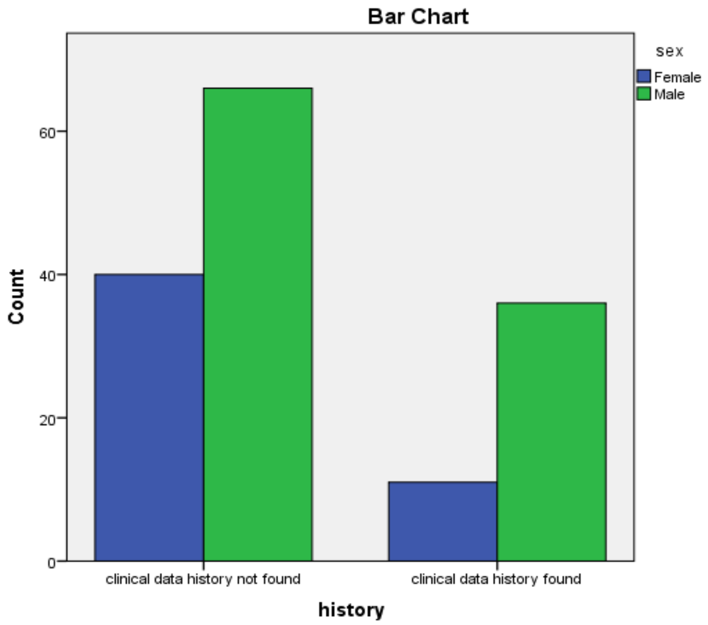


Figure (4. 4) show distribution clinical history versus sex

			Sex		Total
			Female	Male	
FINDINGS	Negative	Count	36	55	91
		% within FINDINGS	39.6%	60.4%	100.0%
		% within sex	70.6%	53.9%	59.5%
		% of Total	23.5%	35.9%	59.5%
	positive	Count	15	47	62
		% within FINDINGS	24.2%	75.8%	100.0%
		% within sex	29.4%	46.1%	40.5%
		% of Total	9.8%	30.7%	40.5%
Total		Count	51	102	153
		% within FINDINGS	33.3%	66.7%	100.0%
		% within sex	100.0%	100.0%	100.0%
		% of Total	33.3%	66.7%	100.0%

Table (4. 7) show the clinical findings versus sex

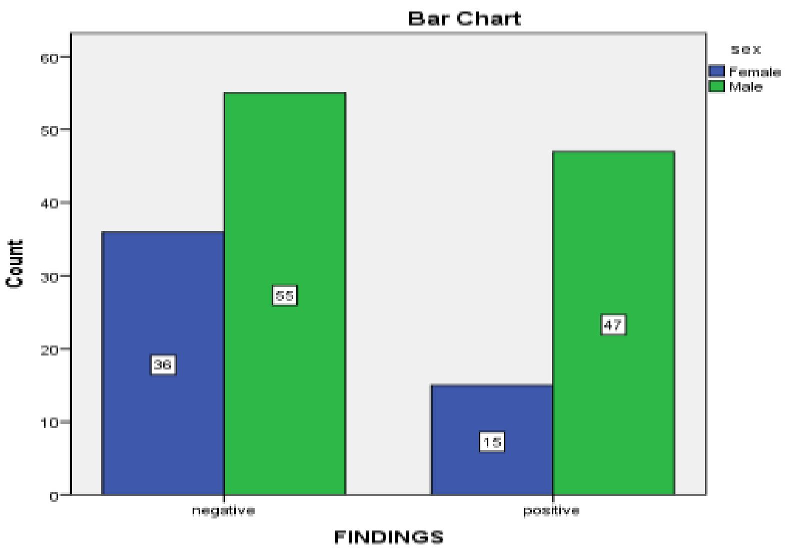
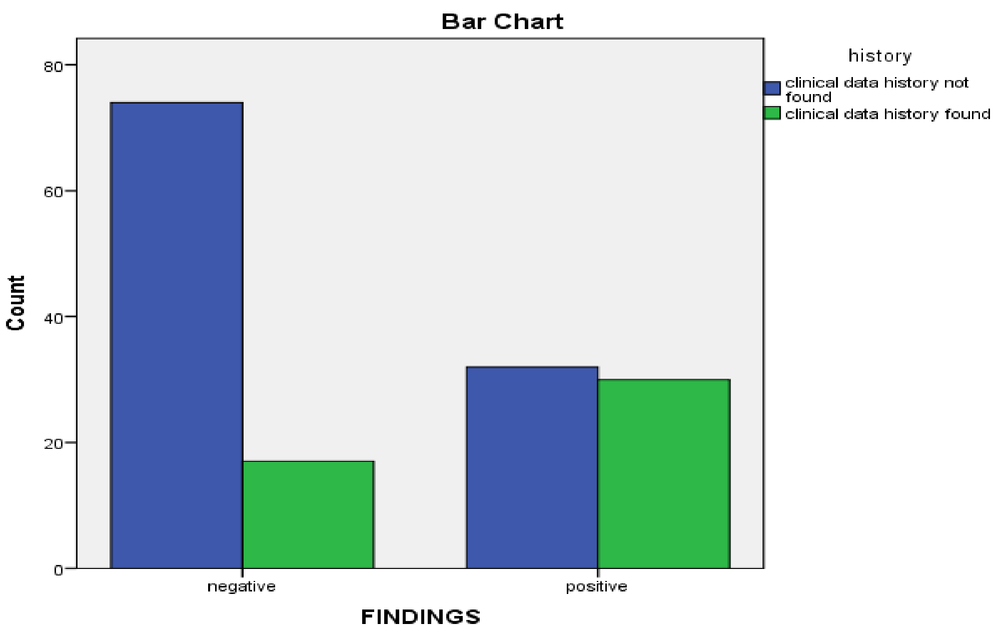


Figure (4. 5) show distribution of clinical findings versus sex

Table (4. 8) the relation between the clinical findings and clinical history

			History		Total
			clinical data history not found	clinical data history found	
FINDINGS	Negative	Count	74	17	91
		% within FINDINGS	81.3%	18.7%	100.0%
		% within history	69.8%	36.2%	59.5%
		% of Total	48.4%	11.1%	59.5%
	positive	Count	32	30	62
		% within FINDINGS	51.6%	48.4%	100.0%
		% within history	30.2%	63.8%	40.5%
		% of Total	20.9%	19.6%	40.5%
Total		Count	106	47	153
		% within FINDINGS	69.3%	30.7%	100.0%
		% within history	100.0%	100.0%	100.0%
		% of Total	69.3%	30.7%	100.0%



Figure(4. 6)show clinical history versus clinical finding s

Chapter five

Discussion, Conclusion, Recommendations, Outcome

5.1. Discussions

The study carry out in 153 patient the variables was age sex clinical history and clinical findings Its show in table (4.1),The females were 51(33.1) the males were102(66%)show in table(4.2)figure(4.1) ,the patents requests without clinical history were 106(6.9.3%)and with clinical history and inductions 47(30.7)show in table(4.3)figure(4.2) The clinical findings from the patient examinations the negative CT scan findings were 91(59.5%)and the positive CTscan findings were 62(40.5%)show in table(4.4)figure(4.3)the ages were from 11to 89 years old the mean of age 44,show table (4.5), the relation between clinical findings and clinical history we I found that there is (81%)of negative CT findings has no clinical history and 17(18.7) of negative CT scan has clinical history, in the positive CT scan findings I found that32(51.2%) without clinical history and 30(48.8)%)shown in table (4.8)figure(4.6)

IN this study I found that the frequency of negative CT scan finding is 59.5%,and the positive CT scan findings were (40.5%) , the study done by Erik et al the study was (61%)of the patent requested by CT scan with head trauma were without risk factor 39%with risk factor ,

In this study there is, increasing of using CT scan 81% of this negative findings had no clinical history or indicator for CT scan we can say its UNCT un necessary CT scan 48.4% from total.IN The Study done by Parma et al their purpose of study was to reviewed their use of CT scan they account the UNCT (24.2%)

IN this study there is increase in negative findings in patent without clinical history compeer with positive findings, the positive findings were (51.2) without clinical history and(48.8 %)has clinical history and good request relative high but decrease than negative CT scan the ,I suggest that good examinations help in good requested form help in good It wil help in control and decreasing used of CT scan diagnoses for the In study done by Gimbel RW et al they found that after they applied (CCHR) Canadian there was decrease of used ct scan from 66.9%to 45.1%

5.2. Conclusion

This study found that there is increasing in frequency of the negative ct finding in head trauma more than half 59.5% the causes of this percentage there is no guide lines in requested ct brain although CT brain examination is high cost and high radiation hazard positive CT findings was (40.5%) of the positive findings have good request form ruled by NICE guide line, good clinical history and good diagnosis

5.3. Recommendations

1- Awareness the physicians no any patient has head trauma need CT scan

They must be use NICE guide lines a CCHR to take decision of doing ct scan

2-Awere the technologist, any request form without clinical history and the physician signature must be return back

3-generliztion this guide lines and follow using of ct scan

5.3 References

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Appendeces

Apendex 1 data collection sheet

Age	Sex	Clinical history	Negative findings	Positive findings

Apendex2male 45 years old positive CT scan findings acute subdural hemorage

Apendex3 female 35 years old negative findings 3D CT scan