بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduates Studies

Study of Acute Stroke in Adult Patients Using Computed Tomography in Khartoum State

دراسة السكتة الدماغية الحادة للمرضي البالغين باستخدام التصوير المقطعي المحوسب في ولاية الخرطوم

Thesis Submitted in Partial Fulfillment for the Requirements of M.Sc. in Diagnostic Radiologic Imaging

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الآيـة

قُــال تــعـالــى :

(اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ *خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ *اقْرَأْ وَرَبُّكَ الْأَكْرَمُ *الَّذِي عَلَّمَ بِالْقَلَمِ *عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ)

صدق الله العظيم

(سورة العلق)

Dedication

To the purity of my mother's heart and to my eyes and us way to heaven, to the only thing that time can't change to our mother and father.

To my brothers, sisters, friends, and classmates who encouraged us to finish this study.

To those who did not succumb to defeat, to whoever struggled with all the strength that Allah gave,To those who went to the mercy of Allah, To the Corona disease fighters.

Acknowledgment

First and foremost, I have to thank my parents for their love and support throughout my life. Thank you both for giving me strength to reach for the stars and chase my dreams.

My lovely sister deserves my wholehearted thanks as well for her continuous support.

I would like to sincerely thank my supervisor Dr. **Hessein Ahmed Hassan ,** for his guidance and support throughout this study and especially for his continuous collaboration and trusting in me.

Abstract

This is descriptive study done to assess acute stroke in adult patients using computed tomography in Khartoum state in different hospitals in the duration between November 2020 July 2021. Th sample of 60 cases include both gender, 22 females and 32 males in range of age from 20 to 99 came to the Radiology department for Brain computed tomography.

Tools applied included using CT Toshiba 164 slice and data collection sheet.

Data sheet contained information about the patient's age, gender, clinical presentation, risk factors, and their Computed tomography findings.

The conducted study concluded with range of age 60-69 years old being the most affected age group and proved the accuracy of detection of strokes in all individuals through utilizing CT as modality of diagnosis.

Furthermore, results were evident that acute ischemic strokes have higher rates of incidence than haemorrhagic strokes with an incidence ratio 66.7 to 33.3.In clinical presentation weekness and numbness are ost common symptoms also patients with hypertention resembled the highest risk of developing acute stroke.

In a typical acute stroke patient, the fastest available imaging is still mandatory to avoid delayed treatment. This study has proved that CT is the gold standard for diagnosis of acute stroke.

To improve the detection and characterization of stroke other protocol may be performed.

المستخلص

تم إجراء هذه الدراسة الوصفية لتقييم السكتة الدماغية الحادة عند المرضى البالغين باستخدام التصوير المقطعي المحوسب في ولاية الخرطوم في مستشفيات مختلفة في الفترة ما بين نوفمبر 2020 يوليو 2021. عدد العينات 60 حالة تشمل كلا الجنسين ، 22 إناث و 32 ذكر في الفئة العمرية من 20الي 99سنة . وصل إلى قسم الأشعة للتصوير المقطعي للدماغ.

تضمنت الأدوات المطبقة استخدام شريحة **CT Toshiba 164** وصحيفة جمع البيانات.

احتوت ورقة البيانات على معلومات حول عمر المرضى ، والجنس ، والعرض السريري ، وعوامل الخطر ، ونتائج التصوير المقطعي المحوسب.

وخلصت الدراسة إلى أن الفئة العمرية 60–69 سنة هي الفئة العمرية الأكثر تضرراً ، وأثبتت دقة الكشف عن السكتات الدماغية لدى جميع الأفراد من خلال استخدام التصوير المقطعي المحوسب كوسيلة للتشخيص.

علاوة على ذلك ، أظهرت النتائج أن السكتات الدماغية الحادة لديها معدلات حدوث أعلى من السكتات الدماغية النزفية بنسبة حدوث 66.7% إلى 33.3.

يعتبر ضعف العرض السريري والخدر من الاعراض الشائعة, كما ان المرضي الذين عانون من ارتفاع ضغط الدم يعتبرون اعلي عرضة للإصابة بالسكتة الدماغية الحادة.

في مريض السكتة الدماغية الحادة النموذجي ، لا يزال أسرع التصوير المتاح إلزاميًا لتجنب العلاج المتأخر. أثبتت هذه الدراسة أن التصوير المقطعي المحوسب هو المعيار الذهبي لتشخيص السكتة الدماغية الحادة.

لتحسين الكشف عن السكتة الدماغية وتوصيفها ، يمكن إجراء بروتوكول

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List of Abbreviations

CT	Computed Tomography
CTA	Computed tomography Angiography
CTP	Computed Tomography Perfusion
MCA	Middle Cerebral Artery
MRI	Magnetic Resonance Imaging
NCCT	Non Contrast Computed Tomography
CNS	Central Nervous System
SPSS	Statistical Package for the Social Sciences
CSF	Cerebrospinal Fluid
CVA	Cerebrovascular Accident
TIA	Transient Ischemic Attack
CBC	Complete Blood Count
AVM	Arteriovenous Malformation

Chapter one

1.1Introduction:

Stroke, is defined as abrupt onset of a focal neurological deficit lasting more than24 hours. It is also called cerebrovascular accident (CVA) or apoplexy. An acute stroke refers to the first 24-hour- period of a stroke. Focal neurological deficit lasting less than 24 hours (usually 5–20 minutes) known as transient ischemic attack (TIA) is relevant but
beyond the scope of this discussion paper. (Andrew M. Demchuk et al 2005).Stroke is classified on the basis of its a etiology as either ischemic (80%) or hemorrhagic (20%) . **Ischemic stroke** is produced by occlusion of a cerebral artery [thrombotic or atherosclerotic (50%), embolic (25%) and micro artery occlusion, "lacunar stroke", (25%)]. Hemorrhagic stroke is caused mainly by spontaneous rupture of blood vessels or aneurysms or secondary to trauma . (Andrew M. Demchuk et al 2005)

Neurological symptoms and signs of an ischemic stroke usually appear suddenly, but less frequently, they occur in a progressive manner (stroke-in-progress) .

Symptoms and signs vary depending on the location of the occlusion and the extent of the collateral flow.

Atherosclerotic ischemic stroke is commoner in the elderly, and occurs without warning in more than 80% of cases. A TIA a few months before the stroke is considered an important warning sign (Andrew M. Demchuk et al 2005).

The pathophysiology is similar to that of ischemic heart disease; an atherosclerotic plaque in a cerebral artery ulcerates triggering the aggregation of platelets and coagulation of fibrin to produce the thrombus that occludes the artery. Fewer than 20% of cases do not evolve to

ulceration, but progresses to cause gradual obstruction of flow and may manifest as TIAs. In hypertension-induced arteriosclerosis,
small penetrating arteries of the deep white matter of the brain are affected producing small infarctions known as “lacunar infarcts”. In around 40% of elderly stroke patients no clear origin of the infarction can be found. (Andrew M. Demchuk et al 2005).

1.2Problem statement:

Dose computed tomography always diagnose acute stroke?

How does acute stroke appear in computed tomography?

1.3 Hypothesis of the study:

Computed tomography is primary diagnostic tools for the investigation of acute stroke, and it appear hyper dense in hemorrhagic stroke and hypo dense in ischemic stroke.

1.4 Objectives:

1.4.1 General objective:

To assess acute stroke in adult patients using computed tomography in Khartoum state.

4.2 Specific objectives:

To estimate acute stroke among age group.

To estimate acute stroke among gender.

To determine the appearance of acute stroke in computed tomography.

To identify related clinical presentation and risk factors of acute stroke.

To determine the location and type of acute stroke.

Chapter Two

Literature Review and background studies

2.1 Anatomy of the Brain:

The brain is the most complex part of the human body. The brain is the seat of intelligence, interpreter of the senses, initiator of body movement, and controller of behavior. The brain is the source of all the qualities that define our humanity. The brain is the crown jewel of the human body. (Gray's Anatomy 2000) The brain is composed of three parts: cerebrum, cerebellum, and brainstem. The cerebrum is made up of the left and right cerebral hemispheres, separated by the falx cerebral. Each hemisphere has five lobes: the frontal lobe in the front, the temporal and parietal lobes on the sides, the occipital lobe in the back, and the insular lobe located between the temporal lobe and the frontal lobe. The cerebral cortex is the outer layer of the cerebrum. The surface of the cerebral cortex has folds, grooves, and clefts. The folds are called gyri, the grooves are sulci, and the clefts are called fissures. These features increase the surface area of the brain while still allowing into fitting into its bony vault. The cerebral hemispheres are connected by the corpus callosum, a band of nerve fibers that allows each side to communicate with the other. The cingulate gyrus is located superior to the corpus callosum. It helps coordinate emotions. The hippocampus and the amygdala are located in the temporal lobe and are important for memory. The cerebellum is the portion of the brain lying beneath the tentorium cerebelli in the posterior part of the cranium. It's made up of two hemispheres connected by the narrow wormlike part of the cerebellum called the vermis. The cerebellum controls balance, coordinates movement, and maintains muscle tone. The brainstem includes three parts: the midbrain is the most superior part, the pons is in the middle, and the

medulla oblongata (medulla) is the most inferior portion and connects to the spinal cord. The brainstem controls your levels of alertness, arousal, respiratory rate, blood pressure, digestion, heart rate, and other autonomic functions .(Gray's Anatomy 2000).

2.1.1 Cells of the brain:

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

The 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. Neurons transmit their energy, to each other across a tiny gap called a synapse (Fig2.5). A neuron has many arms called dendrites, which act like antennae picking up messages from other nerve cells. These messages are passed to the cell body, which determines if the message should be passed along. Important messages are passed to the end of the axon where sacs containing neurotransmitters open into the synapse. The neurotransmitter molecules cross the synapse and fit into special receptors on the receiving nerve cell, which stimulates that cell to pass on the message.

The Glia cells:(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.

The Astroglia or astrocytes are the caretakers — they regulate the blood brain barrier, allowing nutrients and molecules to interact with neurons. They control homeostasis, neuronal defense and repair, scar formation, and also affect electrical impulses.

The Oligodendroglia cells create a fatty substance called myelin that insulates axons – allowing electrical messages to travel faster.

The Ependymal cells line the ventricles and secrete cerebrospinal fluid (CSF).

The Microglia are the brain's immune cells, protecting it from invaders and cleaning up debris. They also prune synapses.

2.1.2 Meanings:

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

The Dura mater: is a strong, thick membrane that closely lines the inside of the skull; its two layers, the periosteal and meningeal dura, are fused and separate only to form venous sinuses. The dura creates little folds or compartments. The reared two special dura folds, the falx and the tentorium .The falx separates the right and left hemispheres of the brain and the tentorium separates the cerebrum from the cerebellum.

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

The Pia mater: hugs the surface of the brain following its folds and grooves. The pia mater has many blood vessels that reach deep into the brain. The space between the arachnoid and pia is called the subarachnoid space. Nit is her where the cerebra's Pinal fluid bathes and cushions the brain.

2.1.3 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 (Fig2.6). 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.

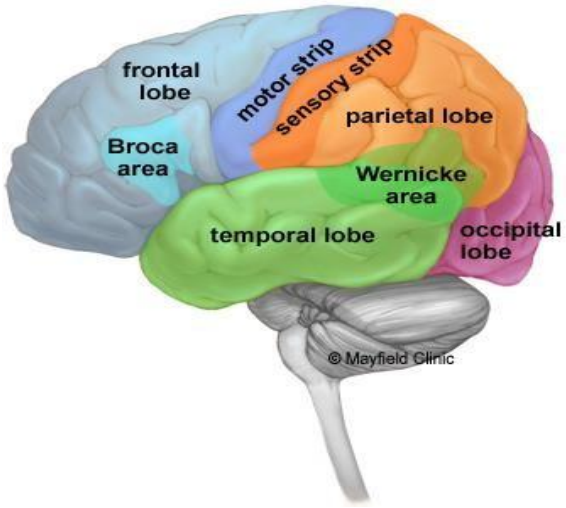

Fig2.1 brain lobe

2. 2 Physiology:

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

The cerebellum is located under the cerebrum. Its function is to coordinate muscle movements, Maintain posture, and balance. The brainstem 8 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. (McGraw-Hill; New York: 2004).

2.3 Pathology of the Brain:

Neurological disorders are diseases of the central and peripheral nervous system. In other words, the brain, spinal cord, cranial nerves, peripheral nerves, nerve roots, Autonomic nervous system, neuromuscular junction, and muscles. These disorders include Epilepsy, Alzheimer disease and other dementias, cerebrovascular diseases including Stroke, migraine and other headache disorders, multiple sclerosis, Parkinson's disease, Neuro infections, brain tumors, traumatic disorders of the nervous system such as brain Trauma, and neurological disorders as a result of malnutrition (Elsevier Mosby; St. Louis 2007).

2.3.1 Stroke:

Is defined as abrupt onset of a focal neurological deficit lasting more than 24 hours.

It is also called cerebrovascular accident (CVA) or apoplexy. An acute stroke refers to the First 24-hour- period of a stroke. Focal neurological deficit lasting less than 24 hours (Usually 5–20 minutes) known as transient ischemic attack (TIA) is relevant but beyond the scope of this discussion paper.(Elsevier Mosby; St. Louis 2007).

2.3.1.1 Types of stroke:

Stroke is classified on the basis of it's a etiology as either ischemic (80%) or Hemorrhagic (20%). **Ischemic stroke** is produced by occlusion of a cerebral artery [Thrombotic or atherosclerotic (50%), embolic (25%) and micro artery occlusion, “lacunar Stroke”, (25%)]. **Hemorrhagic stroke** is caused mainly by spontaneous rupture of blood Vessels or aneurysms or secondary to trauma. (Andrew M. Demchuk 2005).

2.3.1.2 Brain Stroke:

Strokes occur due to problems with the blood supply to the brain either the blood Supply is blocked (Ischemic) or a blood vessel within the brain ruptures (Hemorrhagic). A Stroke is a medical emergency, and treatment must be as quickly as possible. (Andrew M. Demchuk 2005).

There are three main kinds of stroke; first type is Ischemic strokes happens when Blood vessels are blocked by a clot or become too narrow for blood to get through to the Brain, the reduced blood flow causes brain cells in the area to die from lack of oxygen, It accounts for more than 80% of all stroke cases, second 9 type is Hemorrhagic strokes it occurs when a weakened blood vessel ruptures, third type is Transient ischemic attacks

(TIAs) also referred to as mini-strokes are caused by a temporary clot. (Schwamm et al 2005).

2.3.1.3 Signs and Symptoms of Stroke:

Strokes occur quickly, and as such their symptoms often appear suddenly without warning like sudden numbness, confusion, trouble seeing and severe headache.

The Acronym FAST is a way to remember the signs of stroke, and can help toward identifying the onset of stroke in someone, F for Face drooping Arm weakness Speech difficulty Time to look for help (Schwamm et al 2005).

2.3.1.4 Diagnose of Stroke:

There are several different types of diagnostic tests that can use in order to diagnose stroke including clinical examinations, lab test and imaging studies Clinical examinations: checking patient’s symptoms, medical history, check blood pressure, listen to the carotid arteries in the neck and examine the blood vessels at the back of the eyes.

Lab test is complete blood count (CBC) is a routine test to determine the number of red blood cells, white blood cells, and platelets in the body. Imaging modalities incudes CT, MRI, carotid ultrasound and cerebral angiogram (Schwamm et al 2005).

2.3.1.5 Treatment of Stroke:

As the two main different kinds of stroke, ischemic and hemorrhagic, are caused by Different factors, both require different forms of treatment. Ischemic strokes are caused by Arteries being blocked or narrowed and so treatment focuses on restoring an adequate flow of blood to the brain. Treatment can begin with drugs to break down clots and prevent further ones from forming. Aspirin can be 10given; injection of a tissue plasminogen activator (tPA) is very effective at dissolving clots (see figure 1.3) but needs to be injected within (3-4.5) hours of stroke symptoms manifesting themselves (Keith 2001).

Hemorrhagic strokes are caused by bleeding into the brain and so treatment focuses on controlling the bleeding and reducing the pressure on the brain that it is causing. Treatment can begin with drugs being given to reduce the pressure in the brain, overall blood Pressure, prevent seizures and prevent sudden constrictions of blood vessels (Keith 2001).

2.3.1.6 Complications of Stroke:

Stroke leave complications vary according to their strength and size, may lead to a significant hemiplegia (paralysis) in half the body and sometimes disorders in swallowing, breathing, and in the circulatory system, and may cause death in the first few hours or after several hours if not treated. (Fonarow et al 2007).

2.3.1.7 Stroke Risk Factors:

There are two types of risk factors controllable and uncontrollable, controllable Factors are High blood pressure, atherosclerosis, heart disease, smoking, high cholesterol, Diabetes, obesity and excessive alcohol intake. Uncontrollable factors are age, gender, Race, family history, and artery abnormalities (Schwamm et al 2005).

2.4 Computerized Tomography CT:

Since its introduction in the 1970s, CT has become an important tool in medical Imaging to supplement X-rays and medical ultrasonography. A CT scan makes use of computer-processed combinations of many X-ray images taken from different angles to produce cross-sectional (tomographic) images (virtual 'slices') of specific areas of a scanned object, allowing the user to see inside the object without cutting. Digital geometry Processing is used to generate a three-dimensional image of the inside of the object from a large series of two-dimensional radiographic images taken around a single axis of rotation.

Medical imaging is the most common application of X-ray CT. Its cross-sectional images are used for diagnostic and therapeutic purposes in various medical disciplines (Srinivasan et al 2006).

2.4.1 CT Brain Stroke Protocol:

Non-contrast CT of the brain remains the mainstay of imaging in the setting on an acute stroke. It is fast, inexpensive and readily available. Its main limitation however is the limited sensitivity in the acute setting. Detection depends on the territory, the experience of the interpreting radiologist and of course the time of the scan from onset of symptoms. (Srinivasan et al 2006).

The goals of CT in the acute setting are to exclude intracranial hemorrhage, which would preclude thrombolysis; look for any "early" features of infarction and exclude other intracranial pathologies that may mimic a stroke, such as tumor (Srinivasan et al 2006).

CT angiography and CT perfusion also can help diagnose and evaluate blood vessel disease or related conditions, such as aneurysms or blockages, they requires more time than non-contrast CT brain (Srinivasan et al 2006).

2.5 Previous studies:

Biesbroek J.M. Niesten J.M. Dankbaar J.W. Biessels G.J. Velthuis

B.K, Reitsma J.B. van der Schaaf I.C, 2013. A study titled Diagnostic accuracy of CT perfusion imaging for detecting acute ischemic stroke: a systemic review and meta-analysis, aimed at determining the sensitivity and specificity of CT perfusion (CTP) for the detection of ischemic stroke by performing a systematic review and meta-analysis of published reports. It was applied by searching PubMed, Embase and the Cochrane library using the terms ‘perfusion computed tomography', ‘ischemic stroke' and synonyms. The results were evident that the current systematic review shows that CTP has a high sensitivity and a very high specificity for detecting infarcts. (Bies broek J.M., et. al, 2013).

Kennith S, Eric M, 2015, a paper published by the American Family Physicians organization titled “Diagnosis of Acute stroke”, suggested that patients who presented with acute stroke symptoms must undergo either MRI or CT. However it emphasized more on the use of unenhanced CT as it is faster, more available, less expensive, and can be performed in persons with implanted devices (e.g., pacemakers) and in persons with claustrophobia. (Kennith S, 2015).

R. Wannamaker, Buck & K. Butcher, July 2019. A study titled "Multimodal CT in Acute Stroke" was conducted, aimed at proofing that Multimodal CT imaging (non-contrast CT, NCCT; CT angiography, CTA; and CT Perfusion, CTP) is central to acute ischemic stroke diagnosis and treatment. It concluded that Multimodal CT is a powerful imaging algorithm that is central to current ischemic stroke patient care. (Wannamaker,R. 2019).

Qiu W., Kuang H., Teleg E., 2020 an article published by a team of Neuroradiology physicians, titled "Machine Learning for Detecting Early Infarction in Acute Stroke with Non–Contrast-enhanced CT", supported the fact that using non- enhanced CT provided substantial diagnosis of acute ischemic stroke. It proofed that a machine learning approach for segmentation of infarction on non–contrast-enhanced CT images in patients with acute ischemic stroke showed good agreement with stroke volume on diffusion-weighted MRI scans.

This emphasizes the truth that NCCT results can indeed be as accurate as the MRI findings. (Qiu W, 2020)

Chapter Three

3.1 material and method

3.1.1 Study design:

An observational cross-sectional descriptive study was performed in Sudanese patents to assess acute stroke in adult patient using CT

3.1.2 Study area:

The study took place at Khartoum state.

3.1.3 Duration of study:

The study was initiated in February 2020 and concluded in May 2021

3.1.4 Sample size:

The study was applied on 60 adult patients collected according to the certain criteria

3.1.5 Sample type:

The sample was collected using the simple random probability type.

3.1.6 Inclusion criteria:

This study was including all adult patients above the age of 19 years. All patients were presented to the radiology department with sudden focal neurological deficit.

3.1.7 Exclusion criteria:

Patients below at the age of 19 and below and pregnant women were excludedfrom this study.

3.1.8 Tools of data collection:

Data collection sheet

Data were collected by carefully designed data sheet. The data sheet was designed for the purpose of this study.

It consists of biographic data which were gender and age. And clinical presentation which may contain weakness numbness visual and speech disturbances. Stroke data which may be ischemic or hemorrhagic, other part about radiographic appearance which may appear hyper or hypo dense and side of stroke.

3.2Technique:

3.2.1 Patient preparation:

The patient was given a gown and told to remove all piercings and jewelry. Patients were asked sign a consent form that detailed the risks and side effects associated with contrast media if it was used. They were allowed to eat, drink, andtake their prescribed medications prior to the exam. Diabetic patients were advisedto eat light breakfast or lunch three hours prior to the scheduled scan.

3.2.2 Patient Positioning:

The basic principles of skull positioning as used in conventional radiography alsoapply to computed tomography. For all cranial CT scans no rotation and no tilting of the head are important features so that any bilateral asymmetry due to pathologic processes can be determined.

- Each patient was asked to lie supine headfirst.
- Arms rested along the sides of the body.
- Head was immobilized using a head holder.

- Supporting pillow was placed under the head for more patient comfort.

3.2.3 Scanning protocol:

Routine non-contrast CT scan and CT Angiography .

Table 3.1 demonstrates the routine non-contrast CT scan protocol:

Scout Film	Lateral
Landmark	OML
Gantry tilt	From OM: 0º to 10º
Slice Plane	Axial
Breath Hold	None
Contrast Media	None
Start Location	Foramen Magnum
End Location	Vertex
Slice Thickness	4 mm

3.3 Method of Data analysis:

The data collected was symbolized, classified, and analyzed by computer usingsocial package for scientific statistic .

3.4 Ethical considerations:

Ethical clearance was obtained from Sudan university ethical committee and permission from hospitals.

Chapter Four

4.1 Results:

Table (4.1) Frequency distribution of age

Age	Frequency	Percentage
20-29	2	3.3%
30-39	4	6.7%
40-49	7	11.7%
50-59	11	18.3%
60-69	16	26.7%
70-79	9	15%
80-89	9	15%
90-99	2	3.3%
Total	60	100%

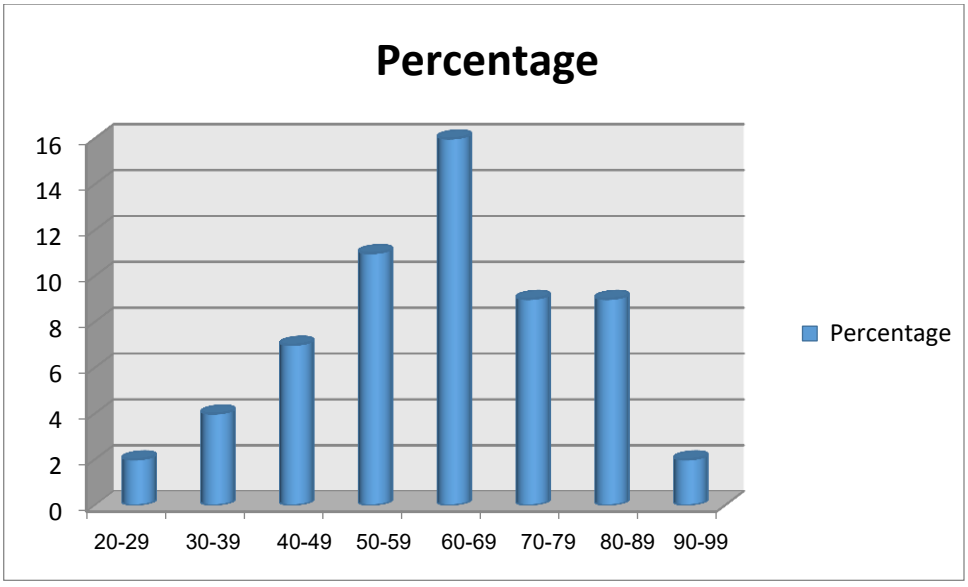

Figure (4.1) Percentage distribution of age

Table (4.2) Frequency distribution of gender

Gender	Frequency	Percentage
Male	38	63.3%
Female	22	36.7%
Total	60	100%

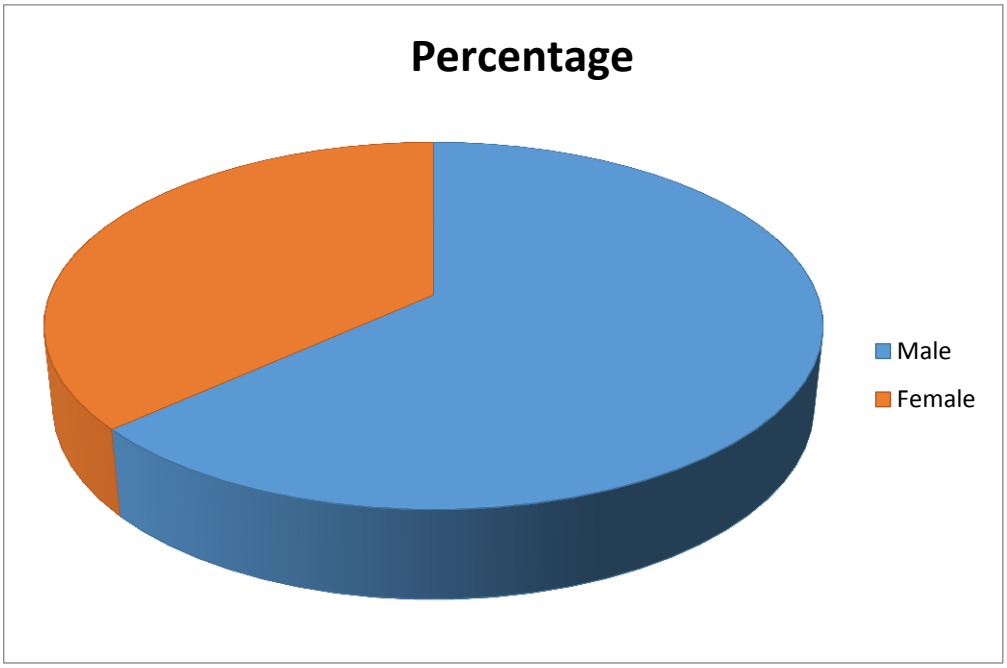

Figure (4.2) Percentage distribution of gender

Table (4.3) Frequency distribution of clinical symptoms

Clinical symptoms	Frequency	Percentage
Weakness and numbness	19	31.7%
Speech disturbance	4	6.7%
Visual and Speech disturbance	2	3.3%
Weakness and confusion	1	1.7%
Weakness and speech disturbance	2	3.3%
Visual disturbance	3	5%
Confusion	7	11.7%
Speech disturbance and confusion	1	1.7%
More than tow	8	13.3%
Other	13	21.6%
Total	60	100%

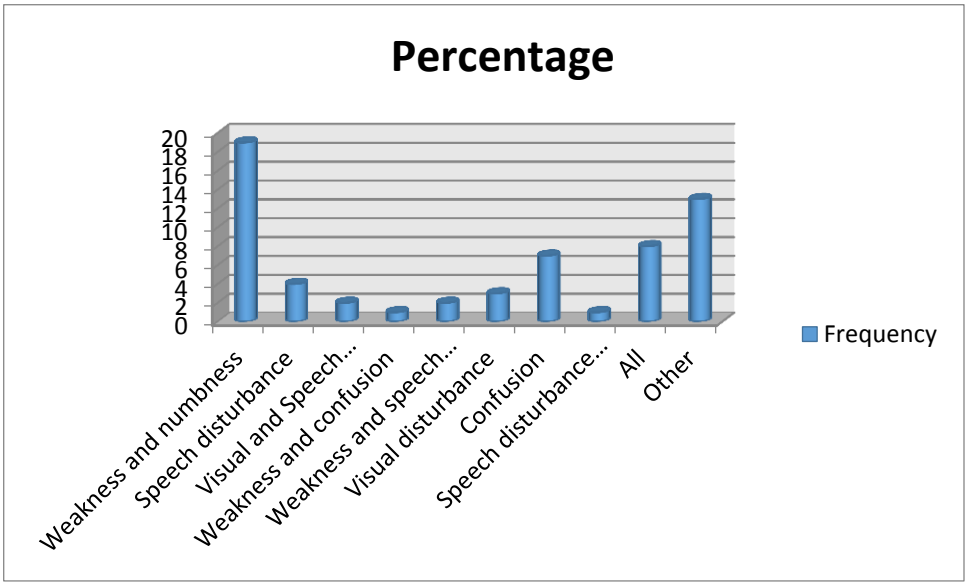

Figure (4.3) Frequency distribution of clinical symptoms

Table (4.4) Frequency distribution of stroke types

stroke types	Frequency	Percentage
Acute haemorrhagic stroke	20	33.3%
Acute ischemic stroke	40	66.7%
Total	60	100%

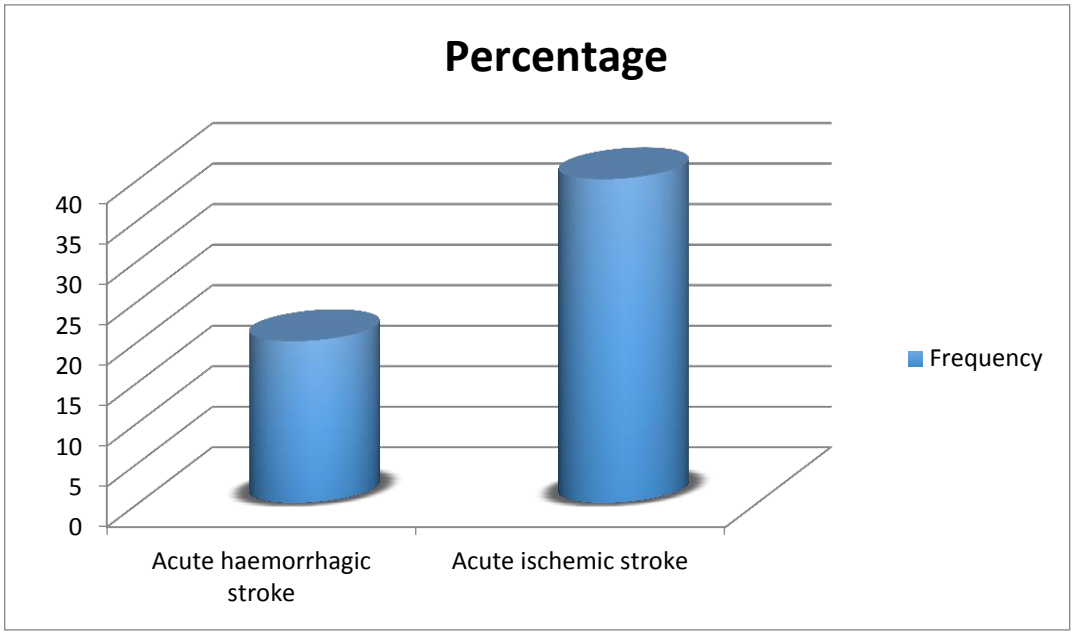

Figure (4.4) Frequency distribution of stroke types

Table (4.5) Frequency distribution of stroke site

Stroke site	Frequency	Percentage
Frontal	5	8.3%
Occipital	4	6.7%
More than one site	14	23.3%
Parital	19	31.7%
Rt.basal gangila	1	1.7%
Temporal	5	8.3%
Intracerebral	5	8.3%
Epi dural	2	3.3%
Basal gangila	5	8.3%
Total	60	100%

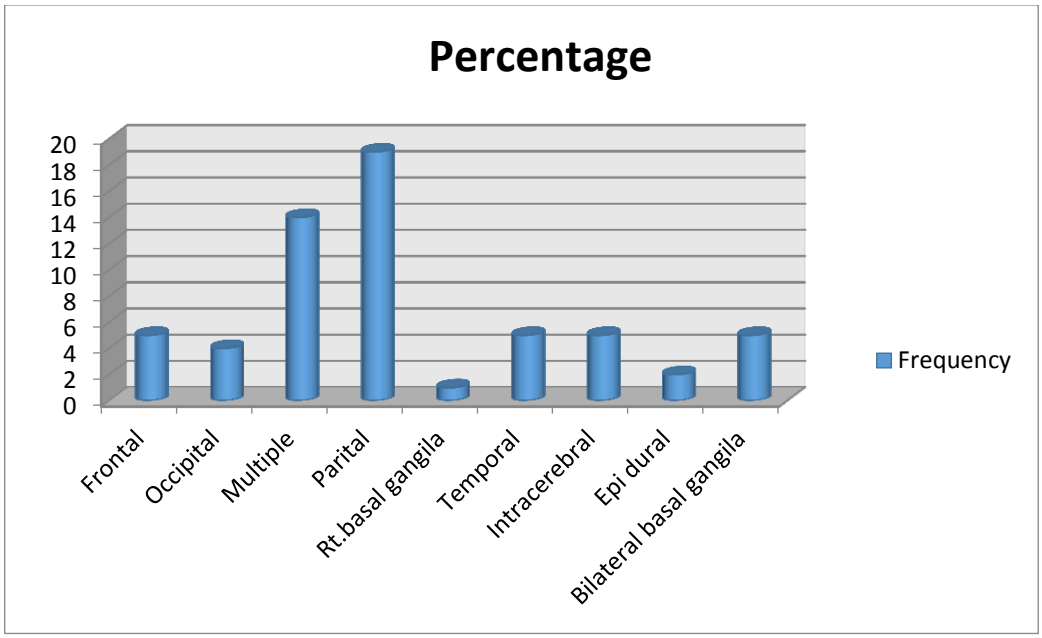

Figure (4.5) Frequency distribution of stroke site

Table (4.6) Frequency distribution of risk factor

Risk factor	Frequency	Percentage
Diabetic	9	15%
Hypertension	39	65%
Hypertension and diabetic	2	3.3%
History of stroke	10	16.7%
Total	60	100%

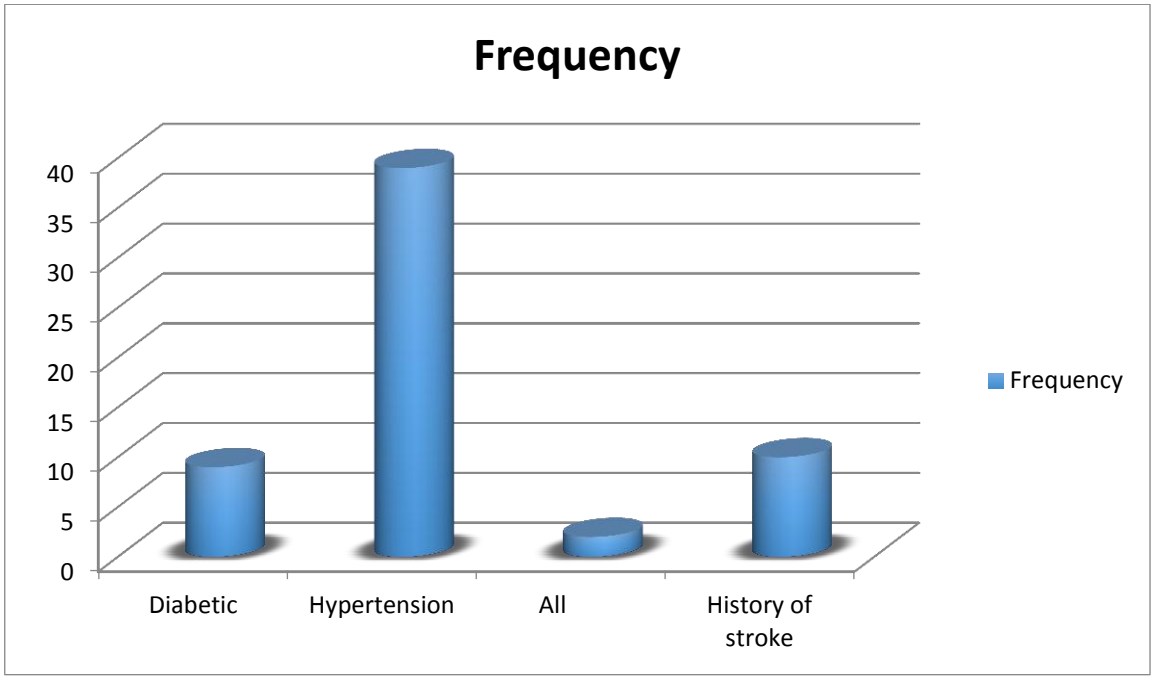

Figure (4.6) Frequency distribution of risk factor

Table (4.7) Frequency distribution of appearance

Appearance	Frequency	Percentage
Hyper dense area	20	33.3%
Hypo dense area	40	66.7%
Total	60	100%

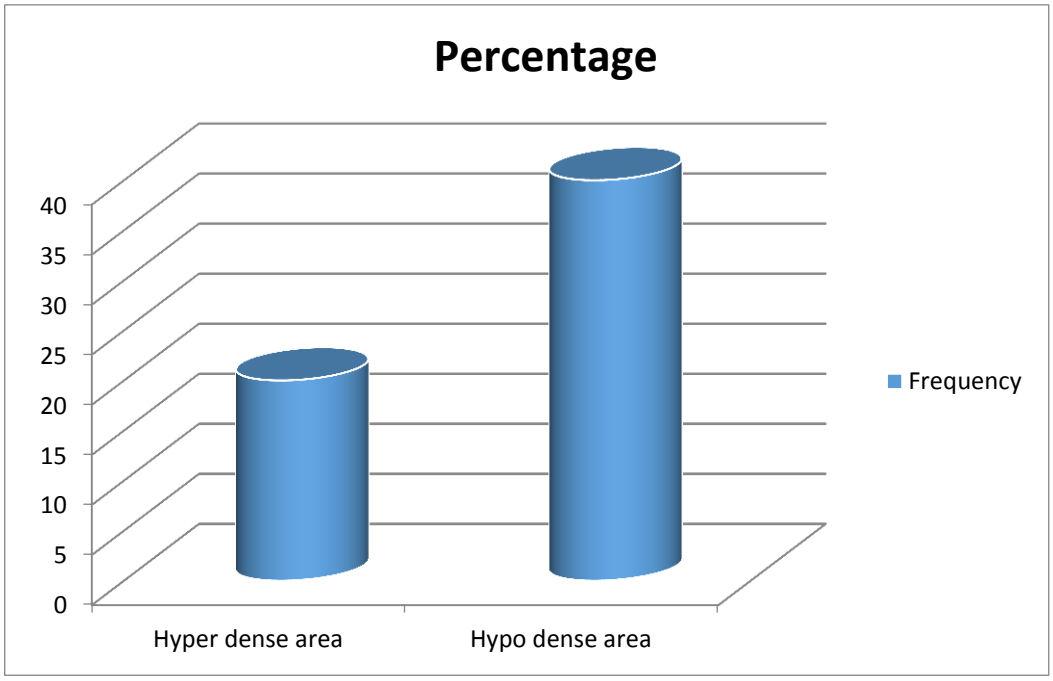

Figure (4.7) Frequency distribution of appearance

Chapter Five

Discussion, conclusion and Recommendation

5.1 Discussion:

This study was carried on a sample of (60) patients of both genders (22females, 38 males). It was evident that acute stroke is more common in males thanfemales with a rate of incidence 63.3% as opposed to 36.7%. Patients within the age criteria of 60-69 years old presented an elevated rate risk of having acute stroke resembled as 26.7% among the rest of age groups, while patients within the age of 20-29 years old had the least common rate of occurrence (3.3%).

In the clinical presentation distribution (Fig4.3), the most common symptoms included weakness or numbness presenting 31.7%, followed by others such as: facialdeviation, dyspnea, pain and headache (22%). For the least common symptom, only 1.7% of the sample was admitted for speech disturbances and confusion.

When clinical history was taken from each patient, a risk factor distribution chart was constructed (Fig4.6). It showed that patients with hypertension resembled the highest risk of developing acute stroke (65%) while the ones with diabetic , had the lowest risk of occurrence (15%) and a very rare condition that combined all mentioned risk factors illustrated in Table 4.6 (Fig4.6) was resembled by the percentage of 3.3%.

Regarding the appearance distribution (Fig4.7), it was apparent that acute strokes with hypodens areas were more common with a percentage of 66.7% in comparison to the less common appearance which was hyper dense areas representing only 33.3% of the total sample. The location distribution proved the accuracy and sensitivity of CT as suggested by

Biesbroek J.M.Niesten J, and it ` demonstrated that stroke was mostly located in both parietal lobes (31.7%) and are rarely detectedin the basal ganglia (1.7%).

Finally, the final diagnostic findings illustrated in the diagnosis distribution chart (Fig4.4) were evident that acute ischemic strokes have a higher rate of incidence in both genders (66.7%) while acute hemorrhagic strokes has a lower rateof incidence among both genders (33.3%).This result comes in agreement with the first study that stated :CT has a very high specificity and accuracy in detecting infarctions(Biesbroek J.M.,2013),which are indication to confirm the presence of an ischemic stroke. An emphasis on the use of unenhanced Ct for detection of strokes in the second study was precise (Kennith S,Eric M,2015)

The result of this study approved that CT is indeed an optimum imaging technique, which should be used for detection of acute stroke including its two types, hemorrhagic and ischemic.

5.2 Conclusion:

In summary, Acute stroke has higher rate of incidence in males. All patients admitted to the hospital for weakness or numbness. Facial deviation, pain, and dyspnea are most likely subjects of acute stroke. And patient with history of hypertension are at higher risk of having acute stroke.

Acute stroke is better diagnosed using unenhanced CT protocol.

Acute ischemic stroke is the most common type of acute stroke presenting a higher prevalence compared to hemorrhagic stroke.

And it’s usually appear as a hypo dense area.

Finally, the results conducted from the study emphasize on the importance of using CT as primary tool for the investigation of acute stroke with in Khartoum population in addition to other population in the previously mentioned studies.

5.3 Recommendation:

It is advised to use CT for the investigation of acute stroke as it clearly presented significant findings. It can detect both types of acute stroke, hemorrhagic and ischemic, very accurately. Also, recommended to explore the partial lobes especially in transverse and sagittal sections for infarcts or other signs of this pathology. A CTP or CTA protocol should be used for more details . MRI is more time consuming and less available than CT but has significantly higher sensitivity and specificity in the diagnosis of acute ischemic infarction in the first few hours after onset.

Reference:

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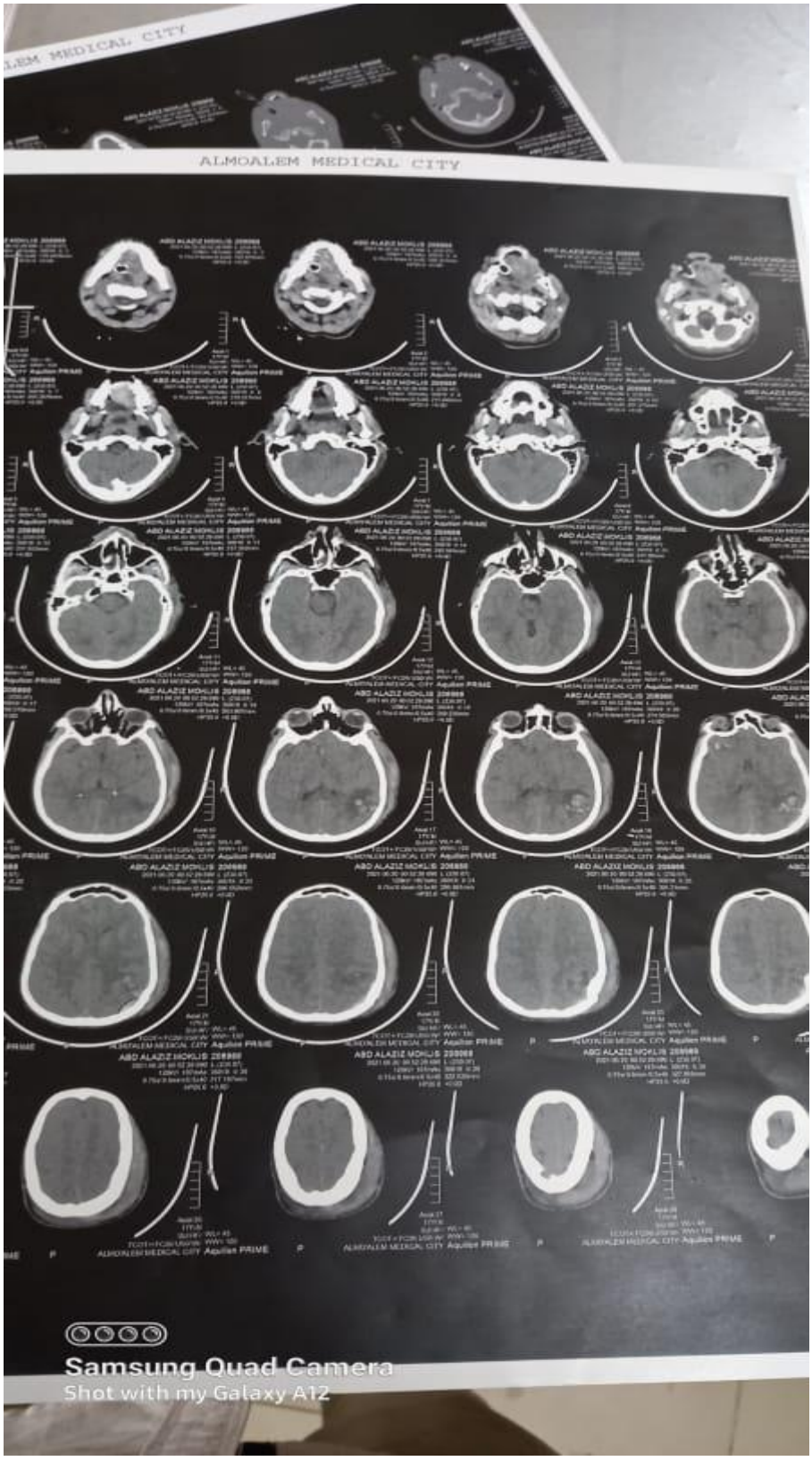
APPENDIX

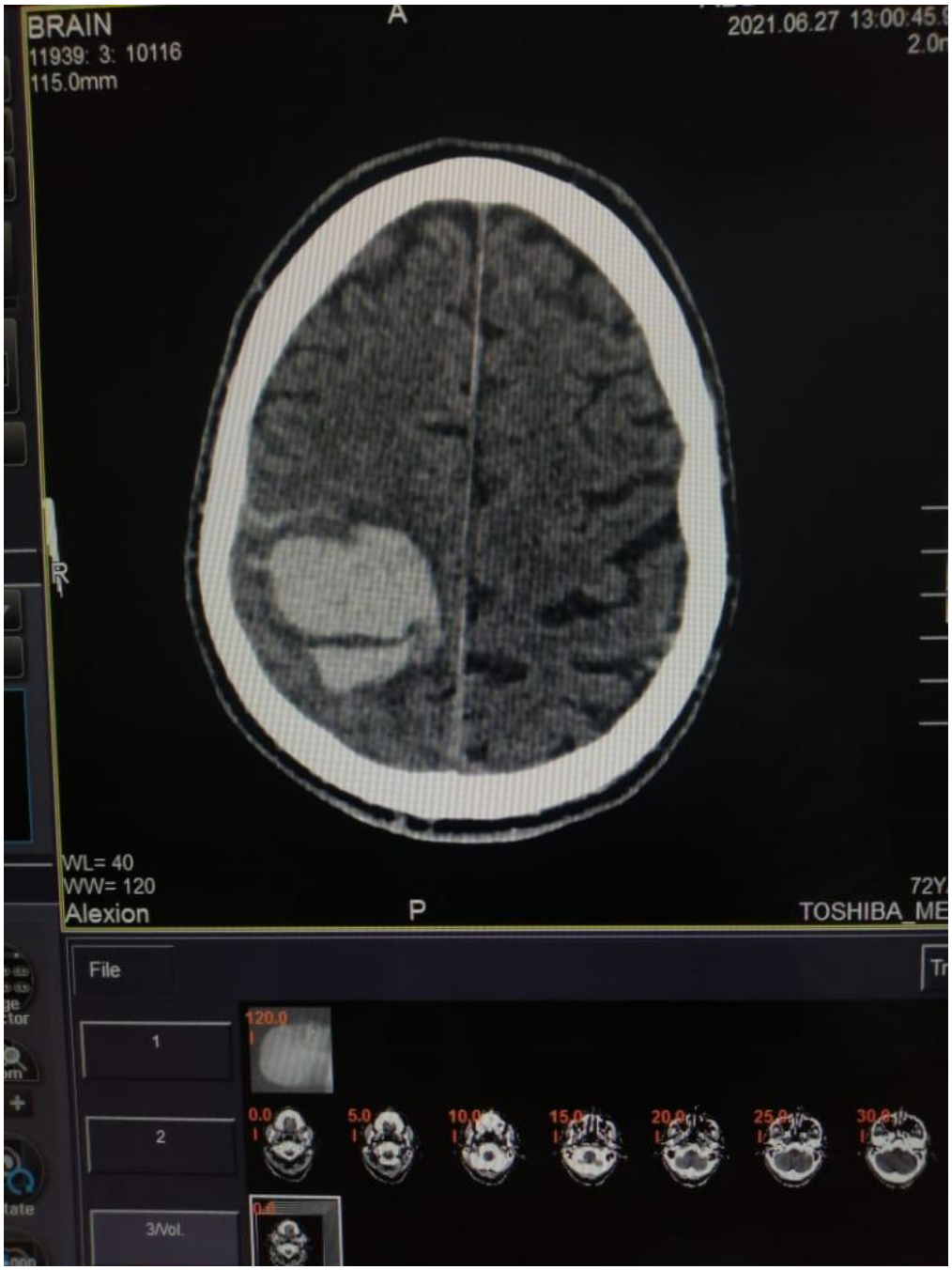
Appendix 1

No	Pt Data			Stroke date		Appended			Site
	Gender	Age	Clinical symptoms	Hemohregic	Ischemic	Iso	Hypo	Hyper	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

Appendix 2


ALMOALEM MEDICAL CITY
Samsung Quad Camera
Shot with my Galaxy A12

Appendix 3


BRAIN
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115.0mm
A
2021.06.27 13:00:45
2.0
R
WL= 40
WW= 120
Alexion
P
TOSHIBA_ME
File
1
2
3/Vol.
120.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0

Appendix 4