



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Sudan University of Science & Technology

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Radiographic Finding of Cerebral Angiogram

نتائج التصوير الإشعاعي للأوعية الدماغية

A Thesis Submitted for Partial Fulfillment of the Award of M.Sc. Degree in
Medical Diagnostic Radiology

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الآية

قال تعالى:

﴿نَرْفَعُ دَرَجَاتٍ مِّنْ نَّشَأٍ وَفَوْقَ كُلِّ ذِي عِلْمٍ عَلِيمٌ﴾

صدق الله العظيم

Dedication

*To my father, mother, sisters,
Brothers, friends, colleagues
And my Teachers.*

Acknowledgment

First of all thank to Almighty Allah for giving me the knowledge and strength to complete this dissertation.

I would like to express my deep gratitude to my supervisor Dr.Ekhlaz Abd Alaziz , for her keen supervision, encouragement and support through this work.

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List of abbreviation

SAH	Subarachnoid hemorahaege
AVM	Arterial malformation
CTA	Computed tomography angiography
DSA	Digital subtracted angiography
CNS	Central nervous system
3D	Three dimintinal
ICA	Internal caroted artery
CSF	Cerebrospinal fluid
VA	Vertebral artery
BA	Basilar artery
ANS	Autonomic nervous system
ADH	Antidiuretic hormone
CN	Cranial nerve
MS	Multiple sclerosis
MIP	Maximum intensity projection
MPR	Multi planner reformation

Abstract

The study was a retrospective study of angiographic findings in ICA problems, this study was conducted in Khartoum state of Sudan in Royal international Hospital Stroke and Vascular Center from March 2016 to February 2017, the problem of the study was the increasing in ICA problems in various age, the study was aimed to find out the finding of cerebral angiogram, and identify whether Angiography can lead to accurate diagnoses of cerebral diseases, the data was collected from 45 patients classified and analyzed using SPSS and found that diagnosed as aneurysm 40% in the study and 37.8 AVM 13.3 SAH 4.4 fistula 4.4 stenosis. After the diagnosis they were treated by 24.4 coiling 17.8 embolization 15.6 stent 13.3 gamma knife 8.9 anti platelet therapy 4.4 dissection. The percentage of the female is greater than the male in cerebral angiography the age group of (20-70) were more exposed to ICA disease and the study was recommended that further studies should be included and pick the rare cerebrovascular pathologies that were not encountered in this study..

الخلاصة

أجريت الدراسة الوصفية على نتائج تصوير الأوعية الدموية في الشريان السباتي الداخلي، وقد أجريت هذه الدراسة في ولاية الخرطوم في السودان في مستشفى رويال كير العالمية ومركز الاوعية والشرايين من مارس 2016 إلى فبراير 2017، وكانت مشكلة الدراسة تزايد في مشاكل السباتي الداخلي في مختلف الأعمار ، وقد هدفت الدراسة إلى معرفة النتائج التي توصل إليها تصوير الأوعية الدماغية، وتحديد ما إذا كان يمكن أن يؤدي التصوير الشعاعي إلى تشخيص دقيق للأمراض الدماغية، جمعت البيانات من 45 مريضا تم تصنيفها وتحليلها باستخدام برنامج الحزم الاحصائية وجدت أن تشخيصها تمدد الأوعية الدموية 40% في الدراسة و 37.8 تشوه الاوعية الخلقى 13.3 النزيف الداخلي 4.4 ناسور 4.4. ونسبة الإناث أكبر من الذكور في تصوير الأوعية الدماغية الفئة العمرية (20-70) أكثر عرضة ، وأوصت الدراسة أنه ينبغي أن تشمل المزيد من الدراسات واختبارات أمراض القلب والأوعية الدموية التي لم تصادف في هذه الدراسة .

Chapter one

Introduction

1.1 Introduction

Angiography is a minimally invasive medical test that uses x-rays and an iodine-containing contrast material to produce pictures of blood vessels in the brain. In cerebral angiography, a thin plastic tube called a catheter is inserted into an artery in the leg or arm through a small incision in the skin. Using x-ray guidance, the catheter is navigated to the area being examined. Once there, contrast material is injected through the tube and images are captured using ionizing radiation (x-rays). Cerebral angiography is also called intra-arterial digital subtraction angiography (IADSA). This phrase refers to acquiring the images electronically, rather than with x-ray film. The images are electronically manipulated so that the overlying bone of the skull, normally obscuring the vessels, is removed from the image resulting in the remaining vessels being clearly seen.

Cerebral angiography uses a catheter, x-ray imaging guidance and an injection of contrast material to examine blood vessels in the brain for abnormalities such as aneurysms and disease such as atherosclerosis (plaque). The use of a catheter makes it possible to combine diagnosis and treatment in a single procedure. Cerebral angiography produces very detailed, clear and accurate pictures of blood vessels in the brain and may eliminate the need for surgery.

The procedure used to help diagnose the cause of symptoms, such as severe headaches slurred speech dizziness blurred or double vision weakness or numbness loss of coordination or balance.

1 2Problem of the study

Increasing of the (ICA)problems and SAH in various age with symptomatic and asymptomatic conditions .

1.3 Objectives

1.3.1 General objectives:

To study Angiographic finding of cerebral angiogram in Sudanese .

1.3.2 Specific Objectives:

- To evaluate arteries of the head and neck before surgery.
- To provide additional information on abnormalities seen on MRI or CT of the head, such as the blood supply to a tumor.
- To prepare for other medical treatment, such as in the surgical removal of a tumor.
- In preparation for minimally invasive treatment of a vessel abnormality.

1.4 overview of the study

This study divided into five chapters chapter one include introduction objectives statement of the problem chapter tow include literature review and anatomy physiology and pathology and previous studys chapter three include material and methods chapter four results chapter five discussion and recomendation and conclusion ,refrances,and apendex .

CHAPTER TWO

Literature review

2.1 Central nervous system

The human central nervous system (CNS), having been evolved over the last 600 million years, is the most complex living organ in the known universe. It has been extensively investigated over centuries, and a vast body of materials has been gathered in the print form and more recently also in electronic format.

Neuroanatomy is presented in numerous textbooks, print brain atlases and electronic brain atlases. Several textbooks combine text with atlases, and some provide neuroanatomy for various specialties including neurosurgery, neuroradiology, neurology, and neuroscience. The comprehension of neuroanatomy is crucial in any neurosurgical, neuroradiological, neurooncological, or neurological procedure. Therefore, CNS anatomy has been intensively studied by generations of neuroanatomists, neurosurgeons, neurologists, neuroradiologists, neurobiologists, and psychologists, among others, including Renaissance artists. This resulted, however, in neuroanatomy discrepancies, inconsistencies, and even controversies among various communities in terms of parcellation, demarcation, grouping, terminology, and presentation. Williams et-al (2009)

2.1.1 Structural (Gross) Neuroanatomy:-

parcellation of the brain was presented in 3D followed by sectional neuroanatomy. The stereotactic target structures and functional (Brodmann's) areas also are outlined. Parthenon, Lancaster (2001)

2.1.2 Brain Parcellation

The CNS consists of the brain and the spinal cord. The brain encases the fluid-filled ventricular system and is parcellated into three main components

(Fig. 2.1a): Cerebrum, Cerebellum (the little brain), Brainstem.

The cerebrum comprises: Left and right cerebral hemispheres Interbrain between the cerebrum and the brainstem termed the diencephalon.

Deep gray nuclei the cerebral hemispheres are the largest compartment of the brain and are interconnected by white matter fibers (see Sect. 2.4.2). The hemispheres are composed of: Outer gray matter termed the cerebral cortex Inner white matter encompassing the deep gray nuclei. Parthenon, Lancaster (2001)

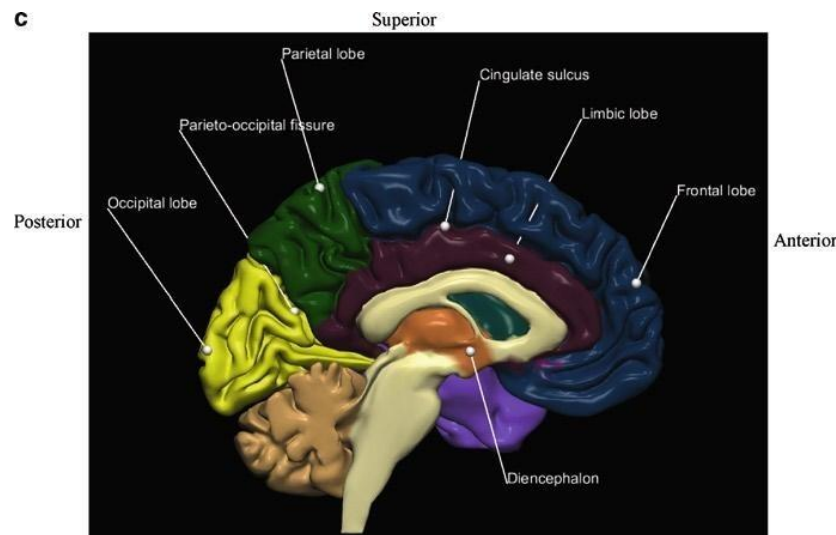


Fig. 2.1 Gross anatomy of the left cerebral hemisphere. Afshar, Watkins,etal Atlas of the Human Brainstem and Cerebellar Nuclei. Raven, New York (1978)

The gray matter contains mainly nerve cell bodies, while the white matter is made up predominantly of nerve fibers (axons). The cerebral cortex is highly convoluted. The folds form gyri that are separated by grooves called sulci or fissures (deep sulci). The cerebral hemispheres are parcellated into five lobes (Fig. 2.1b, c): Frontal lobe, Temporal lobe, Parietal lobe, Occipital lobe and Limbic lobe.

The insula is sometimes classified as the central or insular lobe. The lobes are partly demarcated by the sulci/fissures, Fig. 2.1. The central sulcus separates the frontal lobe anterior from the parietal lobe posterior, Fig. 2.1b. The Sylvian (lateral) fissure demarcates the temporal lobe below from the

frontal and parietal lobes above, Fig. 2.1b. The parieto-occipital fissure separates the parietal lobe anterior from the occipital lobe posterior, Fig. 2.1c. The cingulate sulcus separates the frontal lobe above from the limbic lobe below, Fig. 2.1c. The diencephalon contains (Fig. 2.1c):Thalamus, Subthalamus including the subthalamic nucleus Hypothalamus. 7th edn. Lippincott Williams & Wilkins, Baltimore (2008)

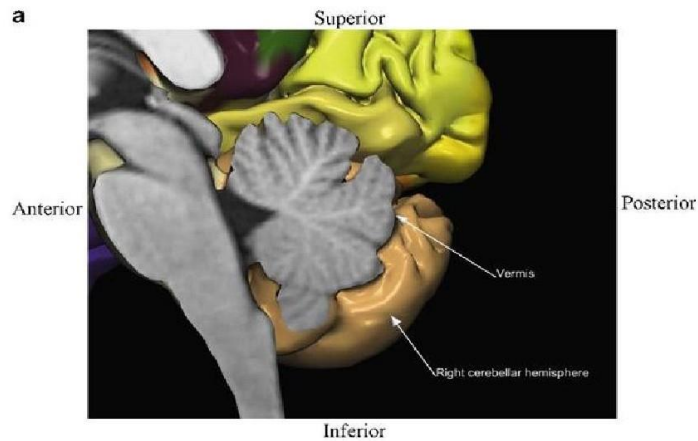
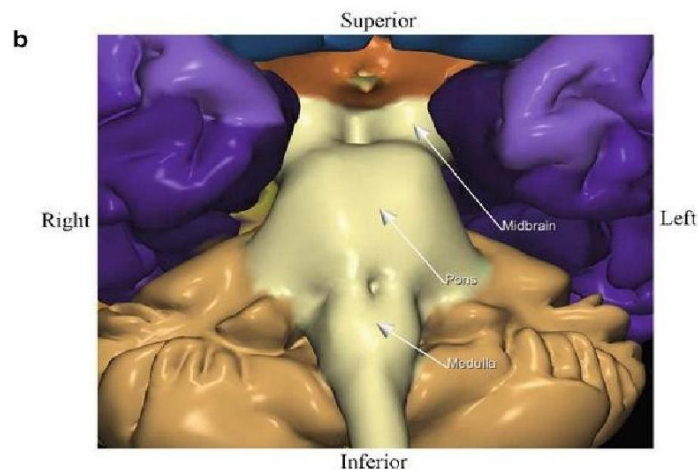


Fig. 2.2 Cerebellum and brainstem, cerebellum (medial view) Afshar, Watkins,etal Atlas of the Human Brainstem and Cerebellar Nuclei. Raven, New York (1978)

Left and right cerebellar hemispheres, vermis which unites them.The brainstem is subdivided into (Fig. 2.2b): Midbrain , Pons, Medulla



(Fig. 2.2b) (b) midbrain, pons, and medulla of the brainstem. Afshar, Watkins,etal Atlas of the Human Brainstem and Cerebellar Nuclei. Raven, New York (1978)

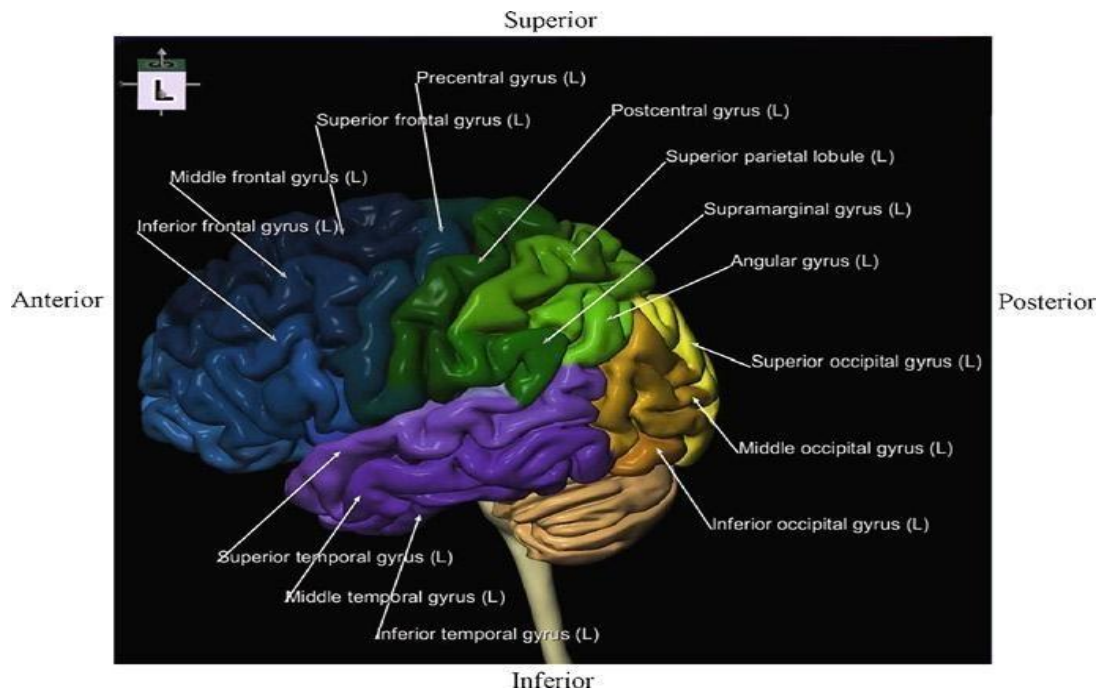


Fig. 2.3 Cortical areas of the left (L) hemisphere: lateral view. The orientation cube in the top-left corner indicates the viewing direction (L left; R right; S superior (dorsal); I inferior (ventral); A anterior; P posterior). Each gyrus is assigned a unique color. Afshar, Watkins, et al Atlas of the Human Brainstem and Cerebellar Nuclei. Raven, New York (1978)

2.1.3 Cortical Areas

The cortex has three surfaces: lateral, medial, and inferior (also called basal or ventral). Moreover, the transitional areas form the frontal, temporal, and occipital poles. Williams & Wilkins, Baltimore (2008)

2.1.4 Lateral Surface

Four lobes are present on the lateral surface: frontal, temporal, parietal, and occipital, Fig. 2.1b. The lateral surface of the frontal lobe is subdivided by three sulci (superior frontal sulcus, inferior frontal sulcus, and precentral sulcus) into four gyri.

Superior frontal gyrus, Middle frontal gyrus, Inferior frontal gyrus and Precentral gyrus.

The lateral surface of the temporal lobe is subdivided by two sulci (superior

temporal sulcus and inferior temporal sulcus) into three gyri
Superior temporal gyrus, Middle temporal gyrus, Inferior temporal gyrus

The lateral surface of the parietal lobe is subdivided by the intraparietal sulcus into three gyri.

Postcentral gyrus, Superior parietal gyrus (lobule), Inferior parietal gyrus (lobule), Supramarginal gyrus – Angular gyrus.

The lateral surface of the occipital lobe is subdivided by two sulci (superior occipital sulcus and inferior occipital sulcus) into three gyri.

Williams & Wilkins, Baltimore (2008).

2.1.5 Medial Surface

The frontal, parietal, occipital, and limbic lobes are present on the medial surface, Fig. 2.1c. The limbic lobe contains the gyri located at the inner edge (or limb) of the hemisphere including Subcallosal gyrus (area), Cingulate gyrus, Isthmus (of cingulate gyrus), Parahippocampal gyrus. The superior frontal gyrus (separated from the limbic lobe by the cingulate sulcus, occupies most of the medial surface of the frontal lobe, Fig. 2.4. The parietal lobe includes the precuneus, Fig. 2.4 (separated from the occipital lobe by the parieto-occipital fissure, Fig. 2.1c). The occipital lobe comprises the cuneus and the lingual gyrus, Fig. 2.4.

2.2 Inferior Surface

The inferior surface includes the frontal, temporal, and occipital lobes.

The frontal lobe comprises (Fig. 2.5): Straight gyrus

Orbital gyri parcellated by the approximately H-shape sulcus into the anterior, medial, lateral, and posterior orbital gyri. Williams & Wilkins, Baltimore (2008)

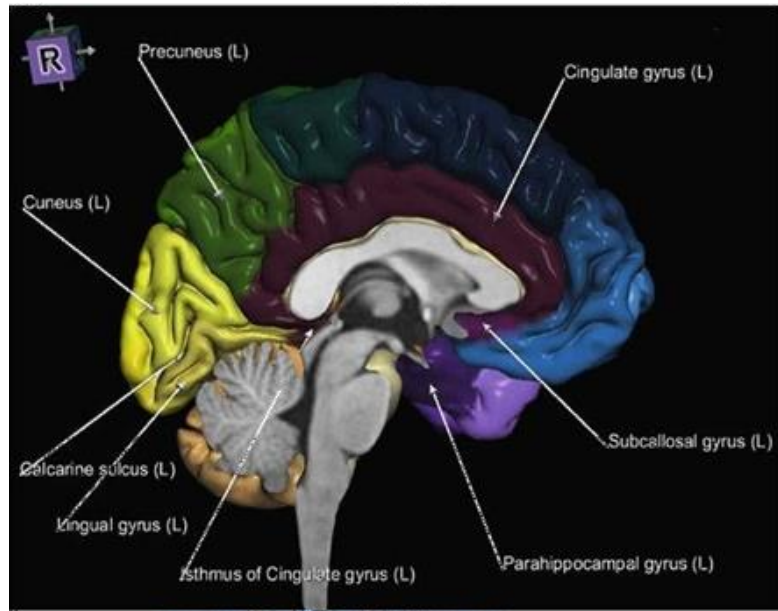


Fig. 2.4 Cortical areas of the left hemisphere: medial view Afshar, Watkins,etal Atlas of the Human Brainstem and Cerebellar Nuclei. Raven, New York (1978

Medial occipitotemporal gyrus whose temporal part constitutes the parahippocampal gyrus and the occipital part the lingual gyrus.

Inferior temporal gyrus The lingual gyrus is separated from the cuneus by the Lateral occipitotemporal gyrus (called also the fusiform gyrus) calcarine sulcus (fissure).

2.2.1 Deep Gray Nuclei

The deep gray nuclei are paired gray matter structures. The main deep gray nuclei (Fig. 2.5):

Basal ganglia (nuclei) include :-

Lentiform nuclei, Caudate nucleus, Putamen, Globus pallidus, Lateral (or outer) segment , Medial (or inner) Thalamus, Hippocampus Amygdala (amygdaloid body) The lentiform nuclei and the caudate nucleus form the striatum. Williams & Wilkins, Baltimore (2008)

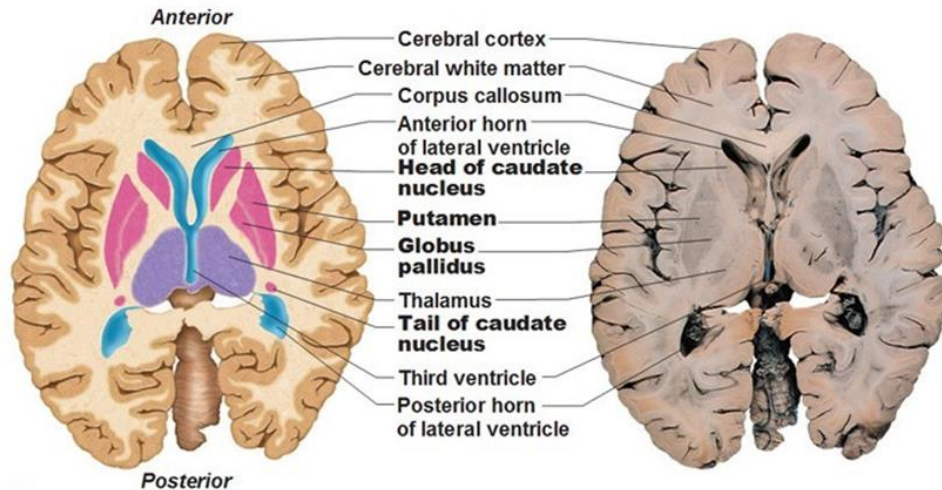


Fig. 2.5 Planar neuroanatomy in axial orientation show deep gray nuclei
 Afshar, Watkins,etal Atlas of the Human Brainstem and Cerebellar Nuclei.
 Raven, New
 York (1978)

2.2.2 Ventricular System

The ventricular system contains four interconnected cerebral ventricles (cavities) filled with cerebrospinal fluid (CSF) (Fig. 2.7a):

left and right lateral ventricles, Third ventricle, Fourth ventricle

CSF is secreted mainly in the choroid plexus (a network of vessels) and circulates from the lateral ventricles through the paired interventricular foramina (of Monro) to the third ventricle, and then via the aqueduct to the fourth ventricle, Fig. 2.7a. The lateral ventricles are the largest and each contains Williams & Wilkins, Baltimore (2008)

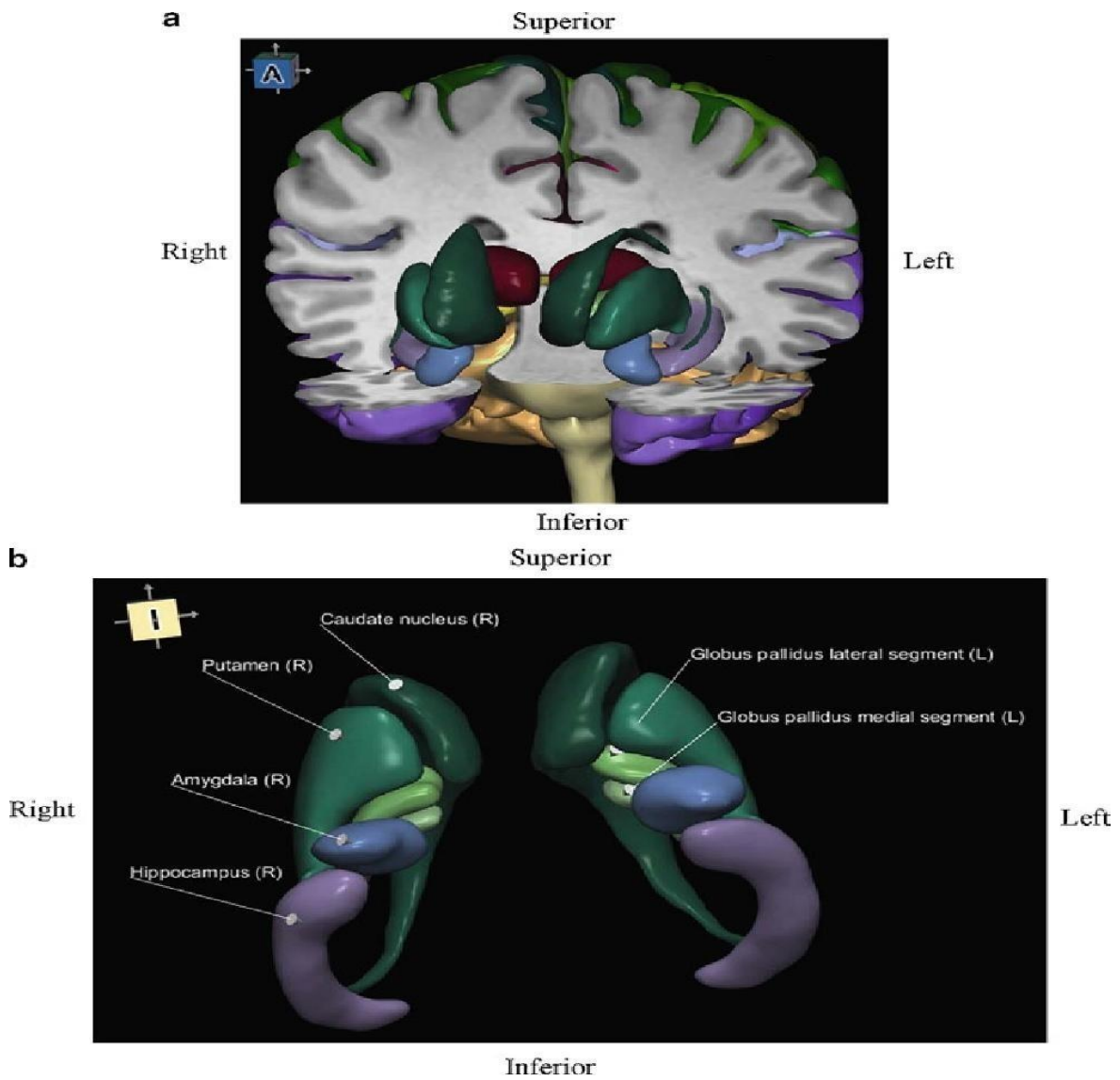


Fig. 2.6 Deep gray nuclei: (a) embedded into the brain; (b) shown in isolation
 Body (or central portion), Atrium (or trigon) Horns Frontal (anterior) ,Occipital
 (posterior) , Temporal (inferior)

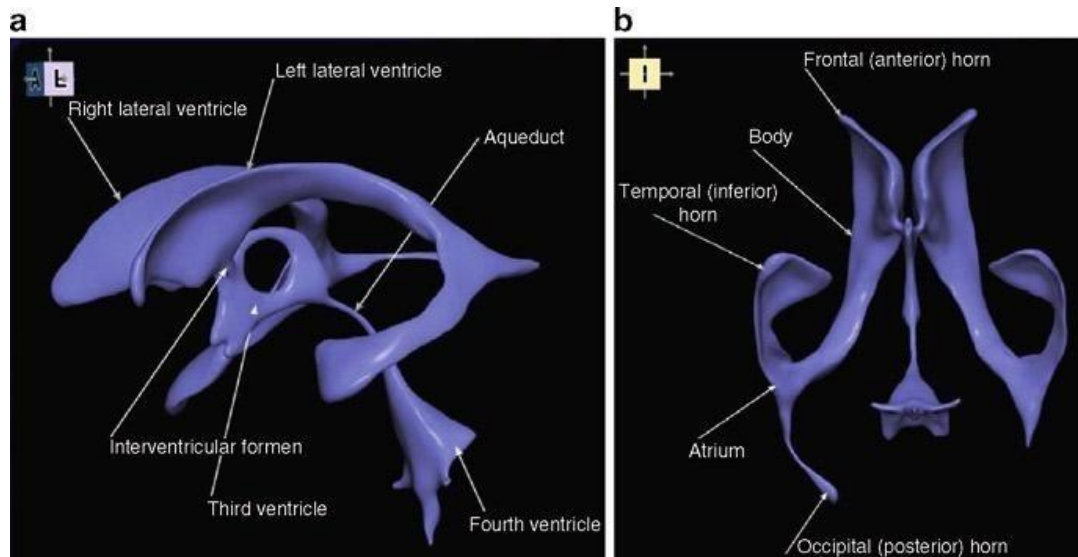


Fig. 2.7 Ventricular system: (a) interconnected ventricles; (b) components of the lateral ventricle Afshar, Watkins, et al Atlas of the Human Brainstem and Cerebellar Nuclei. Raven, New York (1978)

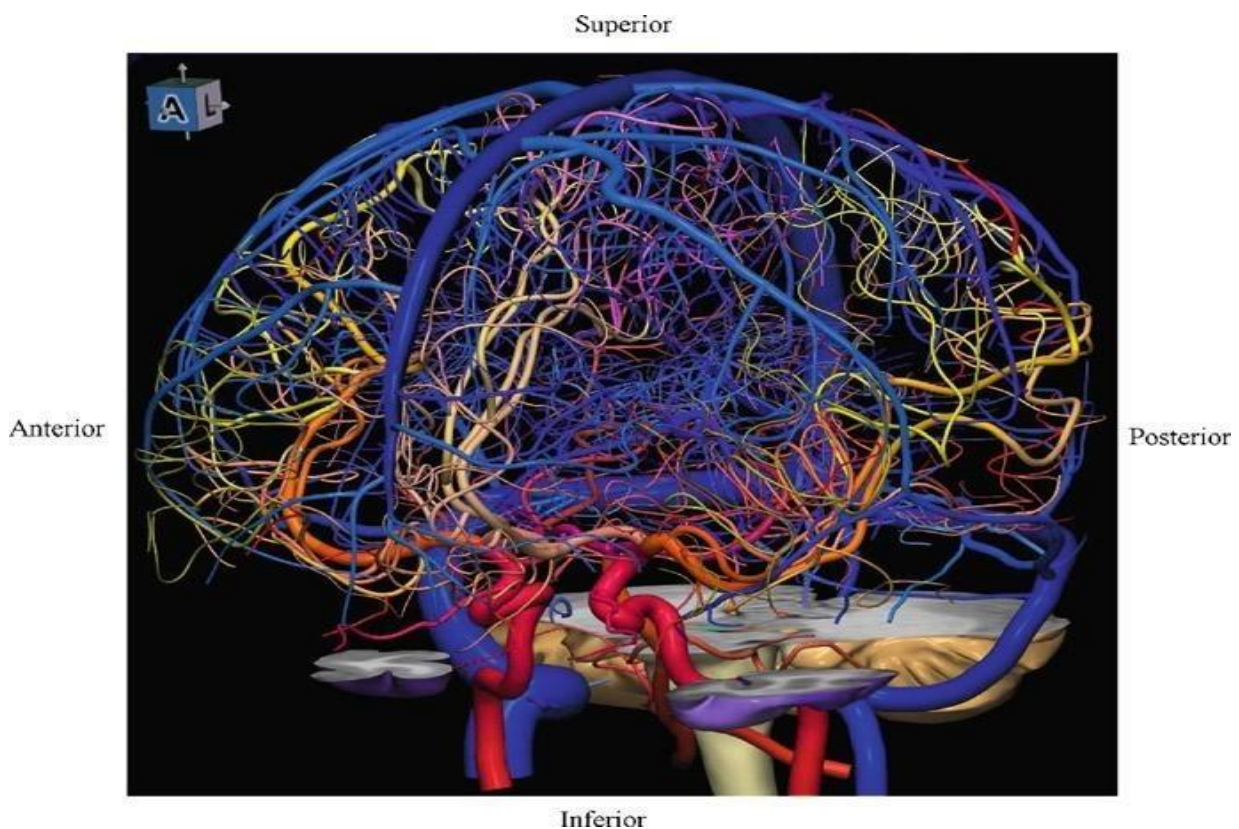


Fig. 2.8 The cerebral vasculature with arteries, veins, and dural sinuses. The vessels are uniquely color-coded such that all vessels with the same name have the same color. Diamond, . , Fusco, et al : Structure of the Human Brain. A Photographics Atlas, 3rd edn. Oxford University Press, New York (1989))

2.2.3 Arterial System

2.2.4 Parcellation of Arterial System

The brain is supplied by two pairs of arteries:

left and right internal carotid arteries anteriorly, left and right vertebral arteries posteriorly forming the basilar artery (Fig. 2.9a) interconnected by the circle of Willis. The internal carotid artery (ICA) branches into the anterior cerebral artery (Fig. 2.9c) and the middle cerebral artery (Fig. 2.9d). The left and right posterior cerebral arteries originate from the basilar artery. Williams & Wilkins, Baltimore (2008)

2.2.5 Anterior Cerebral Artery

The anterior cerebral artery has the following main branches (Fig. 2.18):

A1 segment (precommunicating part), A2 segment (post communicating part) Pericallosal artery, Callosomarginal artery.

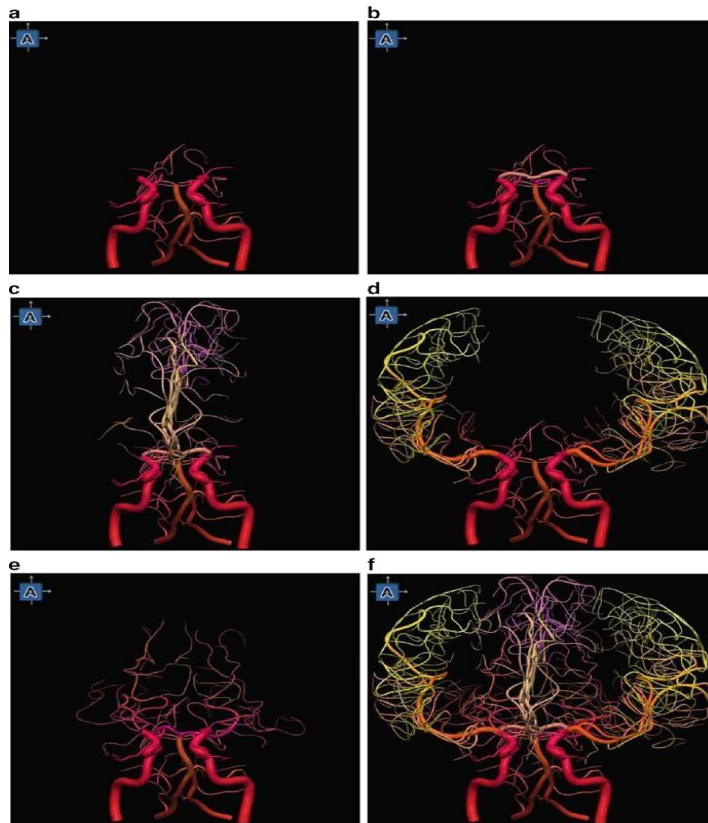


Fig. 2.9 The cerebral arteries: (a) blood supply to the brain by the internal carotid artery (ICA) anteriorly, and the vertebral artery (VA) and the basilar artery (BA) posteriorly; (b) ICA and VA connected by the circle of Willis; (c) anterior cerebral artery along with the ICA, VA, and BA; (d) middle cerebral artery along with the ICA, VA, and BA; (e) posterior cerebral artery along with the ICA, VA, and BA; (f) complete arterial system. Diamond, , Fusco, etal : Structure of the Human Brain. A Photographics Atlas, 3rd edn. Oxford University Press, New York (1989)

2.2.6 Middle Ce rebral Artery

The middle cerebral artery is subdivided into four segments (Fig. 2.19a): M1 segment (sphenoid part), M2 segment (insular part), M3 segment (opercular part) , M4 segment (terminal part) Its main branches for the left hemisphere are shown in Fig. 2.19b. Williams & Wilkins, Baltimore (2008)

2.2.7 Posterior Cerebral Artery

The posterior cerebral artery is parcellated into four segments (Fig. 2.20): P1 segment (precommunicating part), P2 segment (postcommunicating part) P3 segment (lateral occipital artery) ,P4 segment (medial occipital artery)

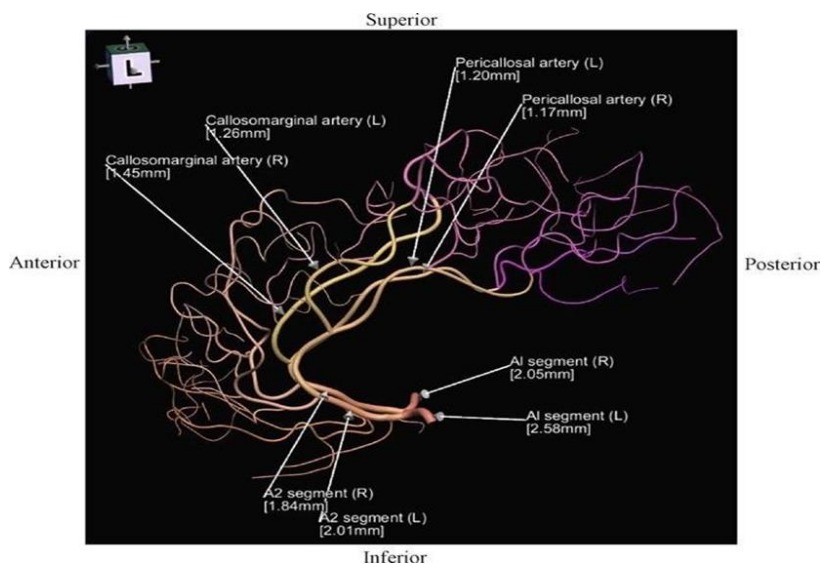


Fig. 2.10 show cerebral arteries Diamond,., Fusco, etal : Structure of the Human Brain. A Photographics Atlas, 3rd edn. Oxford University Press, New York (1989))

2.3 Circle of Willis

The circle of Willis connects the anterior and posterior circulations. It includes the following vessels.

Anterior communicating artery , Part of the left and right internal carotid arteries Left and right posterior communicating arteries , Left and right A1 segments of the anterior cerebral arteries and Left and right P1 segments of the posterior cerebral arteries. Williams & Wilkins, Baltimore (2008)

2.4 Venous System

2.4.1 Parcellation of Venous System

The main components of the venous system are Dural sinuses.

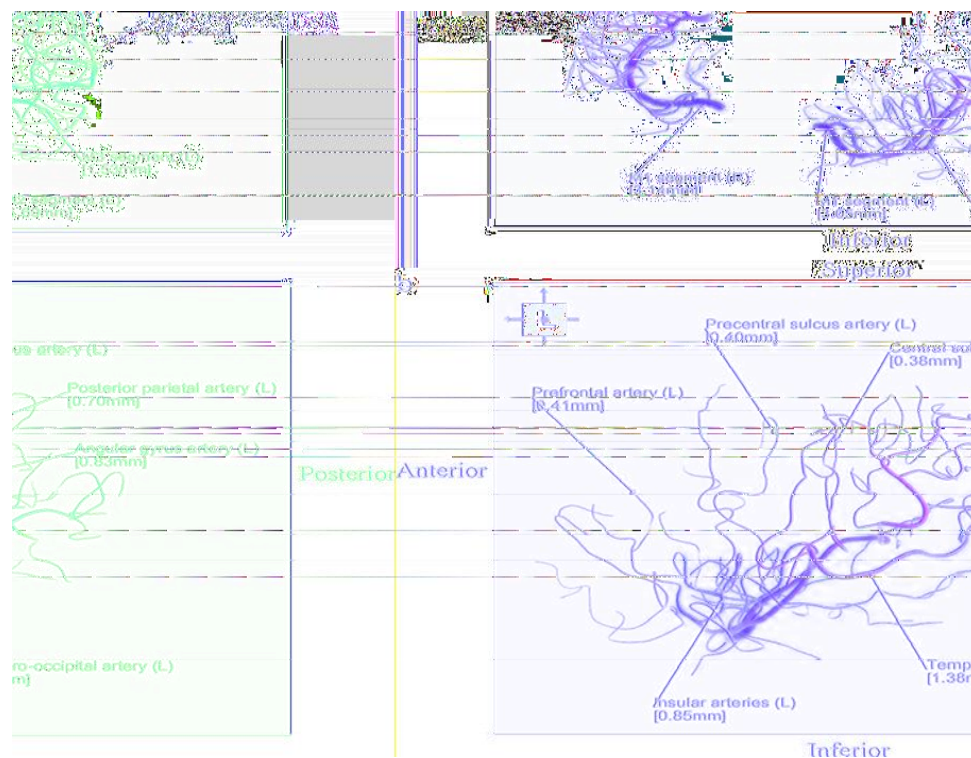


Fig. 2.11 Middle cerebral artery: (a) M1, M2, M3, and M4 segments; (b) main branches of the left hemisphere. Diamond, . , Fusco, etal : Structure of the Human Brain. A Photographics Atlas, 3rd edn. Oxford University Press, New York (1989)

2.4.2 Cerebral Veins

The main superficial cerebral veins are: Frontopolar veins , Prefrontal veins , Frontal veins ,Parietal veins , Occipital veins . Williams & Wilkins, Baltimore (2008)

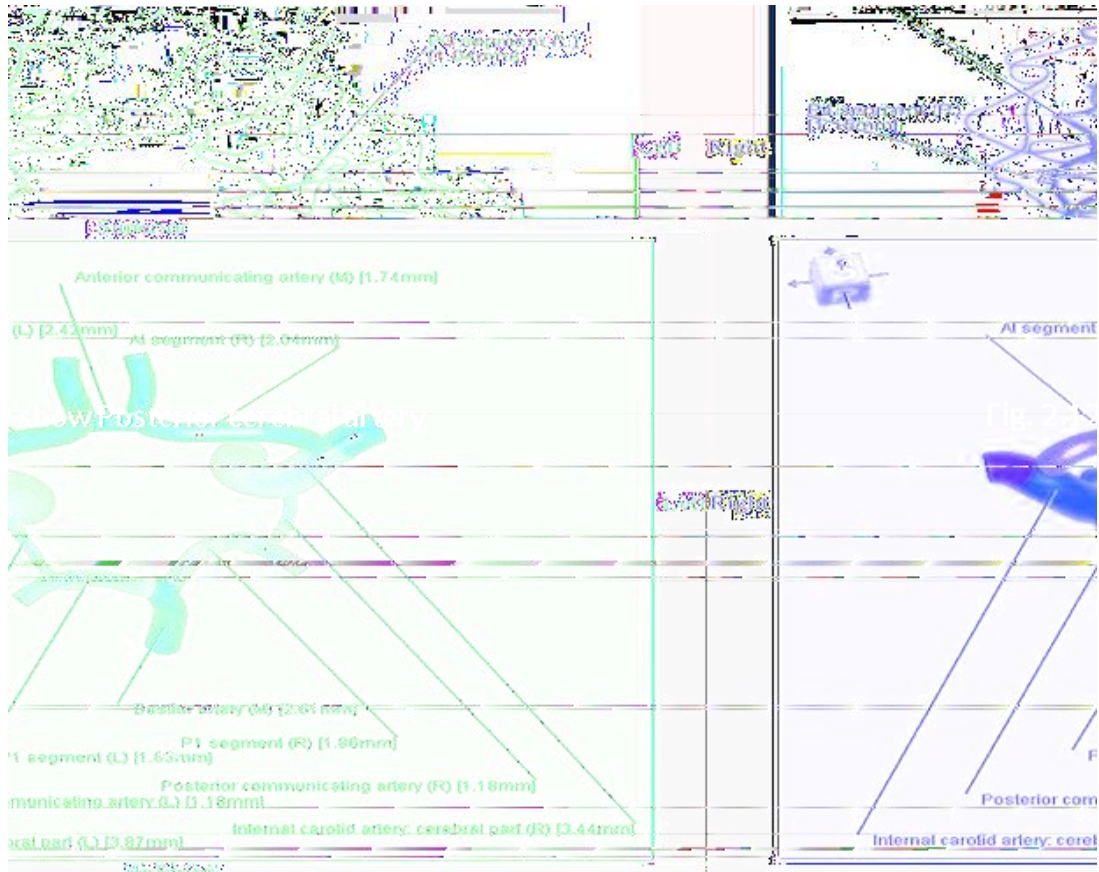


Fig. 2.12 show The circle of Willis Diamond, Fusco, et al : Structure of the Human Brain. A Photographics Atlas, 3rd edn. Oxford University Press, NY1989

2.4.3 Dural sinuses

The main dural sinuses are: Superior sagittal sinus , Inferior sagittal sinus , Straight sinus , Left and right transverse sinuses and Left and right sigmoid sinuses . Williams & Wilkins, Baltimore (2008)

2.4.4 Cerebral Veins

The main superficial cerebral veins are : Frontopolar veins , Prefrontal veins , Frontal veins , Parietal veins , Occipital veins . Williams & Wilkins, Baltimore (2008)

2.4.5 Vascular Variants:

The human cerebrovasculature is highly variable and vascular variants have been extensively studied. Variations exist in terms of origin, location, shape, size, course, branching patterns as well as surrounding vessels and structures. The knowledge of cerebrovascular variants is central in diagnosis, treatment, and medical education. Williams & Wilkins, Baltimore (2008)

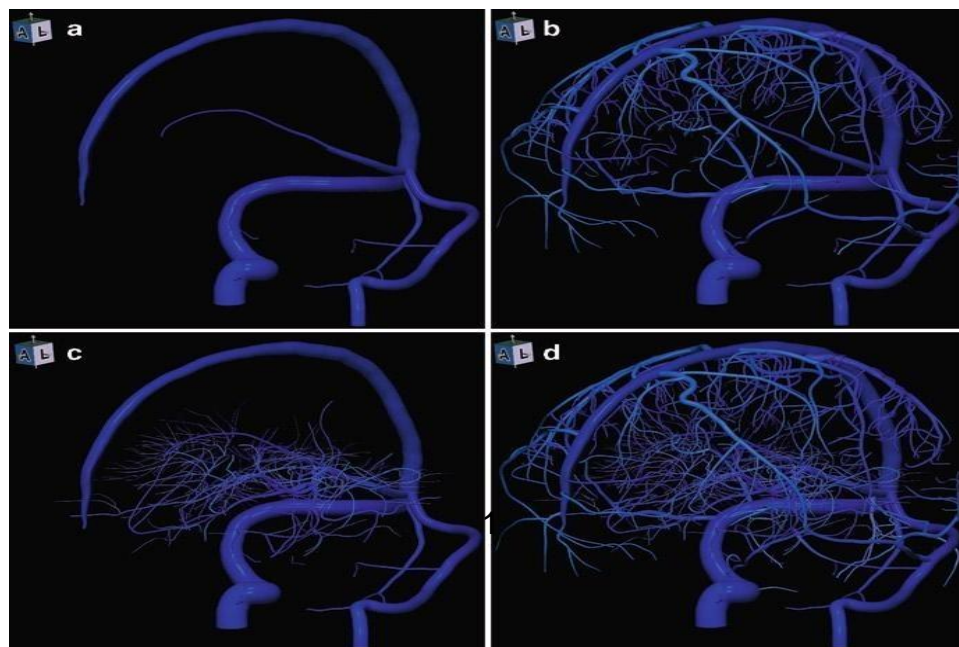


Fig. 2.13 Parcellation of the venous system: (a) dural sinuses (DS); (b) superficial veins with the DS; (c) deep veins with the DS; (d) complete venous system. Diamond, , Fusco, etal : Structure of the Human Brain. A Photographics Atlas, 3rd edn. Oxford University Press, New York(1989)

2.1.2.1 Connectional Neuroanatomy Three types of white matter connections (or tracts, fibers, bundles, fiber pathways, fascicles) are distinguished in the cerebral hemispheres.

Commissural tracts, Association tracts, Projection tracts In addition, three cerebellar paired peduncles:

Middle peduncle ,Superior peduncle, Inferior peduncle. Williams & Wilkins, Baltimore (2008)

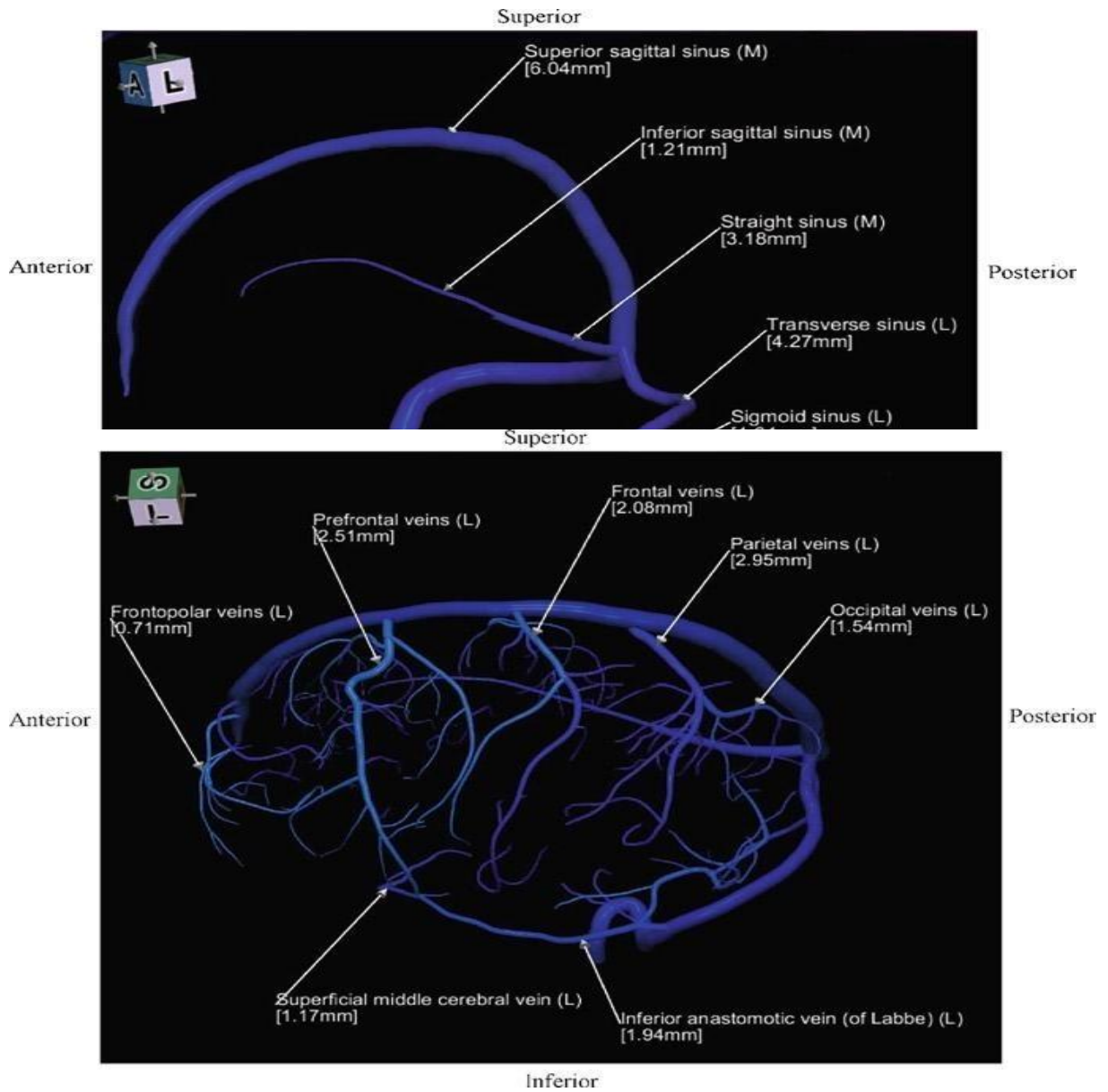


Fig. 2.14 Superficial cerebral veins of the left hemisphere Diamond,., Fusco, etal : Structure of the Human Brain. A Photographics Atlas, 3rd edn. Oxford University Press, New York (1989)

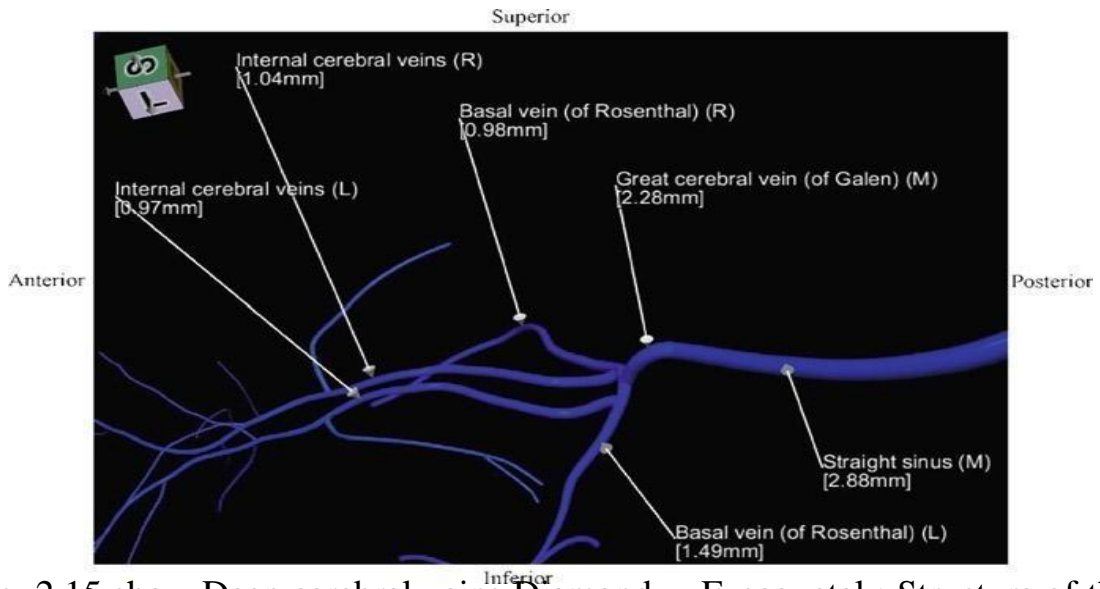


Fig. 2.15 show Deep cerebral veins Diamond,.. , Fusco, etal : Structure of the Human Brain. A Photographics Atlas, 3rd edn. Oxford University Press, New York (1989))

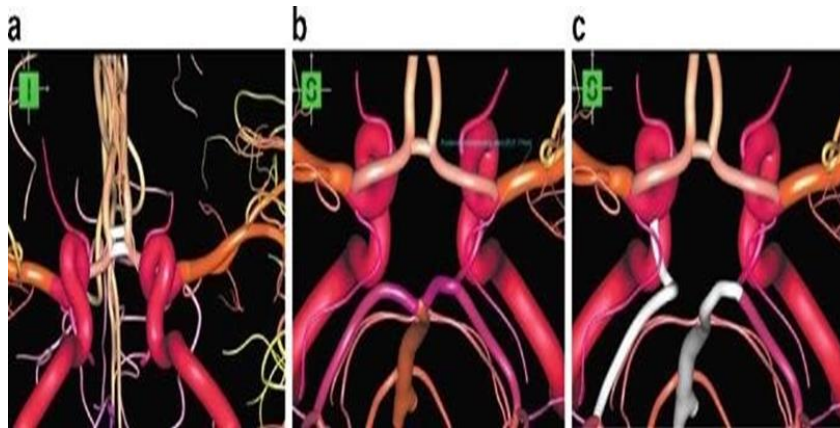


Fig. 2.16 Vascular variants of the circle of Willis: (a) double anterior communicating artery; (b) absent left posterior communicating artery; (c) absent left P1 segment (the variants are in *white*) Diamond,.. , Fusco, etal : Structure of the Human Brain. A Photographics Atlas, 3rd edn. Oxford University Press, New York (1989))

2.6 physiology of the brain :-

The brain can be divided into six parts in terms of physiological functions:

Cerebrum, Hypothalamus, Midbrain, Cerebellum, Pons and Medulla oblongata. Rodney Rhoades, David R. Bell (2009)

Cerebrum This is the most developed area of brain in the human species and is considered to be the center of the highest functions. The major functions include: awareness of sensory perception; voluntary control of movement (regulation of skeletal muscle movement); language; personality traits; sophisticated mental activities such as thinking, memory, decision making, predictive ability, creativity and self-consciousness. We will examine 4 lobes of the cerebrum. Rodney Rhoades, David R. Bell - 2009

The Frontal Lobe Concerned with higher intellectual functions and is involved in the many behavioral aspects of humans. It inhibits certain primitive behaviors. The Primary motor cortex controls the movement of the rest of the body while the premotor cortex just adjacent to it is concerned with the initiation, activation, and performance of the actual movement. Rodney Rhoades, David R. Bell 2009

2.6.1 The Parietal Lobe

This lobe is primarily concerned with the interpretation and integration of sensory inputs. The Somatosensory cortex is associated with reception and perception of touch, vibration, and position sense of the body. Rodney Rhoades, David R. Bell (2009)

The Temporal Lobe :The temporal lobe contains the auditory cortex - for the reception and interpretation of sound information, and the olfactory cortex - for the sense of smell. It also houses the language cortex in the dominant hemisphere (usually the left hemisphere) and participates in recognition and interpretation of language. Rodney Rhoades, et-al (2009)

The Occipital Lobe:This lobe contains the primary visual cortex for visual

information interpretation. degenerative conditions in specific regions can cause problems in fine motor control. Parkinson's disease is characterized by slow jerky movements; tremors of the face and hands; muscle rigidity; and great difficulty initiating voluntary movements. In Parkinson's disease, an overactive region acts like a stuck brake, continuously inhibiting the motor cortex. The disease results from the degeneration of a region called the substantia nigra, in particular dopaminergic neurons (those using the neurotransmitter dopamine) in this region. Huntington's disease involves an over stimulation of motor activities, such that limbs jerk uncontrollably. Syamal K, et-al (2008)

The Limbic system: Is a group of structures on the medial aspect of each hemisphere and diencephalon and is more a functional system than an anatomical one. The limbic system is the "emotional brain", participating in the creation of emotional states such as fear, anger, pleasure, affection, arousal, etc. and processing vivid memories associated with those states. For example, the amygdala is central for processing fear and stimulates a sympathetic response. The amygdala enables us to recognize menacing facial expressions in others and to detect the precise gaze of someone who is looking at us. Syamal K, et-al (2008)

Cerebral Lateralization: Although anatomically the two hemispheres of the cerebrum look very similar, functionally the two sides are different. Thus, the term lateralization is used to denote that each lobe has developed special functions that are not shared by other lobes. In general:

Left side: Language, logic, analytical, sequential, verbal tasks, (holistic information processing). "Thinkers"

Right side: Spatial perception, artistic and musical endeavors (fragmentary information processing). "Creators"

Epithalamus, Thalamus and Hypothalamus The epithalamus contains the pineal gland, a hormone secreting endocrine structure. Under the influence of

the hypothalamus, the pineal gland secretes the hormone melatonin, which prepares the body for the night-time stage of the sleep/wake cycle. The thalamus makes up about 80% of the diencephalon and is the main relay center for the various sensory and motor functions. The Hypothalamus controls and regulates many important functions of the body, including:

Control of the Autonomic Nervous System - adjusts, coordinates, and integrates the A.N.S. centers in the brain that regulate heart rate, blood pressure, bronchiole diameter, sweat glands, G.I. tract activity, etc. It does this via the Parasympathetic and Sympathetic divisions of the A.N.S.

Control of Emotional Responses - in association with the limbic system, it forms part of the emotional brain. Regions involved in fear, pleasure, rage and sex drive are located in the hypothalamus. **Regulation of Body Temperature** - the body's thermostat and set point is located in the hypothalamus. There are also 2 centers in the hypothalamus that respond to changes in the set point.

Heat-losing center: activation of this center causes sweating and cutaneous vasodilation. **Heat-promoting center:** activation of this center causes shivering and cutaneous vasoconstriction. **Regulation of Hunger and Thirst Sensations** - hypothalamus contains the feeding and thirst centers.

Feeding center: this center is always active and stimulates hunger which is 'fed' by eating. **Satiety center:** stimulated when satisfied, this inhibits the always hungry feeding center. **Thirst center:** osmoreceptors detect changes in osmotic pressure of blood, ECF, stimulate thirst.

Control of the Endocrine System - controls the release of pituitary hormones. Controls the anterior pituitary gland, when the hypothalamus releases hormones, it can stimulate or inhibit the release of other hormones from the pituitary (6 hormones). Also, it makes the 2 hormones (oxytocin and antidiuretic hormone (ADH)) that are stored in the posterior pituitary and released when signaled. All of these hormones regulate many other organs in the body. Rodney Rhoades, et-al (2009)

2.6.2 Midbrain

Portions receive visual input auditory input from the medulla oblongata and are involved in cranial reflexes, e.g., when you turn your head if you thought you heard your name called out. Rodney Rhoades,et-al (2009)

The Cerebellum has two primary functions: Controls postural reflexes of muscles in body - i.e., it coordinates rapid, automatic adjustments to maintain equilibrium, e.g. regaining your balance when you start to fall.

Produces skilled movements - involved in implementing routines for fine tuned movements. Controlled at the conscious and subconscious level, refines learned routines (e.g. driving, skating, playing an instrument) until the action becomes routine. This then reduces the need for conscious attention to the task. The cerebellum gets incoming information from proprioceptors, a type of sensory receptor found in movable joints, tendons and muscle tissue. Using the information from proprioceptors in the body, the cerebellum can determine the relative position of various body parts and compares motor commands and intended movements with the actual position of the body part (legs, arms). In this way, it can perform any adjustments needed to changes the direction or make the movement (action) smooth and coordinated .Syamal K,et-al (2008) **2.2.12Pons**

Plays a role in the regulation of the respiratory system. Contains two ‘pontine’ respiratory centers: 1) the pneumotaxic center and 2) the apneustic center. These two centers will be discussed later in the respiratory system. The pons is not responsible for the rhythm of breathing (the medulla oblongata is) but controls the changes in depth of breathing and the fine tuning of the rhythm of breathing set by the medulla oblongata. The pons also prevents over inflation of the lungs. Rodney Rhoades,et-al (2009)

2.6.3 Medulla Oblongata:

The medulla oblongata is the last division of the brain. It becomes continuous with the spinal cord. It houses some very important visceral or vital centers,

The cardiac center adjusts the force and rate of the heartbeat.

The vasomotor center regulates the diameter of blood vessels and therefore systemic blood pressure (constriction increases and dilation decrease blood pressure) and the respiratory center – for control of the basic rhythm and rate of breathing. Additional centers regulate sneezing, coughing, hiccupping, swallowing and vomiting. Rodney Rhoades, et-al (2009)

2.7 Pathology of the brain

2.7.1 Cerebral Edema

Excess fluid (increased volume) within or around the brain parenchyma. Owl Club Review Sheets (2013)

2.7.2 Raised ICP and Herniation

Mean ICP of CSF > 200mmH₂O with patient recumbent, occurring when expansion of the brain parenchyma exceeds compression of veins and CSF . Owl Club Review Sheets (2013)

2.7.3 Types of Herniation

2.1.2.2 Subfalcine Herniation Cingulate Gyrus

Unilateral expansion of the cerebral hemisphere displaces the cingulate gyrus under the falx cerebri, compressing pericallosal arteries (arteries of corpus callosum) and anterior cerebral circulation. Owl Club Review Sheets (2013)

2.7.4 Transtentorial Herniation Uncal

Medial Aspect of Temporal lobe goes through the tentorium cerebella
Compression of the 3rd CN ipsilateral pupil dilation and eye paralysis
Compression of the posterior cerebral artery infarct of visual cortex
Compression of the contralateral peduncle ipsilateral hemiparesis (relative to the herniation); called Kernohan's Notch Hemorrhage in midbrain and pons may result (Duret's Hemorrhage) Owl Club Review Sheets (2013)

2.7.5 Tonsillar Herniation Cerebellum

Fatal herniation of cerebellum through the foramen magnum Compresses brainstem, leading to death Owl Club Review Sheets (2013)

2.7.7 Hydrocephalus

Accumulation of excessive CSF within the ventricular system. Owl Club Review Sheets (2013)

2.7.8 Subdural

Between the dura and the arachnoid exists a real space Associated with bridging veins and dural sinuses coursing through Brain can move but the vessels are fixed; with trauma, brain shears the vessels and the patient bleeds Superior sagittal sinus of the elderly and demented are at highest risk Hematoma hugs the brain matter, but does not enter subarachnoid space (isn't between the sulci), called a crescent shaped hematoma. Owl Club Review Sheets (2013)

2.7.9 Hypoxia, Ischemia , Infarction

Infarction from Obstruction to Flow (Focal Cerebral Ischemia)

Thrombotic or Embolic event that occludes the lumen to blood flow, depriving a particular region of tissue, supplied by that artery, of O₂. Owl Club Review Sheets (2013)

2.7.10 Intracranial Hemorrhage:

Bleeding into the cerebral tissue from cerebral vasculature within the tissue. This is bleeding inside the brain.

2.7.11 Subarachnoid Hemorrhage, Ruptured Saccular Aneurysm:

Bleeding into and around the brain parenchyma (between pia and arachnoid layers) from cerebral vasculature.

2.7.12 Vascular Malformations: 2.3.16.1 Arteriovenous Malformation

Arteries connected to veins without an intervening capillary bed. Owl Club Review Sheets (2013)

2.7.13 Cavernous Hemangioma

Occur most commonly in the cerebellum, pons, subcortex Distended, loosely organized, low-flow vasculature with thin collagenized walls devoid of intervening nervous tissue. Owl Club Review Sheets (2013)

2.8 Previous study:

Intracranial aneurysms, Mosby year book Co, St Louis, *hand book o f Neuroradiology* 1991; :79-84. found The commonest age group examined was 41-60 years which comprised 44.3% of the sample population.

The study also showed aneurysms and vascular stenosis being the common cerebrovascular pathologies in these age groups.

This finding could be due to the age at which these pathologies become symptomatic. Intracranial aneurysms. *Diagnostic Neuroradiology* 1994; :248-263) stated that aneurysm typically become symptomatic in people aged 40-60 years. Ruberti (4Warnack NG, Gandhi MR, Begrall et al. Complications of intra arterial DSA in patients investigated for cerebrovascular disease.

BJR 66:1993;790:855-858.~' also showed that intracranial aneurysms typically become symptomatic at the age group 40-60 years. Intracranial arteriovenous malformations: Current imaging and treatment, *invest radiology* 1990; 25:952-960) found that AVM's commonly present between 20 and 40 years.

CHAPTER THREE

Methodology

3.1 Materials :

3.1.1 Area and duration of the study:

This study was a descriptive, study designed to assess the ability of ANGIOGRAPHY to diagnose cerebral aneurysm in adult Sudanese chief complaint of headache conc.

The study was collected from radiology department of ROYALCARE INTERNATIONAL HOSPITAL, A STROKE AND VASCULAR CENTER. The study was carried out in the (Khartoum- Sudan). The study was carried out with in 9 month from march 2016 to **February** 2017.

3.1.2 Machine used

In this procedure, x-ray biplane equipment will be used.

3.1.3 Machine principle.

Technique and 3d subtraction MIP +MPR

3.1.4 Accessories Instrumentations used

Automatic injector

Contrast media (OMNIPAQUE) 70-80ML

Flow rate 4-4.5 ML/SEC

3.1.5 Study Population

The study include Sudanese group of patient with headache subarachnoid hemorrhage.

Study includes 45 patients visiting the emergency department with headache, neck stiffness .

Exclusion criteria pediatric Patients and normal patients.

3.2 Methods

3.2.1 Technique used:

45 patients were diagnosed as ICA problems by Fluoroscopy with routine biplane cerebral angiography uses a continuous or pulsed x-ray beam to create a sequence of images that are projected onto a fluorescent screen. Contrast Material Injection Shortscan times require short contrast material injection. The injection protocols used to deliver an appropriate amount of iodine, injection rates of 4–5 mL/sec and highly concentrated contrast medium (iodine, 350–370 mmol/mL). The utility of the contrast material bolus can be increased if a saline bolus is appended .

3.2.2 Data collection

Data collection according to work sheet (appendix) include all above variables data.

3.2.3 Data analysis

Data analysis by using SPSS version 11 .using significant test like T test Frequencies and regression and also correlation between age and prevalence and gender .

3.2.4 Variables

The data of patients obtained from work sheet is used to collect data on 4 variables these variables were include: age, gender ,findings ,treatment .

CHAPTER FOUR

Result

4 Results

Table (4.1) Mean, minimum, maximum, and standard deviation of the age.

	N	Minimum	Maximum	Mean	Std. Deviation
Age	45	19	75	43.89	15.709
Valid N (listwise)	45				

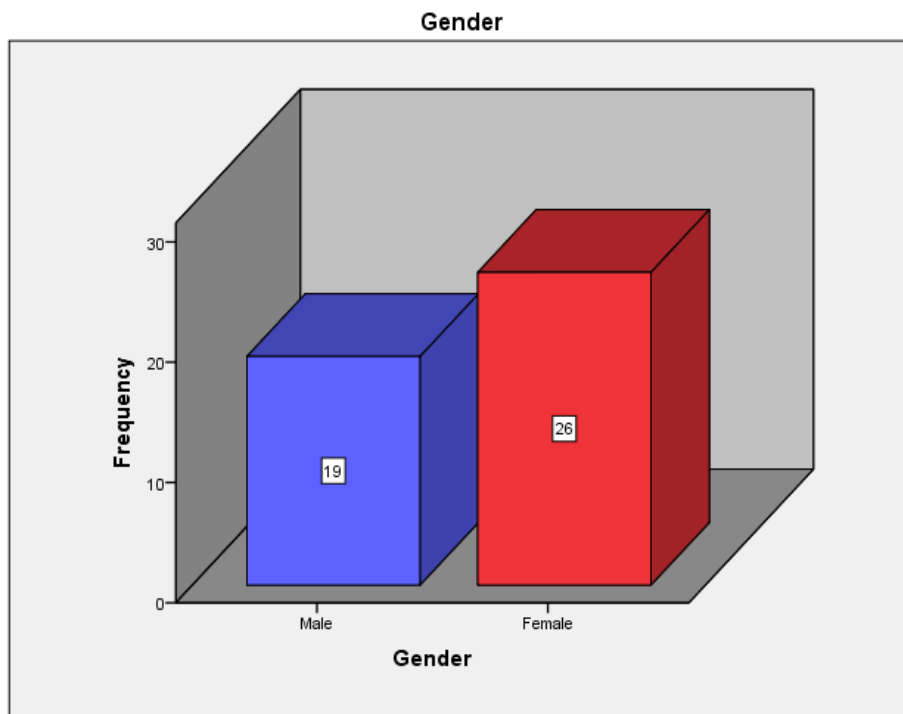


Figure (4.1) Frequency distribution of gender.

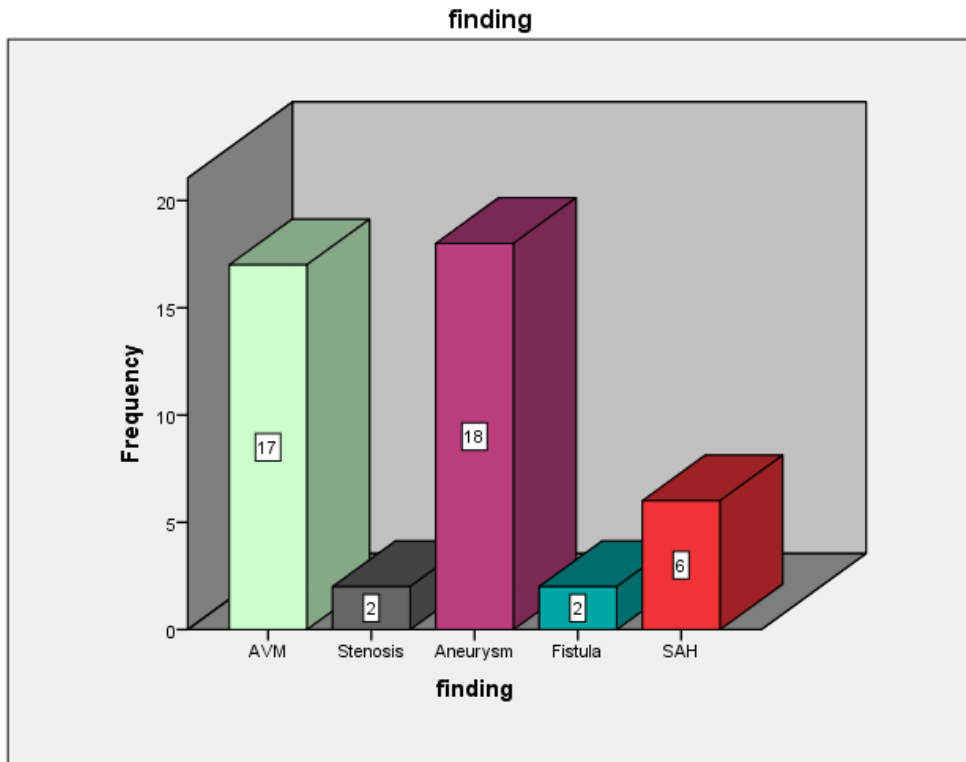


Figure (4.2) Frequency distribution of Findings.

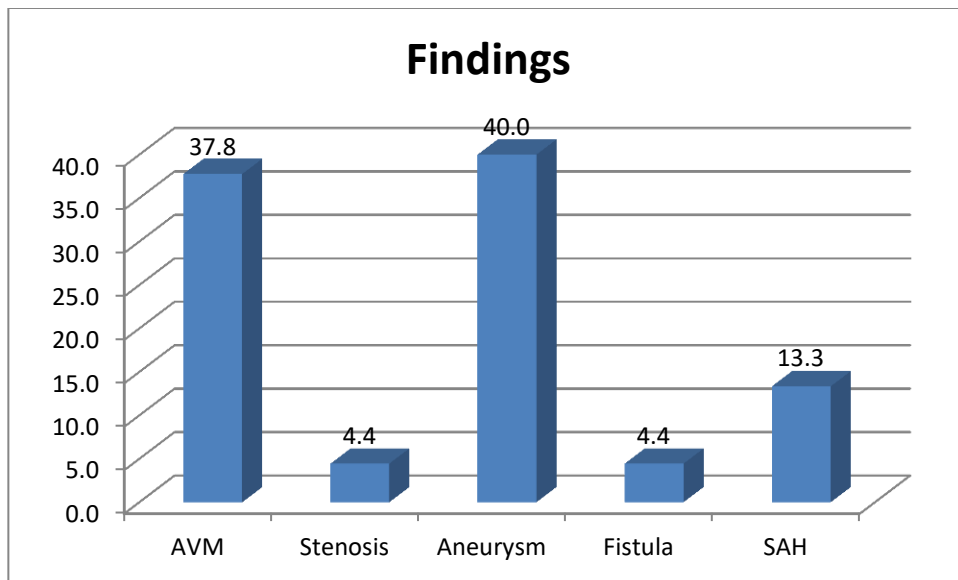


Figure (4.3) Percentage of findings.

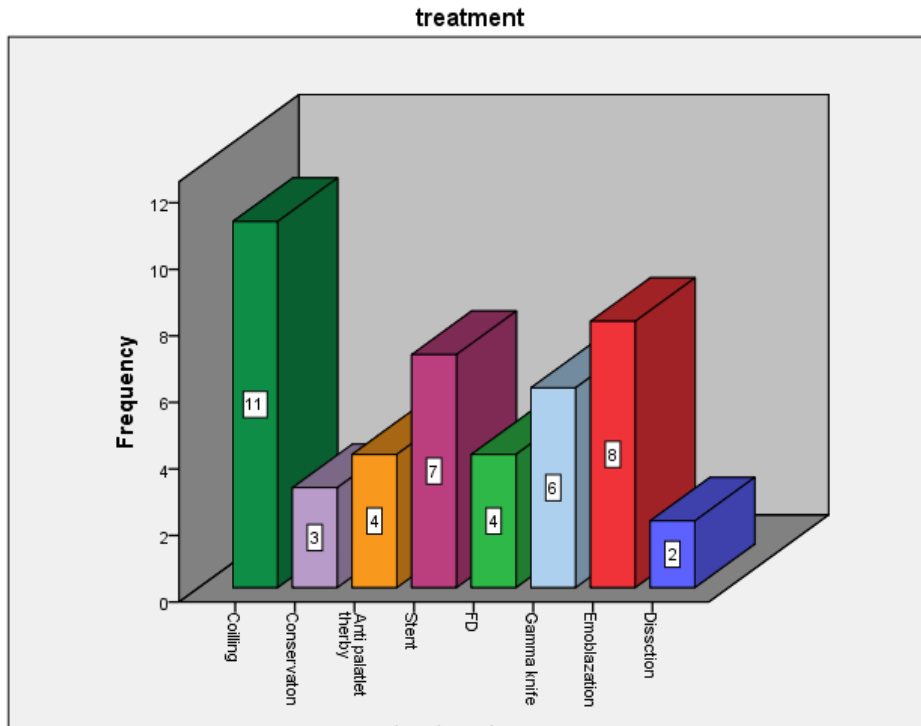


Figure (4.4) Frequency distribution of treatment.

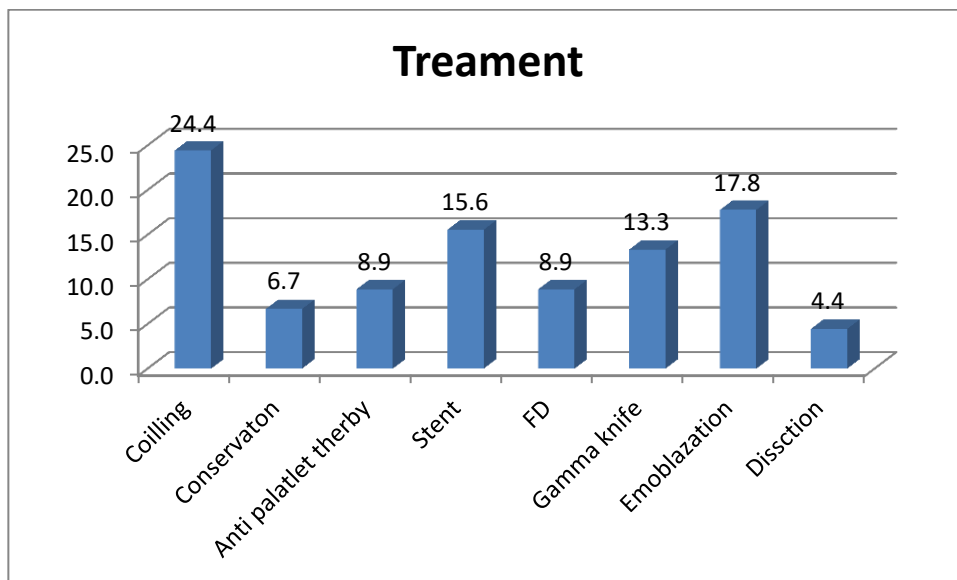


Figure (4.5) Percentage of tretment.

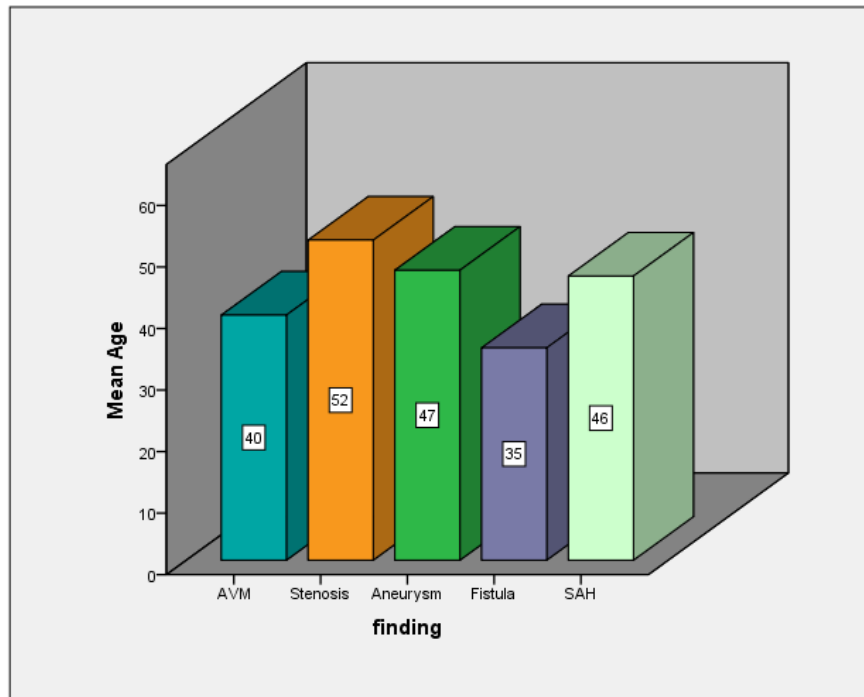


Figure (4.6) Cross tabulation between findings and mean age.

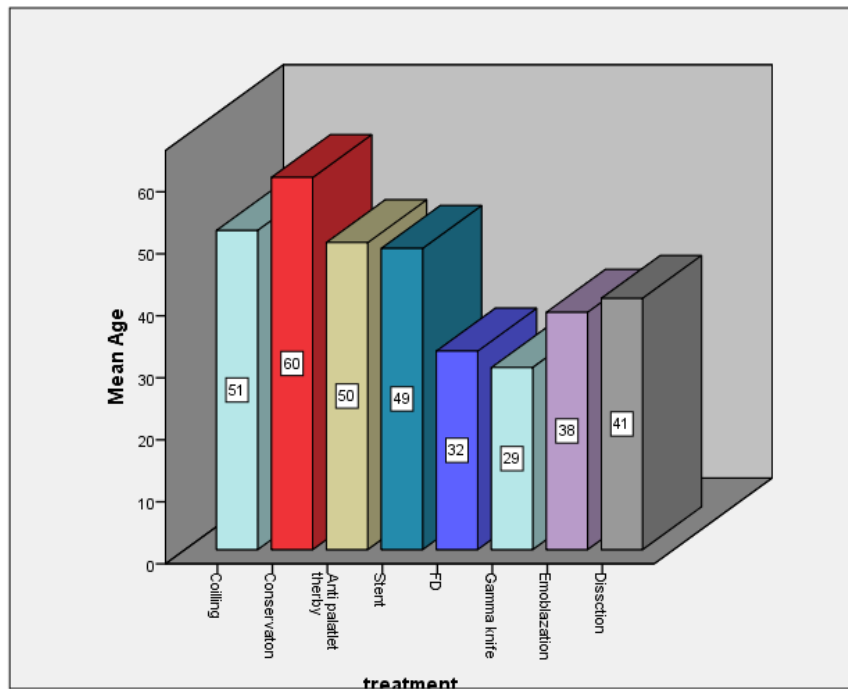


Figure (4.6) Cross tabulation between treatment and mean age.

Chapter Five

Discussion, Conclusion and Recommendations

5.1 Discussion

Intracranial aneurysms, Mosby year book Co, St Louis, *hand book o f Neuroradiology* 1991; :79-84. found The commonest age group examined was 41-60 years which comprised 44.3% of the sample population. The study also showed aneurysms and vascular stenosis being the common cerebrovascular pathologies in these age groups. This finding could be due to the age at which these pathologies become symptomatic. Intracranial aneurysms. *Diagnostic Neuroradiology* 1994; :248-263) stated that aneurysm typically become symptomatic in people aged 40-60 years. Ruberti (4Warnack NG, Gandhi MR, Begrall et al. Complications of intra arterial DSA inpatients investigated for cerebrovascular disease. *BJR* 1993;790:855-858.~' also showed that intracranial aneurysms typically become symptomatic at the age group 40-60 years. Intracranial arteriovenous malformations: Current imaging and treatment, *invest radiology* 1990; 25:952-960) found that AVM's commonly present between 20 and 40 years. Angiography may eliminate the need for surgery. If surgery remains necessary, it can be performed more accurately. No radiation remains in a patient's body after an x-ray examination. X-rays usually have no side effects in the typical diagnostic range for this exam.

5.2 Conclusion

The performance of cerebral angiography is very important in assessing and evaluation of the patient with berry aneurysm to detect aneurysms and AVM.

Therefore angiography remains the modality of choice in patients presenting with aneurysm, it showed that the ultimate decision on whether an aneurysm can be coiled is very subjective. The information provided by minimal-invasive imaging techniques has an important function in the therapeutic decision process in patients presentings with aneurysms and SAH.

5.3 RECOMMENDATIONS:

- There is need for follow-up of angiographically negative cases and possible repeat of angiography especially of those that had shown cerebrovascular disease at CT or MRI.
- A larger series study need to be undertaken in order to establish the exact prevalence of cerebrovascular disease in the population and pick the rare cerebrovascular pathologies that were not encountered in this study.
- There is need for a comparative study on cost effectiveness of cerebral angiography with non-invasive angiographic techniques such as CTA and MRA..

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Appendix



Image show AVM



3D RECONSTRUCTION SHOW THE COIL AFTER RUPTURE ANEURYSM

