Chapter One

Introduction

duction 1.1

The posterior cranial fossa is a part of intra cranial cavity which located between the foramen magnum and tentorium cerebrlli contain cerebellum and brain stem . It is very important area so it houses cerebellum which plays important role in motor control of all the body .Also the posterior cranial fossa contain s brain stem which regulate cardiac and respiratory function(heart rate, breathing ,sleeping and eating).Many disease have been associated with alterations in the size of the cranium and posterior fossa , such as the Chiari and Dandy –walker malformations and Downs syndrome .The main problem of the study is there is no standard measurements for normal

. Sudanese populations

Human cranial variations have been described worldwide for a long time in human anatomy (Poirier, 1896). Akabori (1933) reported many cranial variations in Japanese. Hauser and De Stefano (1989) reviewed the gross anatomy, function, development, of cranial variations on the basis of vast previous anatomical studies.

Anthropologists have long studied cranial data in order to characterize population affinities (Howells, 1973). Ossenberg (1986) has undertaken advanced studies of cranial traits, which proved effective for reconstructing the Pan-Pacific population history. Dodo and his collaborators have intensively studied cranial character from the viewpoint of their stability within populations and diversity among populations (Dodo and Kawakubo, 2002). On the basis of these series of studies, the cranial variations of populations worldwide have been investigated (Dodo and Sawada, 2010; Nakashima et al., 2010).

The most recent and advanced computer *tomography* (CT) and magnetic resonance imaging (MRI) methods can evaluate anatomical variations of living human subjects, (Oshiro et al., 2009; Morita et al., 2010). On the other hand, a wide spectrum of central nervous system diseases have been associated with alterations in the size of the cranium and posterior cranial fossa (PCF) or its contents, such as the Chiari and Dandy-Walker malformations and Down's syndrome (Hashimoto 1991, Barkovich, 1990, Schaefer, 1991).

Quantitative assessment of these morphological changes requires normative data for cranium as well as the posterior cranial fossa and supratentorial cranial cavity. Here, we preliminarily applied the computerized tomography (CT) imaging methods to study the normative

cranial characteristics in order to obtain basic local reference data for Sudanese (PCF) and (SCC) morphometric analysis. To the best of our knowledge, no anatomical study was achieved regarding this area for the .Sudanese population

Problem of the study 1-2

Supratentorial cavity and posterior fossa are on important areas that contain cerebellum which control the total body balance . Also changes in measuring value may be due to any pathological changes. The main problem there is no standard measurements for normal Sudanese .populations

Objectives of the study 1-3

: General objective 1-3-1

- To evaluate (SCC) and (PCF) using CT scan .

: Specific objective 1-3-2

- To measure AP and TRV of posterior fossa and supra . tentorial cavity in axial CT scan

To correlate the age and gender with AP , TRV and -

. (CC of (SC) and (PF

Overview of the study 1-4

This study consist of five chapters one is an introduction which include , problem and objectives of the study . Chapter two is a literature review which include , anatomy , physiology , pathology and previous studies . Chapter three is about research methodology . Chapter four is included results of the study. Chapter five includes ,

. discussion , conclusions and recommendations

Chapter Two

Theoretical background

Anatomy 2-1

Nothing in the world can compare with the human brain. This mysterious three-pound organ controls all necessary functions of the body, receives and interprets information from the outside world, and embodies the essence of the mind and soul. Intelligence, creativity, emotion, and memories are a few of the many things governed by the brain.

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.

Nervous system 2-1-1

The nervous system is divided into central and peripheral systems. The central nervous system (CNS) is composed of the brain and spinal cord. The peripheral nervous system (PNS) is composed of spinal nerves that branch from the spinal cord and cranial nerves that branch from the brain. The PNS includes the autonomic nervous system, which controls

vital functions such as breathing, digestion, heart rate, and secretion of hormones.(R.J. LAST et al 1978).

Skull 2-1-2

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 ethmoid (Fig. 1). The face is formed from 14 paired bones including the maxilla , zygoma, nasal, palatine, lacrimal, inferior nasal conchae, mandible, and vomer.

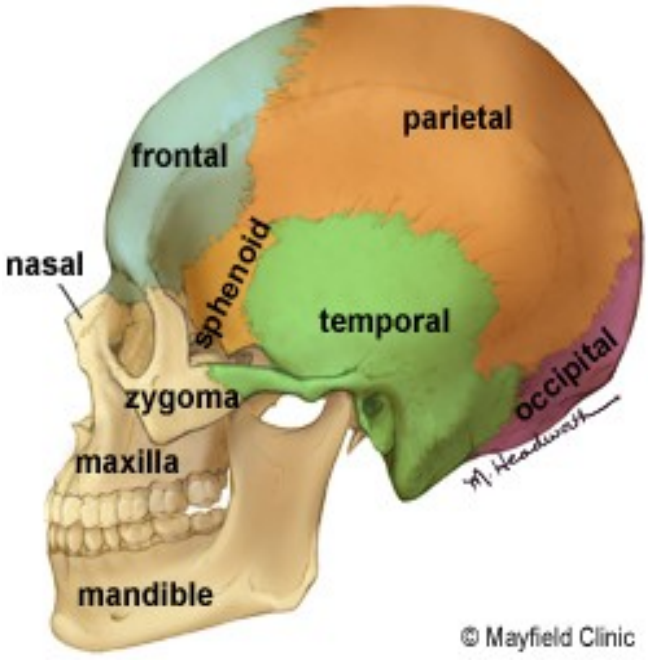


Figure 2-1. Eight bones form the skull and fourteen bones form the face.(Glossing and Harris 2002).

Brain 2-1-3

The brain is composed of the cerebrum, cerebellum, and brainstem.

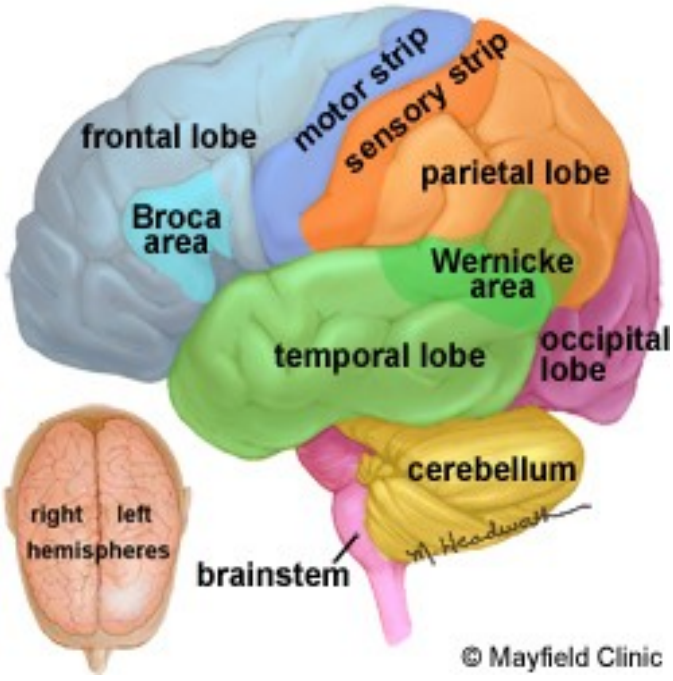


Figure 2-2. The cerebrum is divided into four lobes: frontal, parietal, temporal, and occipital (Glossing and Harris (2002

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

The cerebellum is located under the cerebrum. Its function is to coordinate muscle movements, maintain posture, and balance.

The brainstem includes the midbrain, pons, and medulla. It acts as a relay center connecting the cerebrum and cerebellum to the spinal cord. It performs many automatic functions such as breathing, heart rate, body temperature, wake and sleep cycles, digestion, sneezing, coughing, vomiting, and swallowing. Ten of the twelve cranial nerves originate in the brainstem.(Edward Frohlich. 1993).(.

Right brain – left brain 2-1-3-1

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

Lobes of the brain 2-1-3-2

The cerebral hemispheres have distinct fissures, which divide the brain into lobes. Each hemisphere has 4 lobes: frontal, temporal, parietal, and occipital (Fig 2). 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.(Chummy

.(S.Sinnatamby 1999

Frontal lobe responsible for Personality, behavior, emotions . Judgment, planning, problem solving Speech: speaking ,writing (Broca's area) - Body movement (motor strip) . - Intelligence, concentration

and self-awareness

Parietal lobe responsible for Interprets language, words, Sense of touch, pain, temperature (sensory strip) . , Interprets signals from vision, hearing, motor, sensory and memory .

Occipital lobe responsible for Interprets vision (color, light, movement (

Temporal lobe responsible for understanding language (Wernicke's area) ,Memory , Hearing , Sequencing and organization .

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

Anatomy of posterior cranial fossa 2-1-4

The posterior cranial fossa is part of the intracranial cavity, located between the foramen magnum and cerebelli contain the brainstem and cerebellum

This is the most inferior of the fossae. It houses the cerebellum, medulla and pons. Anteriorly it extends to the apex of the petrous temporal. Posteriorly it is enclosed by the occipital bone. Laterally portions of the squamous temporal and mastoid part of the temporal bone form its walls.(Chummy S.Sinnatamby 1999).

Foramen magnum 2-1-4-1

The most conspicuous, large opening in the floor of the fossa. It transmits the medulla, the ascending portions of the spinal accessory nerve (XI), and the vertebral arteries.

The skull base forms the floor of the cranial cavity and separates the brain from other facial structures. This anatomic region is complex and poses surgical challenges for otolaryngologists and neurosurgeons alike. Working knowledge of the normal and variant anatomy of the skull base is essential for effective surgical treatment of disease in this area.

The 5 bones that make up the skull base are the ethmoid, sphenoid, occipital, paired frontal, and paired temporal bones. The skull base can be subdivided into 3 regions: the anterior, middle, and posterior cranial fossae.

The petro-occipital fissure subdivides the

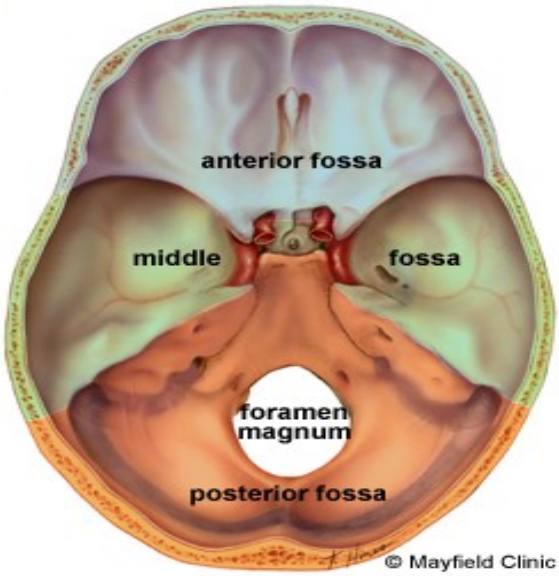


Figure 2-3. The inside of the skull is divided into three areas called the anterior, middle, and posterior fossae.(J.A.Glossing and P.F Harris (2002.

Importance of posterior fossa 2-1-4-2

The posterior fossa is very important region so it houses brain stem and cerebellum . The brain stem provides the main motor and sensory intervation to the face and neck via the cranial nerves .The brain stem also plays an important role in the regulation of cardiac and respiratory function ,it also regulates the central nervous system and sleep cycle. The brain stem has many basic functions including heart rate, breathing, sleeping and eating .The cerebellum is a region of the brain that plays an important role in motor control .It may also be involved in some cognitive functions such as attention and

language and in regulating fear and pleasure responses.

((R.J.Last 1978

Anatomy of Supratentorial Cranial Cavity 2-1-5

In anatomy, the supratentorial region of the brain is the area located above the tentorium cerebelli. The area of the brain below the tentorium cerebelli is the infratentorial region. The supratentorial region contains the cerebrum, while the infratentorial region contains the cerebellum.

The tentorium cerebelli is the membrane that separates the brain from the lower parts of your nervous system. Therefore, a supratentorial problem is NOT a way in which doctors can call you crazy without you knowing it. Rather, it is a way for them to define the cause of the neurological problem. Left supratentorial damage causes sensory and motor dysfunction on the right side of your face and body, and vice versa.The tentorium cerebelli is an arched lamina, elevated in the middle, and inclining downward toward the circumference.

It covers the superior surface of the cerebellum, and supports the occipital lobes of the brain.

Its anterior border is free and concave, and bounds a large oval opening, thetentorialincisure, for the transmission of the cerebral peduncles.

It is attached, behind, by its convex border, to the transverse ridges upon the inner surface of the occipital bone, and there encloses the transverse sinuses; in front, to the superior angle of the petrous part of the temporal bone on either side, enclosing the superior petrosal sinuses.

At the apex of the petrous part of the temporal bone the free and attached borders meet, and, crossing one another, are continued forward to be fixed to the anterior and posterior clinoid processes respectively.(Chummy S.Sinnatamby 1999).

Clinical significance 2-1-5-1

Clinically, the tentorium is important because brain tumors are often characterized as supratentorial (above the tentorium) and infratentorial (below the tentorium). The location of the tumor can help in determining the type of tumor, as different tumors occur with different frequencies at each location. Additionally, most childhood primary brain tumors are infratentorial, while most adult primary brain tumors are supratentorial. The location of the tumor may

have prognostic significance as well.(Edward D .Frohlich .(1993

(Physiology of the Brain(PCF&SCC 2-2

Metabolism 2-2-1

Despite weighing only about 3 pounds, the brain consumes as much as 20% of the oxygen and glucose taken in by the body. Nervous tissue in the brain has a very high metabolic rate due to the sheer number of decisions and processes taking place within the brain at any given time. Large volumes of blood must be constantly delivered to the brain in order to maintain proper brain function. Any interruption in the delivery of blood to the brain leads very quickly to dizziness, disorientation, and eventually unconsciousness. (Andrew Davies ,Asa.

(Blakelely and Cecil Kidd . 2001

Sensory 2-2-2

The brain receives information about the body's condition and surroundings from all of the sensory receptors in the body. All of this information is fed into sensory areas of the brain, which put this information together tocreate a perception of the body's internal and external conditions. Some of this sensory information is autonomic sensory information

that tells the brain subconsciously about the condition of the body. Body temperature, heart rate, and blood pressure are all autonomic senses that the body receives. Other information is somatic sensory information that the brain is consciously aware of. Touch, sight, sound, and hearing are all examples of somatic senses.(Stuart and Ara Fox 1990).

Motor 2-2-3

Our brain directly controls almost all movement in the body. A region of the cerebral cortex known as the motor area sends signals to the skeletal muscles to produce all voluntary movements. The basal nuclei of the cerebrum and gray matter in the brainstem help to control these movements subconsciously and prevent extraneous motions that are undesired. The cerebellum helps with the timing and coordination of these movements during complex motions. Finally, smooth muscle tissue, cardiac muscle tissue, and glands are stimulated by motor outputs of the autonomic regions of the brain (Stuart Ara FOX (1990

Processing 2-2-4

Once sensory information has entered the brain, the association areas of the brain go to work processing and analyzing this information. Sensory information is combined, evaluated, and compared to prior

experiences, providing the brain with an accurate picture of its conditions. The association areas also work to develop plans of action that are sent to the brain’s motor regions in order to produce a change in the body through muscles or glands. Association areas also work to create our thoughts, plans, and personality.(Andrew,Davies,Asa,Blakelely and Cecil

.(Kidd 2001

Homeostasis 2-2-5

The brain acts as the body’s control center by maintaining the homeostasis of many diverse functions such as breathing, heart rate, body temperature, and hunger. The brainstem and the hypothalamus are the

.brain structures most concerned with homeostasis

In the brainstem, the medulla oblongata contains the cardiovascular center that monitors the levels of dissolved carbon dioxide and oxygen in the blood, along with blood pressure. The cardiovascular center adjusts the heart rate and blood vessel dilation to maintain healthy levels of dissolved gases in the blood and to maintain a healthy blood pressure. The medullary rhythmicity center of the medulla monitors oxygen and carbon dioxide levels in the blood and adjusts the rate of breathing to keep these

.levels in balance

The hypothalamus controls the homeostasis of body temperature, blood pressure, sleep, thirst, and hunger. Many autonomic sensory receptors for temperature, pressure, and chemicals feed into the hypothalamus. The hypothalamus processes the sensory information that it receives and sends the output to autonomic effectors in the body such as sweat glands, the heart, and the kidneys.(Edward and Frohlich 1993).

Sleep 2-2-6

While sleep may seem to be a time of rest for the brain, this organ is actually extremely active during sleep. The hypothalamus maintains the body's 24 hour biological clock, known as the circadian clock. When the circadian clock indicates that the time for sleep has arrived, it sends signals to the reticular activating system of the brainstem to reduce its stimulation of the cerebral cortex. Reduction in the stimulation of the cerebral cortex leads to a sense of sleepiness and eventually leads to sleep.

In a state of sleep, the brain stops maintaining consciousness, reduces some of its sensitivity to sensory input, relaxes skeletal muscles, and completes many administrative functions. These administrative functions include the consolidation and storage of memory, dreaming, and development of nervous tissue.

There are two main stages of sleep: rapid eye movement (REM) and non-rapid eye movement (NREM). During REM sleep, the body becomes paralyzed while the eyes move back and forth quickly. Dreaming is common during REM sleep and it is believed that some memories are stored during this phase. NREM sleep is a period of slow eye movement or no eye movement, culminating in a deep sleep of low brain electrical activity. Dreaming during NREM sleep is rare, but memories are still processed and stored during this time(CYRIL A.KEELE ,ERIC NEIL

.(&NORMAN JOELS 1982

Reflexes 2-2-7

A reflex is a fast, involuntary reaction to a form of internal or external stimulus. Many reflexes in the body are integrated in the brain, including the pupillary light reflex, coughing, and sneezing. Many reflexes protect the body from harm. For instance, coughing and sneezing clear the airways of the lungs. Other reflexes help the body respond to stimuli, such as adjusting the pupils to bright or dim light. All reflexes happen quickly by bypassing the control centers of the cerebral cortex and integrating in the lower regions of the brain such as the midbrain or limbic system.

.((ARTHUR C.GUYTON 2000

Language 2-2-8

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 adisturbance 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.

.((ARTHUR C.GUYTON.2000

Pathology 2-3

Tumors of posterior fossa 2-3-1

Posterior fossa tumor is a type of brain tumor located

.in or near the bottom of the skull

Posterior Fossa Meningioma

Posterior fossa meningiomas are tumors that form on the underside of the brain in a region that houses the brainstem and the cerebellum. This small area near the bottom of the skull is responsible for movement,

.coordination, vital functions of the body such as breathing

Although the cause of posterior fossa meningiomas is unknown, they are often benign and slow-growing, arising from the meninges, or layers of tissue covering the brain

.and spinal cord

Depending on the location of the compression, symptoms will vary according to those areas affected. For example, compression near the cranial nerves can cause the

:following

- Double vision
- Hearing loss
- Facial pain, such as trigeminal neuralgia

• Numbness in the face

• Headaches

If a tumor grows in the area of the posterior fossa, it can block the flow of spinal fluid and cause increased pressure on the brain and spinal cord.

Most tumors of the posterior fossa are primary brain cancers. They start in the brain, rather than spreading from somewhere else in the body(Stanleyl.Robbins 1987).

Dandy-Walker Syndrome 2-3-2

Dandy-Walker Syndrome is a congenital brain malformation involving the cerebellum (an area at the back of the brain that controls movement) and the fluid-filled spaces around it. The key features of this syndrome are an enlargement of the fourth ventricle (a small channel that allows fluid to flow freely between the upper and lower areas of the brain and spinal cord), a partial or complete absence of the area of the brain between the two cerebellar hemispheres (cerebellar vermis), and cyst formation near the lowest part of the skull. An increase in the size of the fluid spaces surrounding the brain as well as an increase in pressure may also be present.

The syndrome can appear dramatically or develop unnoticed. Symptoms, which often occur in early infancy,

include slow motor development and progressive enlargement of the skull. In older children, symptoms of increased intracranial pressure such as irritability and vomiting, and signs of cerebellar dysfunction such as unsteadiness, lack of muscle coordination, or jerky movements of the eyes may occur. Other symptoms include increased head circumference, bulging at the back of the skull, problems with the nerves that control the eyes, face and neck, and abnormal breathing.

((http;www.dandy walker.org

Down syndrome 2-3-3

Down syndrome is a genetic disorder caused when abnormal cell division results in extra genetic material from chromosome 21. This genetic disorder, which varies in severity, causes lifelong intellectual disability and developmental delays, and in some people it causes

.health problems

Down syndrome is the most common genetic chromosomal disorder and cause of learning disabilities in

.children

Better understanding of Down syndrome and early interventions can greatly increase the quality of life for children and adults with this disorder and help them live

(fulfilling lives.(www.down syndrome .org.au

2-3-4Chiari malformations

Chiari malformations (CMs) are structural defects in the cerebellum, the part of the brain that controls balance. Normally the cerebellum and parts of the brain stem sit in an indented space at the lower rear of the skull, above the foramen magnum (a funnel-like opening to the spinal canal). When part of the cerebellum is located below the foramen magnum, it is called a Chiari malformation.

CMs may develop when the bony space is smaller than normal, causing the cerebellum and brain stem to be pushed downward into the foramen magnum and into the upper spinal canal. The resulting pressure on the cerebellum and brain stem may affect functions controlled by these areas and block the flow of cerebrospinal fluid (CSF)— the clear liquid that surrounds and cushions the brain and spinal cord—to and from the brain.(Dinah V.Parums 1996).

In September – December 2012 GautamKanodia , Vijay Parihar performed morphometric analysis of the posterior fossa in departments of neurosurgery NSCB medical college = India . This study aimed to find various dimensions of (PF) . Volume and height of (PF) were recorded in 100 head injury patients without any pathology of (PF) and 100 dry skull . Age ranged from 16 – 89 years with a mean of 51.3 years . There were 64 male potierd of head injury . All the dimensions of (PF) were larger in male as compared to female . The mean height (PF) was 3.52 cm (10.43) . The mean value of (PFV) were 157.88 (127.94) cm3 (range 98.75 – 216.88 cm3) and 159.58 (125.73) cm3 (range 116.03 – 252.99 cm3) measured by method one and method two respectively , how ever , the difference was not significant statistically

. ((P>0.05

Method one the volume calculated by abc/2 where a = is the height , b = is AP diameter . and C is

. transverse diameter of the posterior fossa

Method two done by an advanced work station of 16-row bright speed CT scan . Data were entered in Microsoft excel 2007 work sheet and statistical analysis was

. performed IBMSPSS statistics 19 version

In (1994)P.PRASSOPOULOS ,D.CAVOURS and S.GOLFINOPOULOD were investigated developmental changes in (PCF) and (SCC) for children by CT scan with no abnormal findings of 103 boys and 78 girls to age from 3 months to 15 years old . The volume of (PCF) in boy s and girls during childhood increased rapidly during the first 3 years of life .The volume was 165cm in boys and 155cm in girls .The (AP)and (TRV) diameters of (PCF) did not vary . significantly with age ,this result matches with our study

T.TRIGYLIDAS . B.BARONIA .M. VASSILYADI were performed a study about posterior fossa dimensions and volume estimates in pediatric patients with Chiari I malformation . CMI was traditionally defined as the down word displacement of cerebellar tonsils by 5mm or more below the foramen magnum .The study calculated the (PCF)by MRI in sagittal section

Sixty one CMI patients were identified .There were 32 males and 29 females with mean age of 10 years old. Thirty four (55%) of these patient s were symptomatic with scoliosis (38%) ,suboccipital headaches (29%),and motor /sensory deficits (26%) being the most prominent symptoms. Mean (PCF)volume values were found to be .smaller in pediatric CMI patients than control patients

In 2013 a comparative analysis of anterior and posterior length and deflection angle of the MAYRA PAIM

PATEL ,KARYNA MARTIS .This study evaluated the variations in the anterior cranial base(S-N),posterior cranial base(S-Ba)and deflection of cranial base (SN Ba)among three different facial patterns. A sample of 60 lateral cephalometric radiographs BRAZILIAN CAUCASIAN patients,both genders ,between 8and 17 years of age was selected .The sample was divided into 3 groups (pattern I,II,III) of 20 individual .The inclusion criteria for each group were the ANB angle, wits appraisal and facial profile angle ,to compare the mean values obtained from (SN BA.s-n,s-Ba)each group measurements .In results there was no statistically significant difference for the deflection angle of the cranial base among the different facial patterns.There was no significant difference for the measures of anterior and posterior cranial base between the facial patterns I and II. The mean values for S-Ba were lower in facial pattern III with statistically significant difference. The mean value of S-N in the facial pattern III were also reduced ,but without showing statistically .significant difference

Chapter Three

Material and Methodology

Material 3-1

: Material used 3-1-1

, Toshipa 4 slice (Astioan) h-021B .120 kv

mA and 2.9 scan time .The slice thickness in PCF was 200
.5mm and 10mm for the rest skull

Figure 3-1 TOSHIPA 4 SLICE MAGHINE

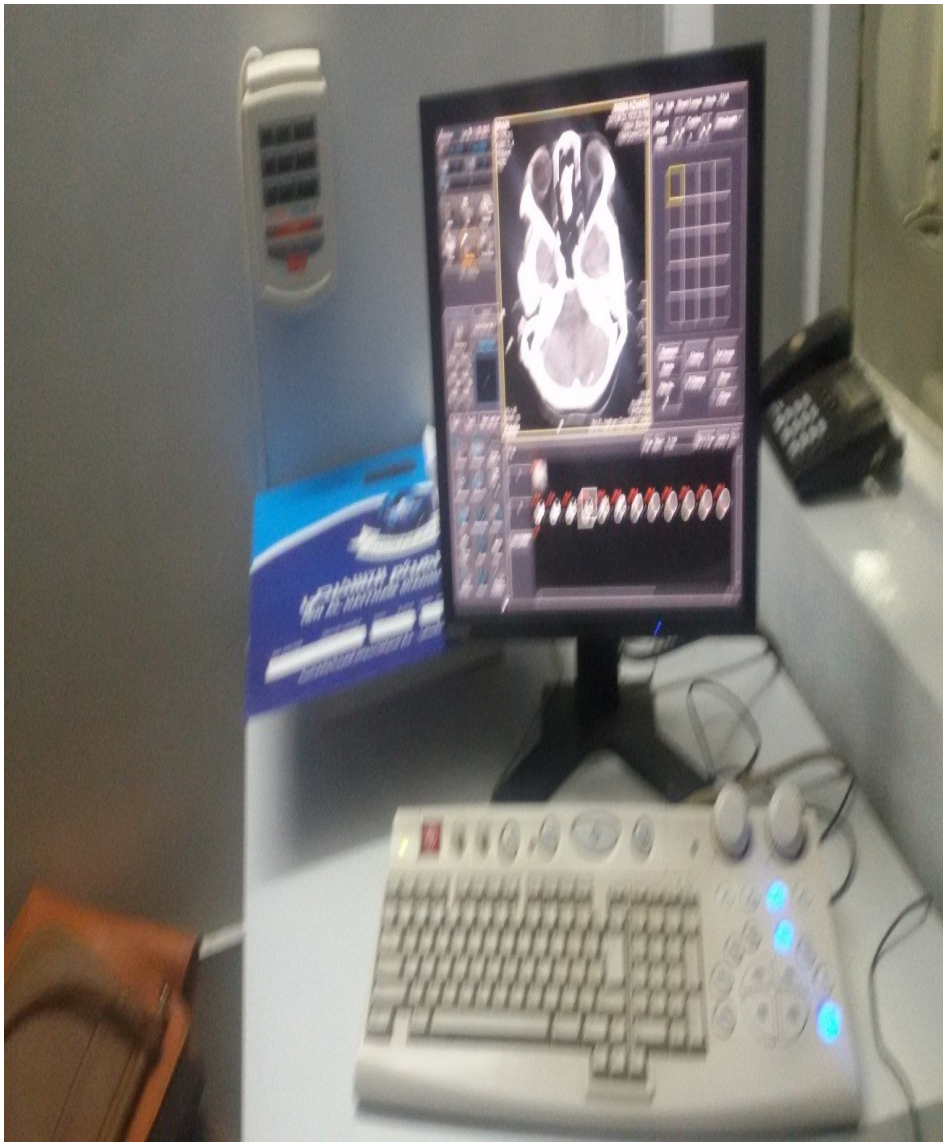


Figure 3-2 CONTROL PANEL

3-2Method

This is a descriptive study that deal with normal cases of CT scan brain consist of 200 patients 103 females .and 97 males at age from 20-80 years old

Area of study 3-1-2

Ibn Alhaitham hospital

Inclusion criteria 3-1-3

.Patients who were normal

Exclusion criteria 3-1-4

Any case with cranial abnormality was excluded .from this study

Method 3-2

data was analysised by using (SPSS) studies and
.the result was presented in form of graphs and tables

-: 3-2-3Variables

(Age - Gender -AP –TRV-CC)

study sample 3-2-4

patients males and females all of them were 200

. normal

-3-2

.

3-2-7Technique

All patients were examined supine with sections parallel to the supraorbital meatal line employing a 256 x 256 matrix, 5 mm slice thickness in the PF and 10 mm in the rest of the skull, 120 kV, 150 mA and 2.9 s scan time. In all CT examinations, linear measurements were performed.

Window settings were adjusted (window width 2500 HU and window level 600 HU). The inner margins of the posterior cranial fossa (PCF) and supratentorial cranial cavity (SCC) were measured; measurements were done by taking into consideration the maximal anteroposterior (AP) and transverse diameters (TRV). The anteroposterior (AP) diameter of the (SCC) was calculated from the number of sections above the sellaturcica and the (PCF) from the number of sections between the foramen magnum and the tentorial apex. Height /Cephalocaudal (CC) was calculated by multiplying the number of slices containing the (PCF) and (SCC) by the slice interval.

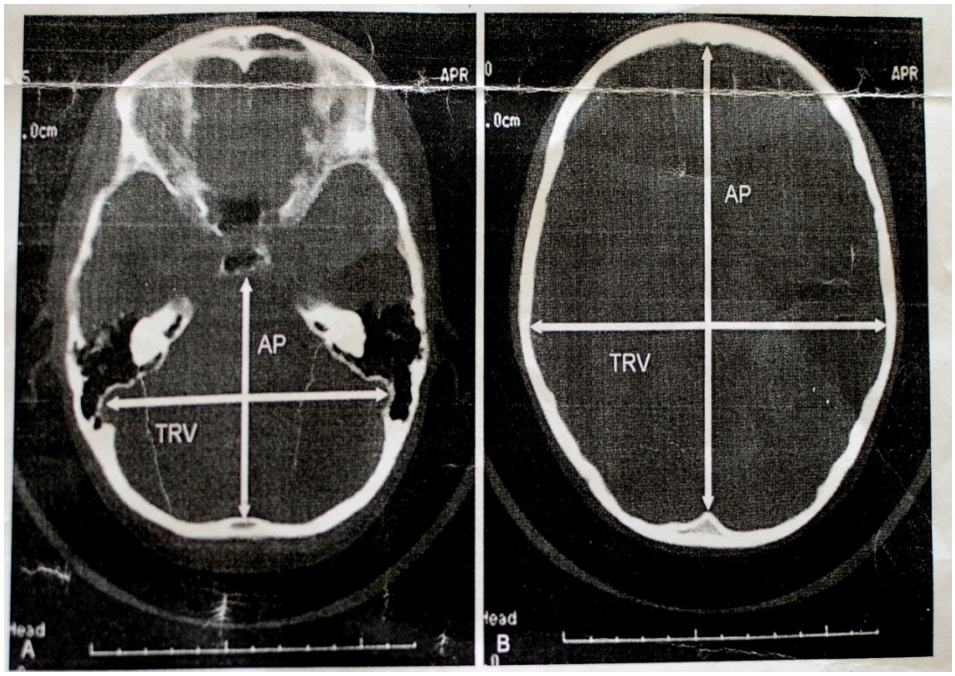
3-2-8 duration of the study

This study was done during the period from January 2014 – February 2015.

3-2-9 Ethical issue :-

. Permission of the hospital was be grand -

. No patient's details were published -



Maximal AP and TRV of PCF and SCC 3-3

The inner margins of the posterior cranial fossa (PCF) and supratentorial cranial cavity (SCC) were measured; measurements were done by taking into consideration the

maximal anteroposterior (AP) and transverse diameters (TRV). The anteroposterior (AP) diameter of the (SCC) was calculated from the number of sections above the sellaturcica and the (PCF) from the number of sections between the foramen magnum and the tentorial apex. Height /Cephalocaudal (CC) was calculated by multiplying the number of slices containing the (PCF) and (SCC) by the .sliceinterval

Chapter Four

Results

Table 1 . The Posterior Cranial Fossa (PCF) and Supratentorial Cranial Cavity (SCC) Morphometric Analyses

		N	Mean ((mm	Std . Deviation	Std. Error Mean	P- value
(AP(mm	PCF	200	72.82	±7.70	0.54	*0.000
	SCC	200	158.69	±6.53	0.46	
(TRV(mm	PCF	200	106.21	±8.75	0.61	*0.000
	SCC	200	125.06	±5.05	0.35	
(CC(mm	PCF	200	65.22	17.81	1.25	*0.000
	SCC	200	401.82	44.52	3.14	

Table 2. The Posterior Cranial Fossa (PCF) and Supratentorial Cranial Cavity (SCC) Morphometric Analyses According to Gender

Variable	Gender	N	Mean ((mm	Std. diviation	P -value
PCF)AP)	Male	97	74.63	±6.848	*0.001
	Female	103	71.11	±8.094	
PCF)TRV)	Male	97	108.07	±5.42	*0.003
	Female	103	104.44	±10.74	
PCF) CC)	Male	97	71.29	±20.14	*0.000
	Female	103	59.49	±12.99	
SCC)AP)	Male	97	160.60	±7.04	*0.000
	Female	103	156.88	±5.47	
SCC)TRV)	Male	97	126.43	±5.41	*0.000
	Female	103	123.77	±4.33	
SCC)CC)	Male	97	403.25	±44.85	0.659
	Female	103	400.46	±44.39	

Table 3. Posterior Cranial Fossa (PCF) Dimensions According To Various Age Groups

	age	N	mean	Std. deviation	Minimum	Maximum	P -value
PCF)AP)	20-30	42	71.90	8.59	27.63	85.39	
	31-40	20	70.42	6.55	59.26	82.28	192.
	41-50	38	72.82	7.89	61.08	98.62	
	51-60	41	72.28	8.15	36.90	91.57	
	61<	59	74.66	6.73	60.48	92.61	
	Total	200	72.82	7.70	27.63	98.62	
) PCF)TRV	31-40	20	100.97	22.0	11.81	115.78	*016.
	41-50	38	108.73	5.66	94.82	120.65	
	51-60	41	105.08	5.42	94.21	118.49	
	61<	59	107.33	5.37	95.75	123.79	
	Total	200	106.20	8.75	11.81	123.79	

	100.00	48.00	10.85	58.47	42	20-30	
	100.00	48.00	14.00	61.60	20	31-40	
200.*	100.00	48.00	16.14	61.47	38	41-50	PCF)CC)
	100.00	48.00	20.68	69.07	41	51-60	
	100.00	48.00	19.71	70.98	59	61<	
	100.00	48.00	17.81	65.22	200	Total	

Table 4 : **Supratentorial Cranial Cavity (SCC) Dimensions According To Various Age Groups in Sudanese Population**

P-value	Maximum	Minimum	Std. deviation	mean	N	age
	182.95	145.60	7.36	159.34	42	20-30
	167.69	143.44	6.26	157.11	20	31-40

	169.89	146.55	5.42	159.29	38	41-50	
0.659							SCC)AP)
	170.22	146.42	5.68	157.97	41	51-60	
	182.67	144.20	7.25	158.87	59	61<	
	182.95	143.44	6.53	158.69	200	Total	
	135.79	113.02	5.16	124.17	42	20-30	
	136.60	117.43	5.63	126.06	20	31-40	
0.344	140.90	117.00	5.38	126.02	38	41-50	
							SCC)TRV)
	137.71	110.90	4.80	124.28	41	51-60	
	140.70	114.90	4.68	125.28	59	61<	
	140.90	110.90	5.05	125.06	200	Total	
	450.00	360.00	44.41	398.00	42	20-30	
	450.00	360.00	43.48	391.10	20	31-40	
	450.00	360.00	44.92	402.05	38	41-50	
	450.00	360.00	45.06	405.60	41	51-60	

						SCC)CC)
450.00	360.00	44.20	405.38	59	61<	

Chapter five

Discussion , Conculusion and Recommendation

5-1 Discussion

Pathologies of the (PCF) are very common. Knowledge of anatomy of this region and the normal range is important in the proper planning of the management. There are normal variations amongst various races, body, habitus, and gender, geographical, and genetic factors (Gautama Kanodia*et al*., 2012). Although there are studies on normal dimensions of the (PCF) and (SCC), there is no study in the Sudanese population. Table (1) presented the measurements done for the 200 patients. The (AP), (TRV) and height (CC)dimensions for (PCF) and (SCC) were found to be 72.82±7.70 (mm), 158.69±6.53(mm) and 106.21±8.75(mm) for the (PCF) and, 125.06±5.05(mm), 65.22±17.81(mm), 401.82± 44.52(mm)for (SCC) respectively with significant difference between the variables at p=0.000.Sudanese height (CC)of the (PCF) and (SCC) were greater than the study done by Gautama .(Kanodia*et al*. (2012

The (AP), (TRV) and height (CC) measurements .(reflects the volume of the cavity Prassopoulos*et al*., 1996

The presentation with hypoplasia of the bony structures could be more in congenital anomalies like

Chiari Malformation 1. Short craniocaudal height of (PCF) and underdeveloped bony structures could lead to downward herniation of the contents in adult (Nishikawa, 1997; Vega, 1990). The congestion of posterior cranial fossa (PCF) can be determined if the normal range of the dimensions and height is available (Gautama Kanodia*et al*., 2012). Grant *et al.*(2011) reported that the myelomeningocele was associated with smaller (PCF). The (PCF) and (SCC) morphometric analyses according to gender was done, this was presented in Table (2). It is useful, when assessing (PCF), (SCC), height (CC) dimensions, to use standards for males and females and to relate (PCF) to (SCC) to eliminate sex differences. We found the (PCF) develop in parallel with the (SCC); its (AP) and (TRV) dimensions showed a strong correlation with the .(SCC) measurements

Dimensions and the height (CC) of the (PCF) and the (SCC) were recorded in 200 Sudanese patients. There were 97 male and 103female patients, The males have larger measurements than females, These differences were statistically significant in all variables except the (SCC) height (CC). No significant difference was detected between the males and females, similar study was done by Prassopoulos*et al*. (1996). There was no difference in dimensions of the (PCF) and (SCC) in various age groups, as shown in tables (3) and (4) except (TRV) and height (CC) of the(PCF) as noted in table(3) it increases by

advanced age . Abnormal changes in the measurements of the (PCF) associated with malformations are usually assessed qualitatively as mentioned by Schaefer GB (1991) and recent reports have stressed the necessity for quantitative morphometric analysis in the study of diseases of the (PCF) (Schaefer *et al*., 1990; Edward 1991). Therefore normative quantitative values will reflect any presence of morphometric changes occurs at that area. This is why we need to establish a local reference for Sudanese. The study concluded that normal ranges of various dimensions of (PCF) and (SCC) for Sudanese population were established and could serve as Local .reference

5.2 Conculusion

- A CT scan of the brain to measure (P F) and (S C) is a method for evaluation the A P , T R V and C C .dimensions
- Normal values of (P F) and (S C) could serve a future references .

5-3Recommendations

- Make comparison between the values taken by C T and MRI to determine which one is more accurate in measuring (the (PF) and (SC .

For more accurate results , future studies should include -
the measurement of volume for (PF) and (S C) to find out
. more advantage

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Appendix A

THE TABLE OF DATA COLLECTED DURING THE STUDY

CC	*TRV*	*AP*	*SCC*	*CC*	*TRV*	*AP*	*PCF*	*Age*	*Gen-der*	
360	121.36	161.11		60	102.99	65.65		43	F	1
360	125.40	169.89		60	114.09	78.13		50	M	2

360	133.13	167.30	60	115.21	72.77	50	F	3
450	123.21	149.12	100	100.18	67.36	55	M	4
448	117.12	159.29	48	108.63	77.59	30	F	5
360	130.80	162.85	60	109.17	74.78	30	M	6
448	125.11	152.46	48	113.48	73.72	47	F	7
448	124.02	167.00	60	107.35	90.60	73	M	8
450	128.16	157.53	60	105.84	67.60	26	M	9
360	119.29	154.16	60	100.94	70.66	22	F	10
448	118.35	148.68	48	103.39	68.52	54	F	11
450	123.88	156.92	60	105.22	80.14	61	M	12
360	133.36	166.09	60	108.28	66.38	38	M	13
448	124.80	152.33	48	100.64	71.88	71	F	14
448	128.47	160.28	48	113.18	72.19	49	F	15
360	121.13	160.5	10	103.3	65.15	65	M	16

		9	0	9				
360	134.59	163.95	60	116.85	64.85	69	M	17
448	121.29	159.86	48	102	91.57	58	F	18
360	121.20	162	100	106.48	76.94	65	F	19
450	119.18	155.06	60	100.78	74.57	30	M	20
360	125.61	158.82	60	106.50	79.80	21	M	21
360	126.90	164	60	108.09	73.07	24	F	22
448	117.97	153.68	48	101.05	69.83	45	F	23
360	120.66	154.21	60	106.35	71.56	72	F	24
360	136.60	156.68	60	115.23	70.39	31	F	25
448	122.64	154.89	48	106.90	79.22	78	F	26
360	118.96	160.63	100	102.96	77.30	65	F	27
448	133.46	162.44	48	109.60	84.84	68	M	28
360	140.70	182.67	60	123.79	77.30	75	M	29

448	123.09	165.08	48	101.88	75.48	47	F	30
450	126.40	152.33	60	109.53	76.04	55	F	31
360	126.10	162.39	60	103.84	75.50	35	F	32
360	120.96	164.86	60	101.15	75.73	52	F	33
450	126.66	158	60	104.79	77.37	28	M	34
360	125.08	165.57	60	103.28	72.92	55	M	35
360	127.70	158.95	60	113.03	78.65	63	F	36
360	130.85	158.19	60	107.19	76.39	50	F	37
360	120.17	155.19	60	100.85	64.01	21	F	38
360	118.66	153.38	60	88.17	59.48	32	F	39
448	120.04	155.59	48	11.81	70.50	40	F	40
360	126.30	170.50	60	102.93	88.10	67	M	41
360	119.13	159.55	60	95.73	74.45	38	F	42
450	122.57	156.4	60	110.5	88.90	48	F	43

		4		4				
360	122.15	161.48	60	103.40	75.79	65	F	44
448	115.18	169.30	48	108.49	85.39	25	M	45
360	132.50	173.83	60	113.05	87.80	65	M	46
360	127.94	163.80	60	113.96	79.01	62	F	47
360	122.17	168.66	60	112.44	90.50	75	M	48
360	129	166.84	100	108.87	75.80	63	M	49
360	129.80	159.85	60	100.80	70.50	55	M	50
360	134.93	165.62	100	96.12	63.83	75	M	51
448	116.60	159.62	48	110.31	70.50	53	M	52
360	124.60	160	60	106.97	64.43	65	F	53
360	130.70	170.20	100	106.84	72	60	M	54
360	124.30	163.50	60	98.17	63.51	20	M	55
448	117.30	147.39	48	97.85	69.90	75	F	56

360	129.30	155.80	60	105.79	69.72	60	F	57
448	124.60	158.63	48	112.75	64.43	47	F	58
360	128.55	164.41	60	103.63	65.34	72	M	59
360	128.54	152.92	60	106.45	69.87	38	F	60
360	125.51	152.86	60	110.62	68.98	45	F	61
360	124.60	164.71	48	113.75	68.07	45	M	62
360	125.50	162.58	60	106.67	70.20	55	F	63
360	120.60	154.60	60	109.87	70.15	70	F	64
450	120.50	159.45	100	94.82	65.95	44	M	65
360	124.60	165.45	60	101.82	75.90	45	F	66
360	125.21	158.63	60	100.70	77.80	45	F	67
360	125.86	159.55	60	101.50	67.40	23	M	68
448	120.86	150.70	48	110.69	80.63	23	M	69
450	124.80	152.8	60	118.2	77.34	52	M	70

		0		8				
448	121.25	158.33	48	100.29	72.33	33	F	71
450	128.24	147.69	60	109.70	74.15	67	F	72
448	122.70	158.84	48	108.71	77.79	57	F	73
448	124.19	158.15	48	93.90	27.63	27	F	74
360	130.30	158.19	60	118.49	75.05	54	F	75
448	126.56	165.40	48	103.90	72.95	35	F	76
360	133.80	157.44	60	109.54	72.28	34	M	77
448	122.90	153.20	48	111.07	76.61	43	M	78
360	130.09	147.98	60	110.52	73.35	20	M	79
450	122.12	152.84	60	108.50	71.84	55	F	80
360	132.45	160.89	100	104.61	72.80	60	M	81
448	130.13	152.12	48	112.87	75.30	26	M	82
360	122.35	155.08	60	105.22	72.80	55	F	83

448	121.93	157.87	60	105.46	64.60	41	F	84
450	119.25	152.20	100	101.12	71.67	42	M	85
448	124.65	156.20	48	115.25	89.22	49	M	86
360	118.90	157.56	60	100.06	84.19	60	F	87
360	128.70	164.28	60	113.52	76.61	43	M	88
360	129.69	157.53	60	114.30	72.49	21	F	89
450	127.80	144.99	60	106.61	77.69	38	F	90
360	121.84	150.90	60	102.48	64.90	33	F	91
450	120.92	155.39	60	113.20	81.36	38	M	92
450	122.84	159.99	100	106.45	76.16	60	M	93
360	125.11	158.14	60	107.98	78.92	58	F	94
448	130.19	149.59	48	108.13	77.83	25	F	95
360	123.39	164.90	60	112.69	81.16	71	M	96
450	124.61	159.0	60	106.7	72.49	49	F	97

		6		5				
450	121.02	158.0	60	107.0	75.77	64	F	98
		0		5				
360	121.01	150.7	60	102.4	66.80	22	F	99
		1		1				
360	125.75	160.5	60	109.5	76.27	20	M	10
		2		0				0
360	125.60	160.8	60	111.1	75.98	57	F	10
		9		8				1
450	122.02	155.2	60	105.2	80.20	63	M	10
		0		4				2
450	118.42	153.4	10	99.71	67.71	60	F	10
		2	0					3
450	126	154.6	10	106.6	68.17	58	M	10
		3	0	3				4
450	123.90	154	60	116.0	73.15	48	M	10
				7				5
360	127.45	162.6	10	109.9	71.79	67	M	10
		8	0	8				6
360	117.43	161.0	10	98	66.54	39	F	10
		5	0					7
360	123.17	162.6	60	109.0	78.49	60	M	10
		8		4				8
448	128.02	160.7	48	104.4	80.32	57	M	10
		8		0				9
360	127.75	162.1	60	114.0	73.05	64	F	11
		5		2				0

448	128.08	149.11	48	102.03	71.36	70	F	111
360	110.90	168.24	60	105.40	72.02	55	M	112
448	115.72	152.70	48	103.12	76.93	23	F	113
360	125.02	154.39	60	111.65	76.47	70	F	114
360	129.04	170.22	60	107.80	80.12	57	M	115
360	117.87	160.45	100	101.90	75.03	65	M	116
450	120.05	150.14	100	96.81	36.90	60	F	117
360	124.19	157.84	60	95.74	70.05	25	F	118
360	124.90	160.37	100	104.60	68.23	56	F	119
360	124.36	165.63	60	106.29	80.39	44	M	120
450	120.01	155.40	60	107.41	79.98	78	F	121
360	122.13	160.20	100	101.73	76.04	55	M	122
450	123.60	158.95	60	111.38	80.43	48	F	123
450	126.44	155.2	10	108.1	70.15	30	F	12

		7	0	4				4
360	128.30	155.76	60	107.09	70.04	20	F	125
360	120.04	164.24	60	113.03	75.99	27	M	126
360	122.00	160.90	100	104.51	71.30	36	M	127
450	113.02	145.60	60	97.11	72.21	30	F	128
450	117.40	152.02	100	108.63	69.69	26	M	129
450	122.02	156.82	100	106.51	71.77	80	M	130
448	128	157.13	48	109.56	66.20	38	F	131
360	124.90	164.83	100	108.71	80.93	44	M	132
360	126.68	172.07	60	108.38	70.38	23	M	133
360	121.25	156.20	60	100.89	66.25	49	F	134
360	130.37	158.63	48	112.14	68.38	44	F	135
448	137.71	162.10	60	116.00	72.57	60	M	136
448	124.14	153.88	48	99.25	61.39	57	F	137

360	129.16	160.76	100	107.88	68.07	50	M	138
448	126.42	146.78	48	102.72	69.29	30	F	139
448	127.34	146.42	48	102.60	70.20	60	F	140
360	122.17	155.90	60	103.63	69.90	58	F	141
448	120.71	166.13	60	98.12	75.54	65	M	142
360	128.27	163.20	60	107.32	70.48	24	F	143
450	126.42	148.91	100	100.29	70.81	62	M	144
360	126.42	165.93	60	100.59	68.07	20	M	145
360	128.85	158.63	60	106.97	59.26	35	F	146
448	117.12	159.17	48	101.80	68.95	30	M	147
448	130.87	153.98	60	115.25	76.21	80	M	148
360	127.94	145.87	60	104.84	60.48	68	F	149
448	125.69	154.07	48	95.28	57.34	58	F	150
360	123.08	162.2	60	109.7	67.16	41	F	15

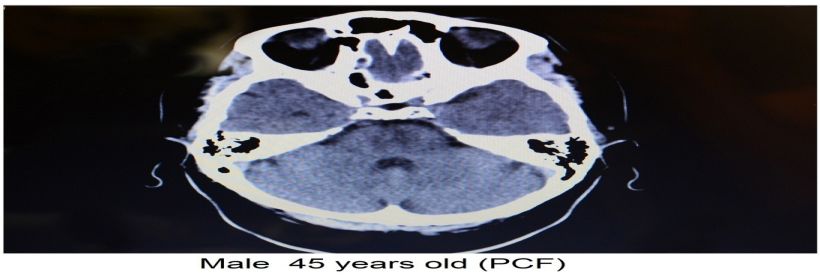
		8		1				1
448	127.64	168.36	60	114.27	74.15	75	M	152
360	139.11	167.88	48	120.65	64.83	46	M	153
450	132.50	154.38	60	109.40	74.76	32	M	154
360	130.07	143.44	60	115.78	60.17	40	M	155
448	121.25	150.12	48	104.54	65.64	72	F	156
360	140.90	146.55	60	107.03	72.98	49	M	157
450	130.37	148.90	100	115.48	74.76	66	M	158
448	123.99	154.68	48	102.72	66.55	58	F	159
360	124.90	161.37	60	95.75	76.89	76	F	160
360	125.21	156.51	60	107.58	67.16	70	F	161
448	134.32	158.63	60	109.71	65.64	45	M	162
360	125.21	161.17	100	112.48	74.81	60	M	163
448	117	153.10	48	102.3	64.21	45	F	164

360	118.82	161.98	60	109.71	79.32	24	F	165
360	130.37	182.95	60	108.19	76.89	24	M	166
450	126.92	159.48	100	108.72	75.39	70	M	167
360	124.60	165.18	60	96.94	67.16	30	F	168
360	116.70	163.80	100	94.21	77.49	53	F	169
360	128.03	160.04	100	102.51	70.69	62	M	170
450	123.70	154.08	100	106.36	70.50	70	M	171
360	123.08	161.38	60	103.02	61.08	46	F	172
360	122.33	164.33	100	101.61	75.20	65	M	173
450	117.74	144.20	60	105.36	73.56	65	F	174
360	126.42	161.67	100	107.58	75.06	70	M	175
360	123.56	157.62	60	104.35	72.48	29	F	176
450	123.98	157.69	100	113.65	75.85	44	M	177
450	125.47	151.8	10	110.1	70.79	70	M	17

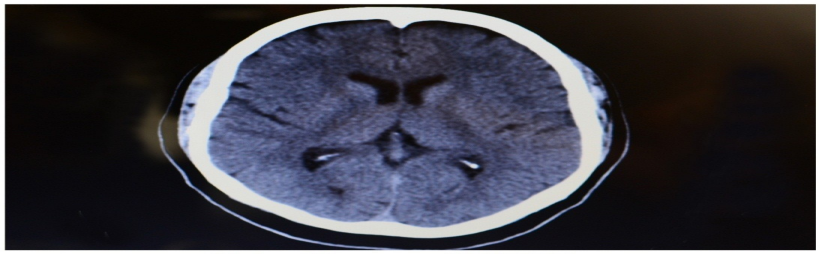
		9	0	0				8
450	114.90	149.45	60	103.39	73.70	70	F	179
360	118.82	162.15	60	112.06	77.45	24	F	180
450	123.90	152.13	100	103.26	68.62	59	M	181
450	129.19	150.29	60	100.19	75.47	55	M	182
360	127.76	167.69	60	109.71	82.28	35	M	183
450	125.90	158.53	100	107.77	67.56	78	M	184
360	135.79	168.41	60	110.41	74.15	22	M	185
448	128.28	170.46	48	114.69	80.52	30	F	186
450	124.90	159.52	60	107.44	92.61	80	M	187
360	123.40	166.63	60	105.73	74.02	80	F	188
448	135.08	150.08	48	112.56	64.41	44	F	189
450	123.58	155.75	60	105.41	70.66	78	F	190
450	127.22	161.16	60	112.39	77.78	74	M	191

360	129.85	163.80	60	109.75	68.55	20	M	192
360	126.60	163.78	60	108.02	69.44	48	F	193
450	129.33	155.37	60	112.92	67.36	75	M	194
450	128.63	158.48	60	113.28	75.91	63	M	195
448	123.97	162.68	48	108.81	66.05	30	F	196
450	122.85	158.29	60	103.40	73.28	52	M	197
448	120.25	161.94	48	103.76	79.19	21	M	198
360	133.16	166	60	114.57	98.62	41	M	199
448	125.11	152.33	100	106.45	72.80	75	M	200

Appendix B

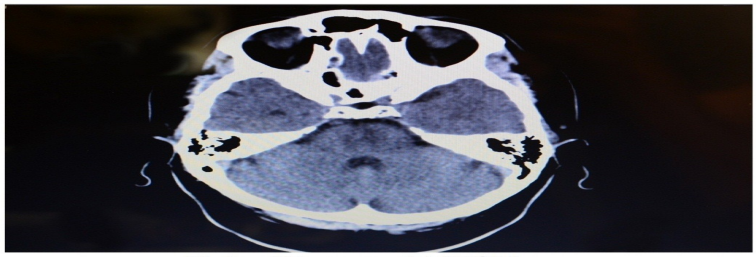


Male 45 years old (PCF)

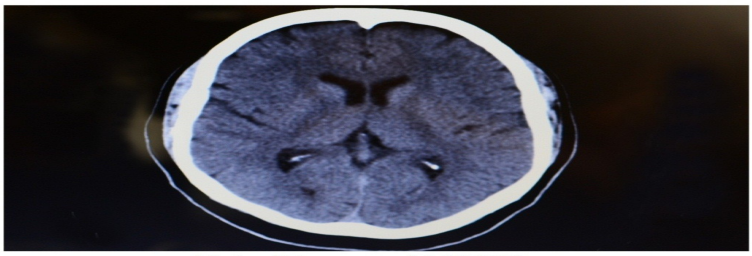


Male 45 years old (SCC)

B: 1) Axial CT scan image for male of 45 years old) measuring PCF



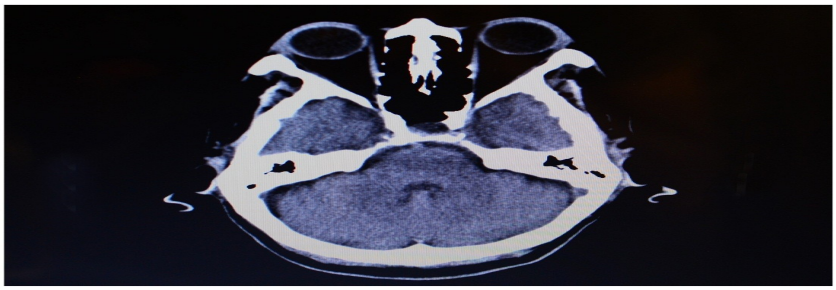
Male 45 years old (PCF)



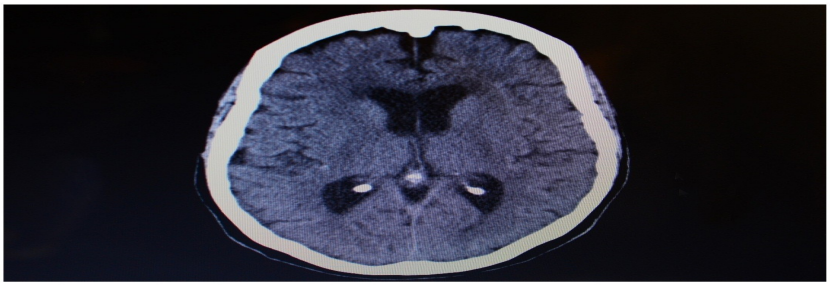
Male 45 years old (SCC)

B: 2) Axial CT image for male of 45 years old measuring) SCC

Normal measurements Female 43 years old



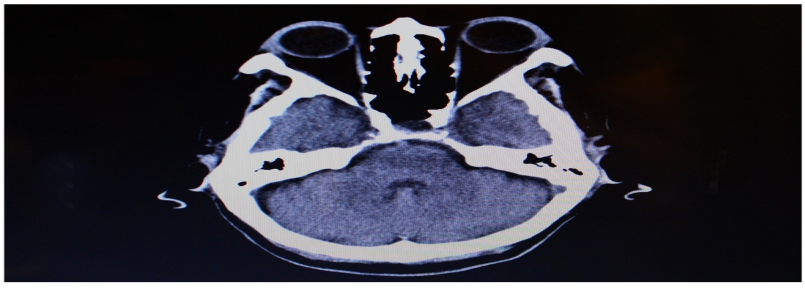
PCF



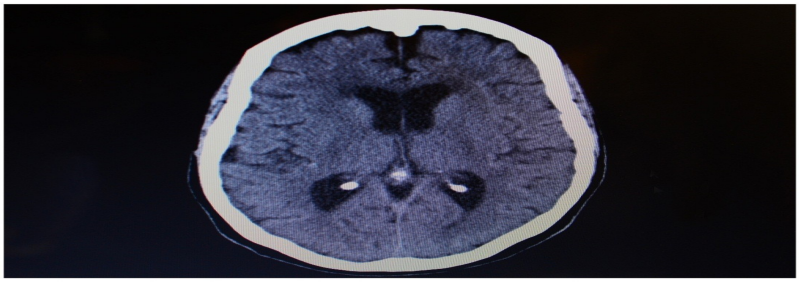
(SCC)

B: 3) Axial CT image for male of 43years old) measuring PCF

Normal measurements Female 43 years old

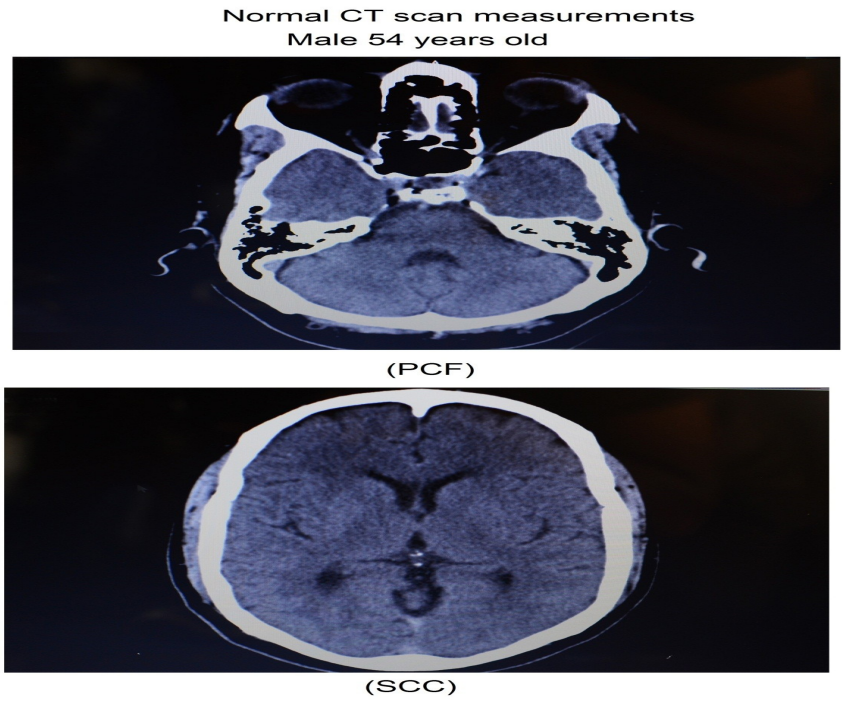


PCF



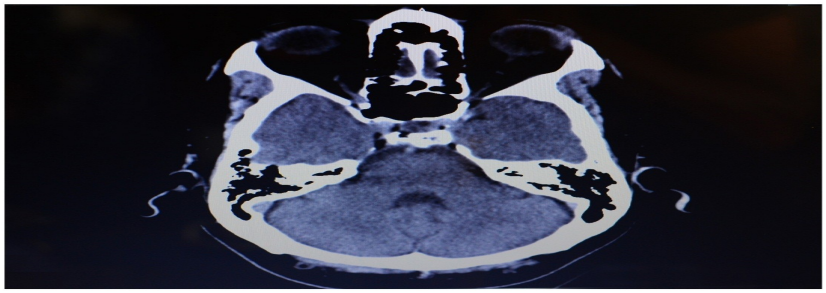
(SCC)

B: 4) Axial CT image for male of 43years old) measuring SCC

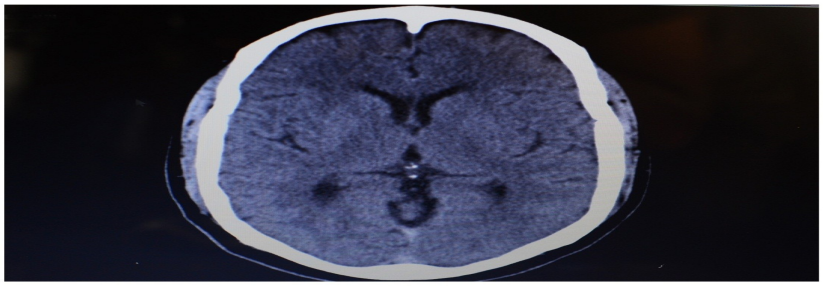


B: 5) Axial CT image for female of 54years old measuring) PCF

Normal CT scan measurements
Male 54 years old



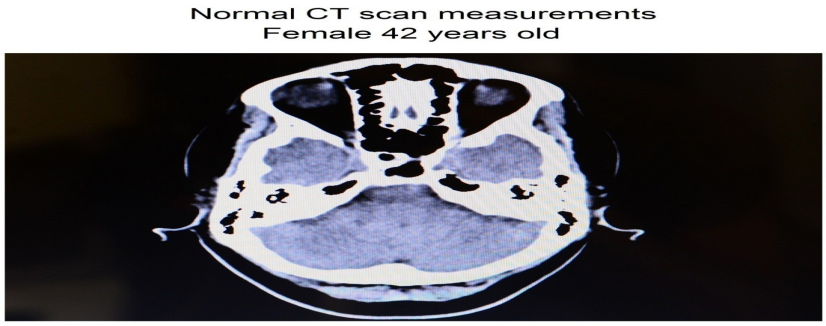
(PCF)



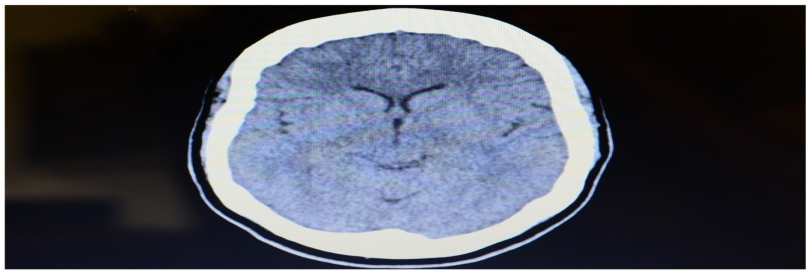
(SCC)

B: 6) Axial CT image for female of 54 years old)

measuring SCC

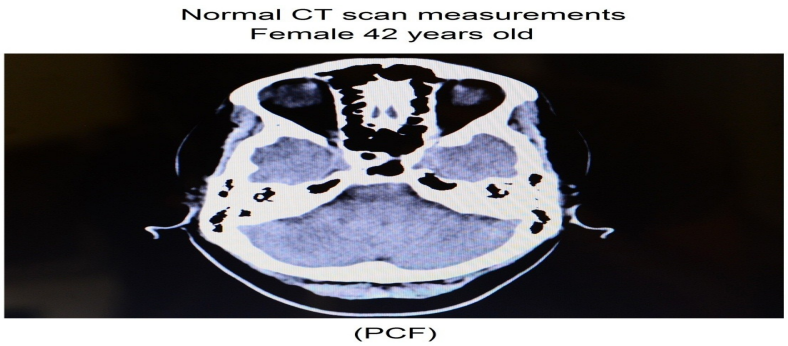


(PCF)

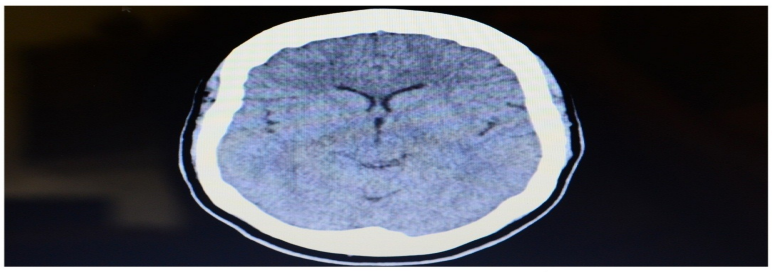


(SCC)

B: 7) Axial CT image for female for 42 years old) measuring PCF



(PCF)

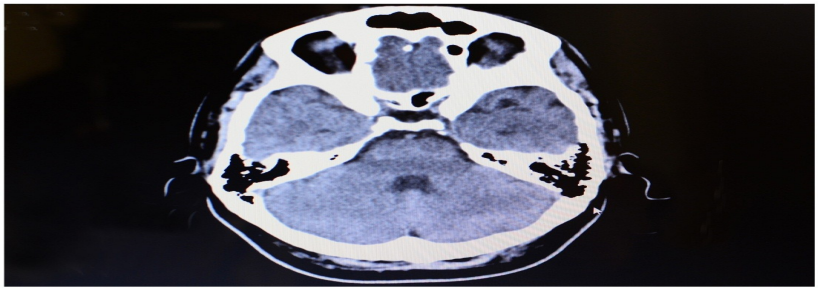


(SCC)

B: 8) Axial CT image for female of 42 years old)

measuring SCC

Normal CT scan measurements
Female 58 years old



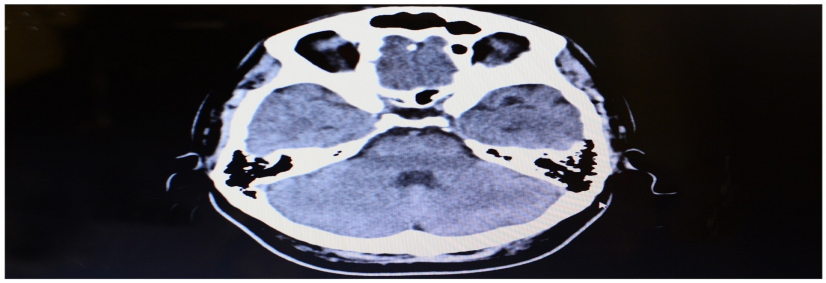
(PCF)

(SCC)

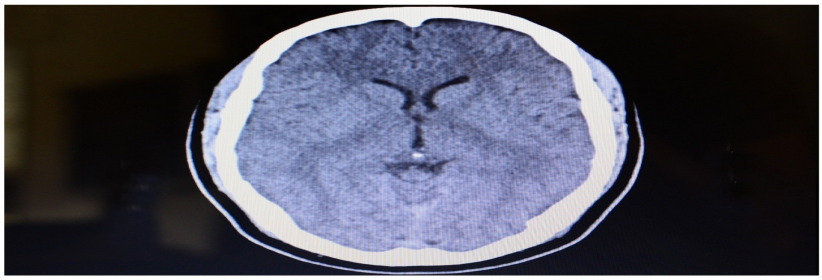
B:9) Axial CT image for female of 58 years old)

measuring PCF

Normal CT scan measurements
Female 58 years old



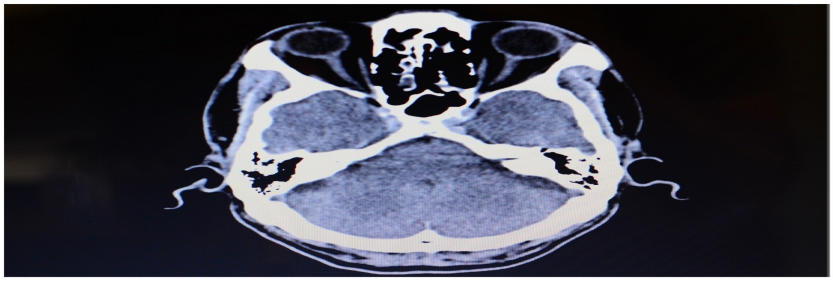
(PCF)



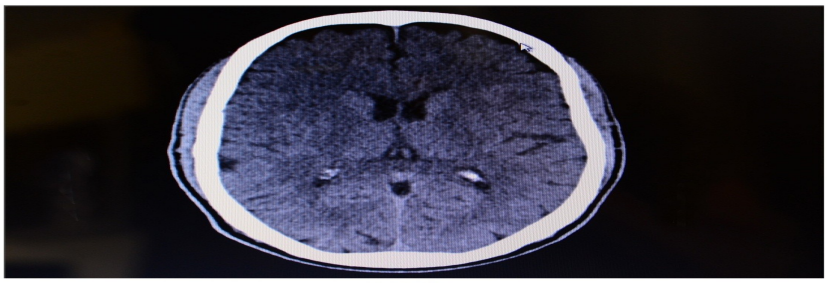
(SCC)

B: 10) Axial CT image for female of 58 years old) measuring SCC

Normal CT scan measurements
Female 40 years old



(PCF)

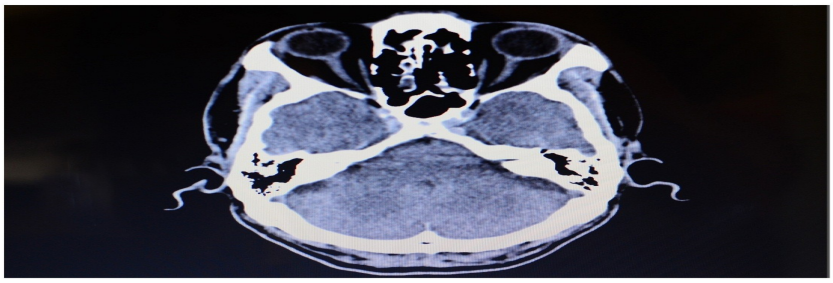


(SCC)

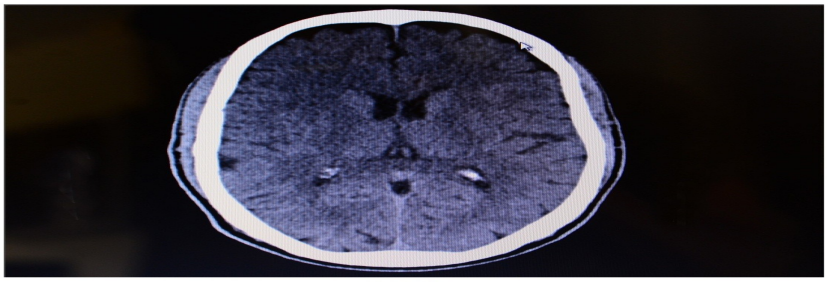
B: 11) Axial CT image for female of 40 years old)

measuring PCF

Normal CT scan measurements
Female 40 years old



(PCF)

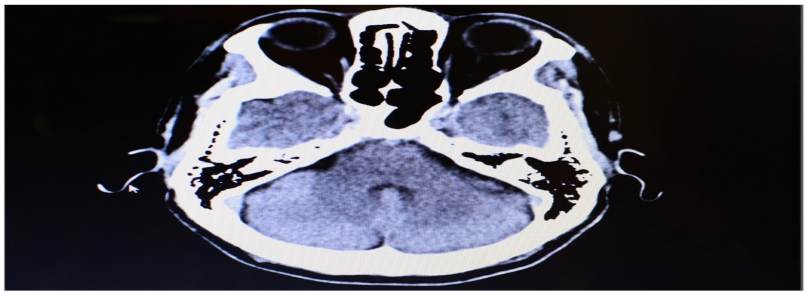


(SCC)

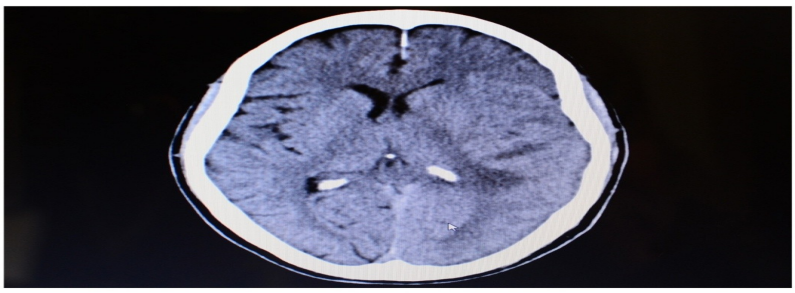
B: 12) Axial CT image for female of 40 years old)

measuring SCC

Normal CT scan measurements
Male 44 years old



(PCF)

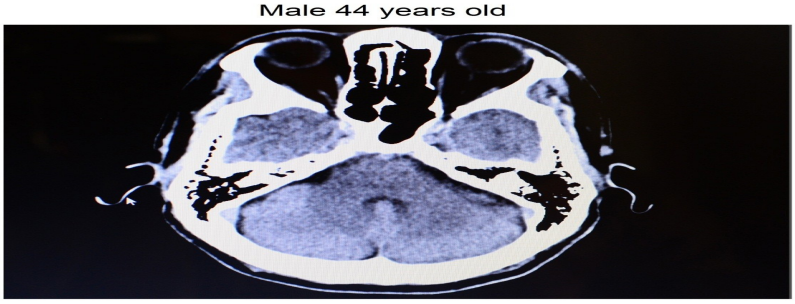


(SCC)

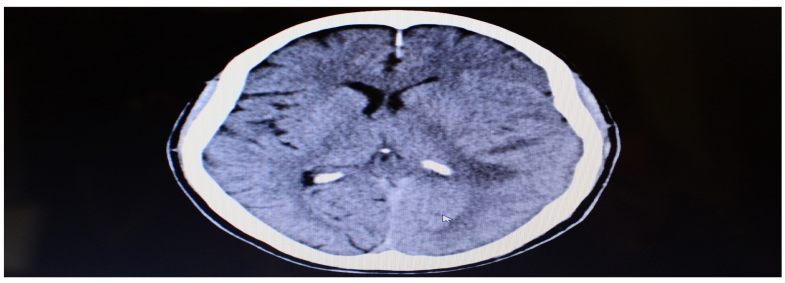
B: 13) Axial CT image for female of 44 years old measuring)

PCF

Normal CT scan measurements
Male 44 years old



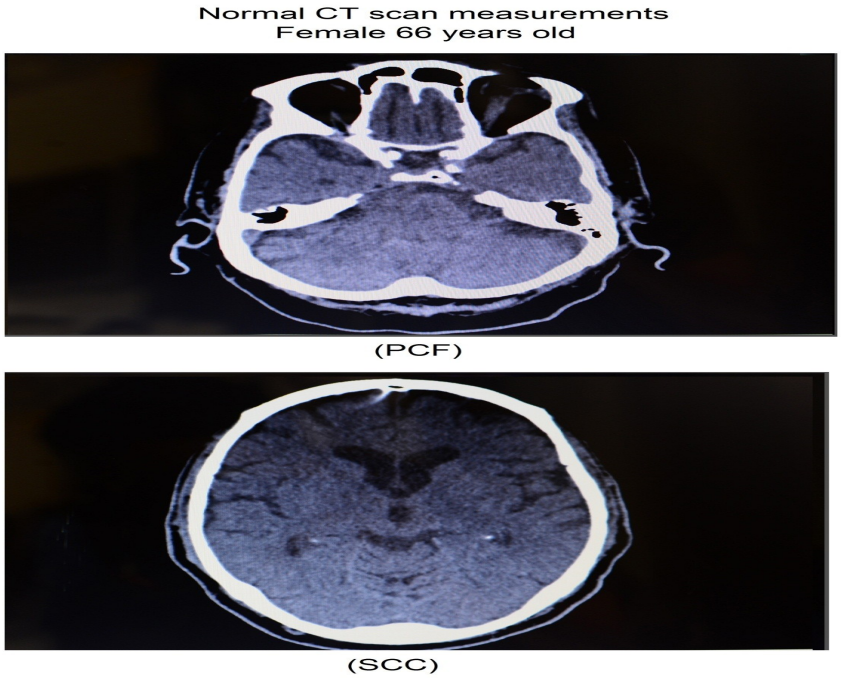
(PCF)



(SCC)

B: 14) Axial CT image for male of 44 years old)

measuring SCC

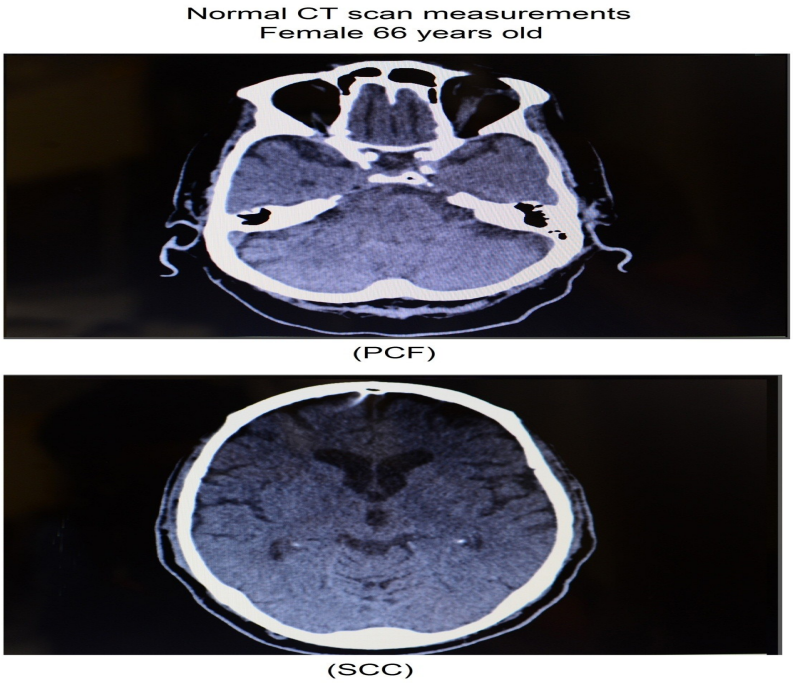


(PCF)

(SCC)

B: 15) Axial CT image of female of 66 tears old)

measuring PCF

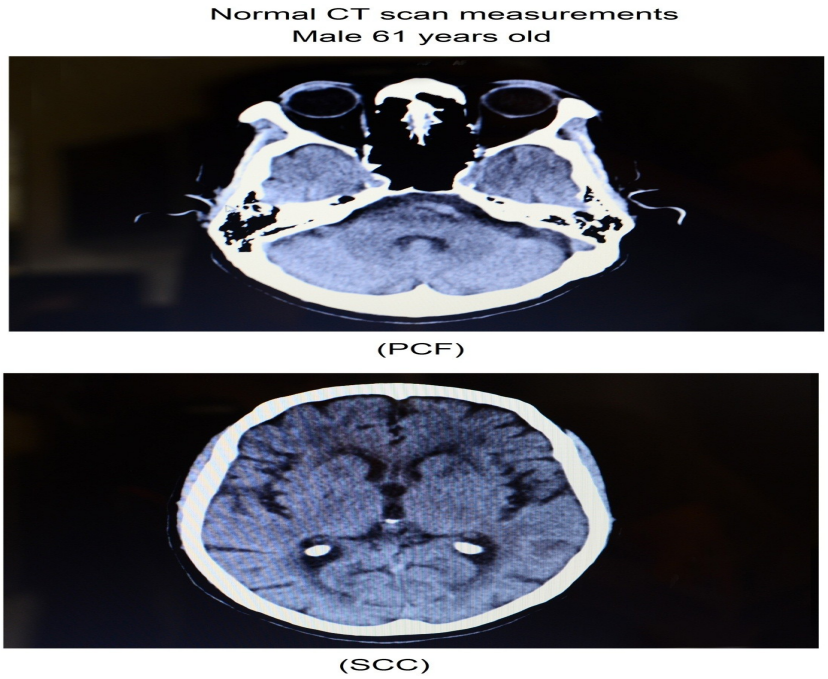


(PCF)

(SCC)

B: 16) Axial CT image for female of 66 tears old)

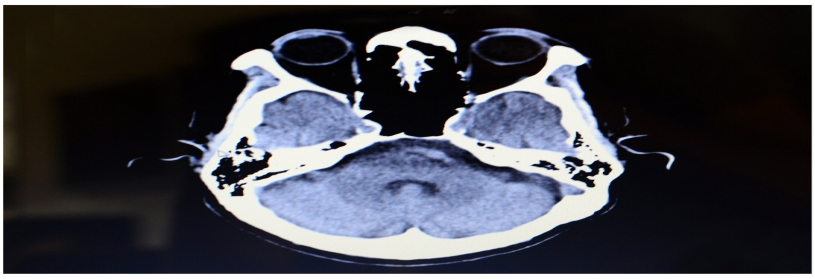
measuring SCC



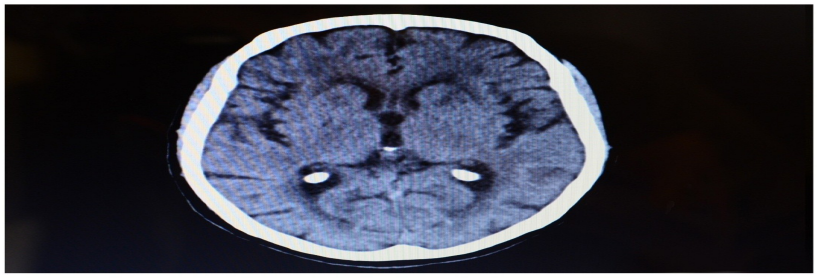
B: 17) Axial CT image for male of 61 years old)

measuring PCF

Normal CT scan measurements
Male 61 years old



(PCF)

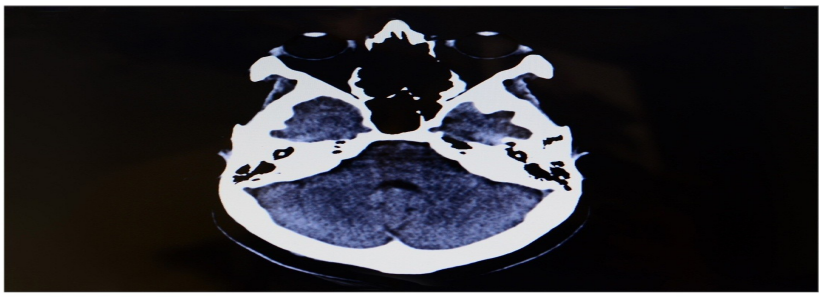


(SCC)

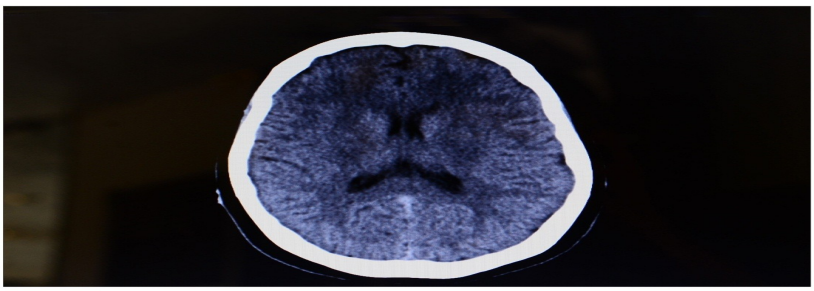
B: 18) Axial CT image for male of 61 years old)

measuring SCC

Normal CT scan measurements
Female 29 years old

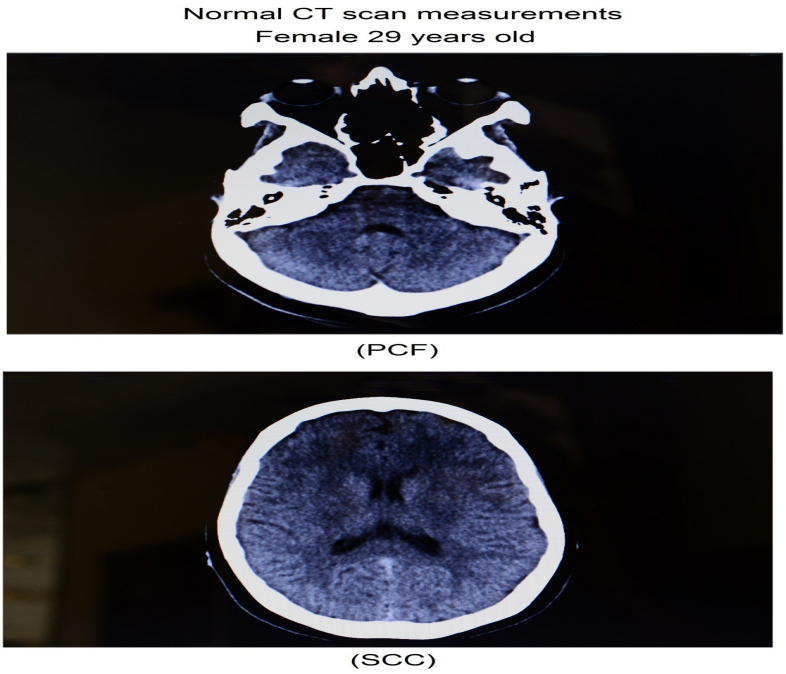


(PCF)



(SCC)

B: 19) Axial CT image for female of 29 years old measuring PCF)



(PCF)

(SCC)

B: 20) Axial CT image for female of 29 years old measuring SCC)