CORRELATION OF MIDLINE SHIFT ONCT WITH GLASGOW COMA PUPILS SCORE (GCS-P) IN PREDICTING PROGNOSIS IN CRANIOCEREBRAL TRAUMA

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RADIO-DIAGNOSIS

TABLE OF CONTENTS

SERIAL No.	TOPIC	PAGE No.
	PART I	
1.	INTRODUCTION	14
2.	AIMS AND OBJECTIVES OF THE STUDY	15
3.	REVIEW OF LITERATURE	16
	PART II	
4.	MATERIALS AND METHODS	42
5.	CASES AND IMAGING GALLERY	46
6.	OBSERVATIONS AND RESULTS	51
	PART III	
7.	DISCUSSION	72
8.	CONCLUSIONS	74
9.	BIBILIOGRAPHY	75
10.	ANNEXURES	80

LIST OF FIGURES

SL. No.	TITLE	PAGE NO.
1.1	AXIAL CT SCAN OF BRAIN DEMONSTRATING SOFT TISSUE SWELLING	17
1. 2	AXIAL CT SCAN OF BRAIN DEMONSTRATING SOFT TISSUE SWELLING	18
1.3	AXIAL CT SCAN OF BRAIN DEMONSTRATING COMMINUTED DEPRESSED FRACTURE	19
1.4	AXIAL CT SCAN OF BRAIN DEMONSTRATING TENSION PNEUMOCEPHALUS	20
1.5	AXIAL CT SCAN OF BRAIN DEMONSTRATING PNEUMOCEPHALUS	21
1.6	AXIAL CT SCAN OF BRAIN DEMONSTRATING PNEUMOORBIT	22
1.7	AXIAL CT SCAN OF BRAIN DEMONSTRATING EXTRADURAL HEMORRHAGE	23
1.8	AXIAL CT SCAN OF BRAIN DEMONSTRATING EXTRADURAL HEMORRHAGE	24
1.9	AXIAL CT SCAN OF BRAIN DEMONSTRATING SUBDURAL HEMORRHAGE	25
1.10	AXIAL CT SCAN OF BRAIN DEMONSTRATING SUBDURAL HEMORRHAGE	26
1.11	AXIAL CT SCAN OF BRAIN DEMONSTRATING SUBDURAL HEMORRHAGE	27
1.12	AXIAL CT SCAN OF BRAIN DEMONSTRATING TRAUMATIC SUBARACHNOID HAEMORRHAGE	28
1.13	AXIAL CT SCAN OF BRAIN DEMONSTRATING BRAIN CONTUSION	29
1.14	AXIAL CT SCAN OF BRAIN DEMONSTRATING BRAIN CONTUSION	30

1.15	**AXIAL CT SCAN OF BRAIN DEMONSTRATING INTRAVENTRICULAR HEMORRHAGE**	31
1.16	**AXIAL CT SCAN OF BRAIN DEMONSTRATING DIFFUSE AXONAL INJURY**	32
1.17	**AXIAL CT SCAN OF BRAIN DEMONSTRATING CEREBRAL EDEMA**	33
1.18	**AXIAL CT SCAN OF BRAIN DEMONSTRATING SUBFALCINE HERNIATION**	35
2	**BRAIN HERNIATION**	35
3	**AXIAL CT SCAN OF BRAIN DEMONSTRATING MIDLINE SHIFT**	46-50

LIST OF TABLES

SL.NO.	TABLES	PAGE NO.
1.	**AGE WISE DISTRIBUTION**	51
2.	**GENDER WISE DISTRIBUTION**	52
3	**CT FINDINGS**	53
4	**MIDLINE SHIFT**	54
5	**GCS SEVERITY**	55
6	**PUPILLARY REACTION**	56
7	**OUTCOME**	57
8	**CORRELATION BETWEEN CT FINDINGS AND AGE**	58
9	**CORRELATION BETWEEN CT FINDINGS AND GENDER**	59
10	**CORRELATION BETWEEN CT FINDINGS AND MIDLINESHIFT**	60
11	**CORRELATION BETWEEN CT FINDINGS AND GCS**	61
12	**CORRELATION BETWEEN CT FINDINGS AND PUPILLARY REACTION**	62

13	**CT FINDINGS AND OUTCOME**	63
14	**CORRELATION BETWEEN MIDLINE SHIFT AND GCS**	64
15	**CORRELATION BETWEEN MIDLINE SHIFT AND PUPILLARY REACTION**	65
16	**CORRELATION BETWEEN MIDLINE SHIFT AND OUTCOME**	66
17	**CORRELATION BETWEEN AGE AND GCS SEVERITY**	67
18	**CORRELATION BETWEEN GCS AND PUPILLARY REACTION**	68
19	**CORRELATION BETWEEN GCS AND OUTCOME**	69
20	**CORRELATION BETWEEN PUPILLARY REACTION AND OUTCOME**	70

LIST OF GRAPHS

SL.NO.	**GRAPHS**	**PAGE NO.**
1.	**AGE WISE DISTRIBUTION**	51
2.	**GENDER WISE DISTRIBUTION**	52
3	**CT FINDINGS**	53
4	**MIDLINE SHIFT**	54
5	**GCS SEVERITY**	55
6	**PUPILLARY REACTION**	56
7	**OUTCOME**	57
8	**CORRELATION BETWEEN CT FINDINGS AND AGE**	58
9	**CORRELATION BETWEEN CT FINDINGS AND GENDER**	59
10	**CORRELATION BETWEEN CT FINDINGS AND MIDLINESHIFT**	60

11	CORRELATION BETWEEN CT FINDINGS AND GCS	61
12	CORRELATION BETWEEN CT FINDINGS AND PUPILLARY REACTION	62
13	CT FINDINGS AND OUTCOME	63
14	CORRELATION BETWEEN MIDLINE SHIFT AND GCS	64
15	CORRELATION BETWEEN MIDLINE SHIFT AND PUPILLARY REACTION	65
16	CORRELATION BETWEEN MIDLINE SHIFT AND OUTCOME	66
17	CORRELATION BETWEEN AGE AND GCS SEVERITY	67
18	CORRELATION BETWEEN GCS AND PUPILLARY REACTION	68
19	CORRELATION BETWEEN GCS AND OUTCOME	69
20	CORRELATION BETWEEN PUPILLARY REACTION AND OUTCOME	70

LIST OF ABBREVATIONS USED

ICP: Intracranial pressure

GCS: Glasgow Coma Scale

GCS-P: Glasgow coma pupils score

GOS : Glasgow Outcome Scale

TBI : Traumatic Brain Injury

ICP: Intracranial pressure

SAH :Subarachnoid Hemorrhage

SDH: Subdural Hematoma

EDH: Extradural Hematoma

DAI: Diffuse axonal injury

HIE: Hypoxic-ischemic encephalopathy

RTA : Road Traffic Accident

CT : Computed Tomography

MRI : Magnetic Resonance Imaging

"CORRELATION OF MIDLINE SHIFT ON CT WITH GLASGOW COMA PUPILS SCORE (GCS-P) IN PREDICTING PROGNOSIS IN CRANIOCEREBRAL TRAUMA"

INTRODUCTION

TBI(Traumatic Brain injury) is damage to the brain induced by an extrinsic mechanical force which can affect physical, cognitive and psychological functions permanently or temporarily. It can also cause altered or reduced levels of consciousness.

TBIs are the known cause of mortality ,morbidity, disability and socioeconomic losses**[1,2]**

Up to 2% population is affected by traumatic brain injury each year, and it is the leading cause of death**[1, 2]**

The most common causes of traumatic brain injury are car accidents, falls, penetrating trauma ,assaults and injuries sustained while participating in sports**[3]**

There are two types of injuries that cause brain damage after trauma.

Primary injury happen at the moment of trauma. Lacerations, brain and brainstem contusions, diffuse axonal injury, bone fractures are seen in primary brain injury. Secondary injury occurs after the initial primary injury. It comprises of injuries due to edema, ischemia because of raised ICP or shock, vasospasm, hypoxemia.

The most frequent and serious complication of traumatic brain damage is the development of raised intracranial pressure, which results in a midline shift. More the midline shift on CT, worse will be the outcome of traumatic brain injury.

The patient's CT scan is helpful in identifying the underlying neuro-parenchymal damage as well as in assessing the risk of traumatic brain injury.

In order to create a more reliable and effective prognostic model, additional factors including the GCS and pupil reactivity have since been introduced **[4]**

GCS is used to determine the state of consciousness and categorize TBI severity as mild, moderate, or severe (GCS)**[4].**

As an initial investigation of traumatic brain injury, CT is chosen over MRI due to its accessibility, affordability, and quicker scan time, as well as the ability to identify bone fractures.

All patients with severe brain injuries undergo routine head CT scans, which provide information for further therapy, such as intracranial pressure (ICP) monitoring or surgical intervention

Additionally, it could give information on prognostic relevance.

The neuro-parenchymal damage can be recognized and the degree of the injury's severity and operability status can be determined using CT scans.

Predicting the diagnosis and implementing quick, early care helps avoid traumatic brain injury consequences.

Patients' conditions can significantly improve with prompt and effective therapy

AIMS & OBJECTIVES OF THE STUDY

Objectives of the study:

- **To evaluate the CT Brain findings in head injury patients.**
- **To correlate the midline shift on CT with the clinical severity of head injury using Glasgow Coma Scale Pupils Score (GCS-P).**

REVIEW OF LITERATURE

Traumatic brain injury is classified as Primary and secondary head injury.

Primary Head Injury:

-It happens at the time of trauma.

-The following categories are used to classify the physical causes of brain damage:

TBI is due to impact loading by the interaction of inertial and contact forces. The acceleration of the head causes inertial force when it is set in motion, irrespective of contact force.Contact force occurs when an impact injury is delivered to the head while it is at rest.
Rarely, gradually shifting object will trap the skull onto the fixed hard structure and progressively pressurise the skull, generating numerous fractures which can be sufficient in displacing the brain to cause severe injury. This is known as static or quasistatic loading.

Injury could result from stretching the brain tissue beyond what is structurally possible due to contact or inertial forces. The quantity of tissue displacement brought on by an external force is measured as strain. Following are the three primary categories of tissue deformation:

- Tensile-Tissue stretching
- Compressive-Tissue compression
- Shear - when tissues slide over other adjacent tissues-Tissue distortion is produced

Primary Injuries:Types

Primary traumatic lesions include skull fractures, scalp injuries, extra-axial hematomas/ hemorrhages, and a spectrum of intra-axial injuries**[5]**

Scalp injuries:

Laceration, Bruising and scalp swelling/ hematoma are the most common scalp injuries. Subgaleal haematoma is almost always seen with a skull fracture.

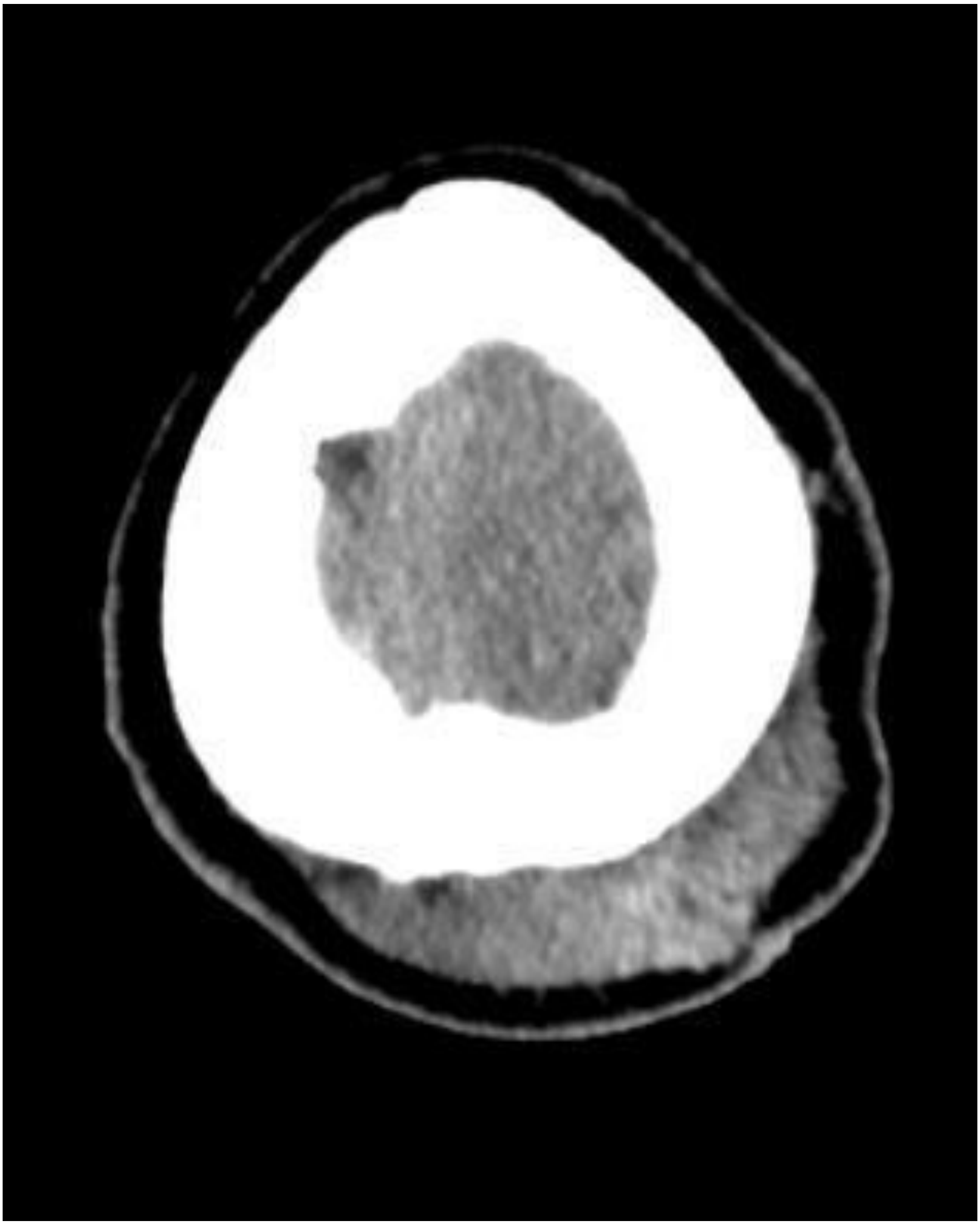


Figure (1.1): Axial CT scan brain demonstrates Soft tissue swelling in left parietal region

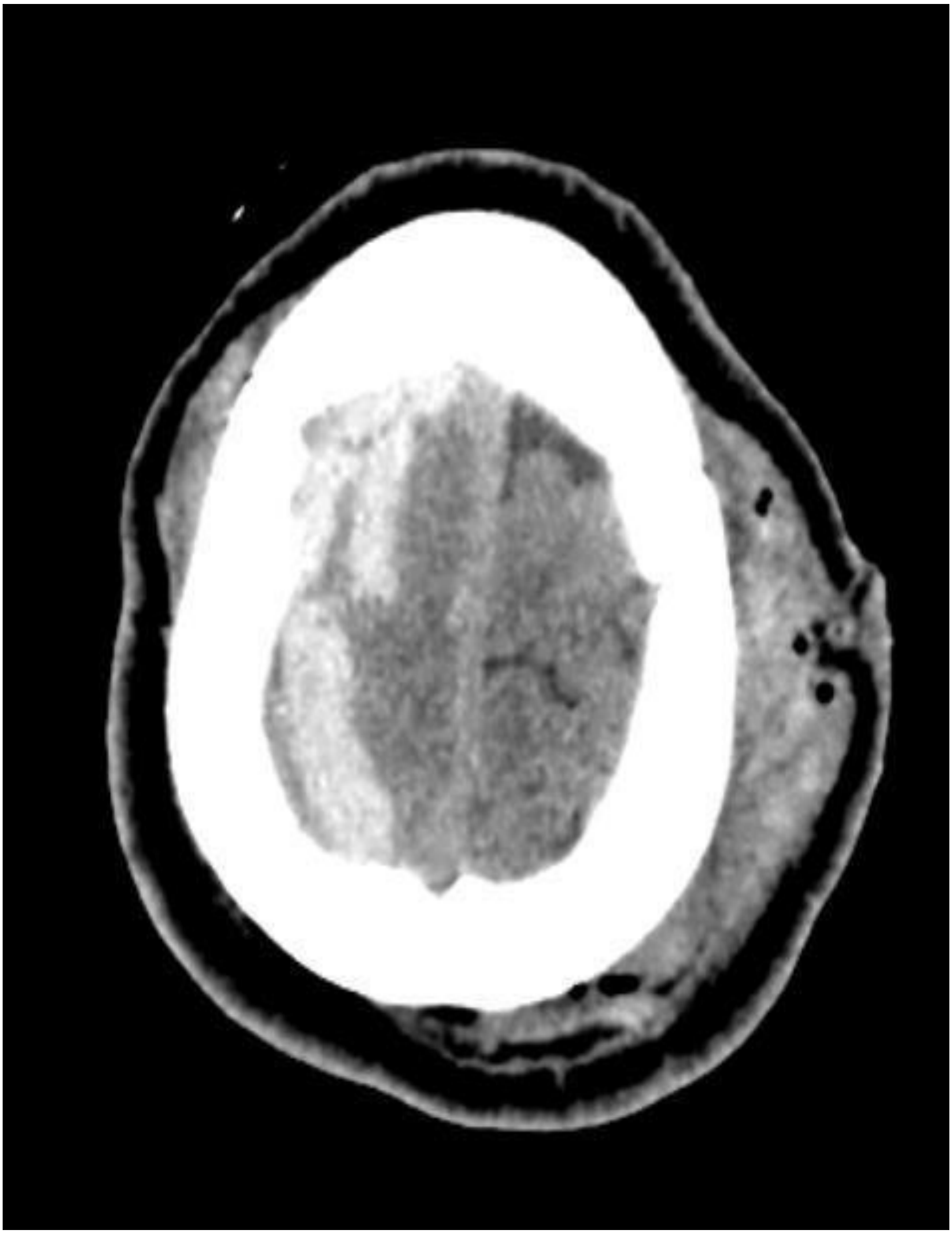


Figure (1.2): Axial CT scan demonstrates Soft tissue swelling with air foci in left parietal region and only soft tissue swelling in right frontal region.

<u>Skull fracture:</u>

According to their site, skull fractures can be fractures of the vault of the skull or fractures of the base of the skull**[5]**

These fractures are classified into two types: linear or depressed fractures.

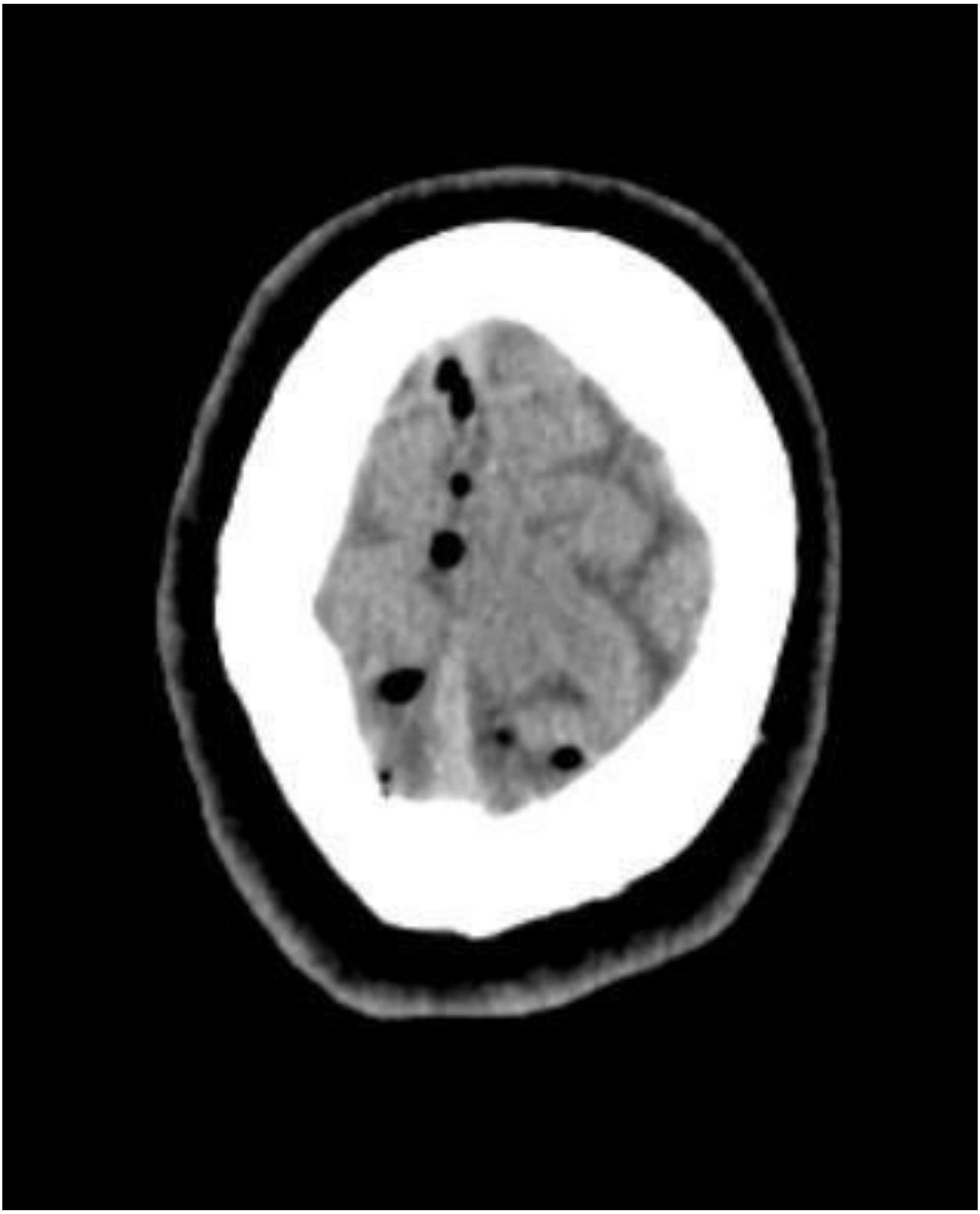
Most common type of skull fractures is Linear fractures, in which there is a break in the bone which does not move the bone. A depressed form of skull fracture is a breach in skull that causes the bone to sink in toward the brain. These fractures being either open skull fracture (also known as a **compound fracture)** is one in which the skin is broken and the bone emerges from it, or closed skull fracture (also called a simple fracture) in which the skull and dura matter remain intact **[5].**

Figure (1.3):CT volume rendered image of Comminuted depressed fracture

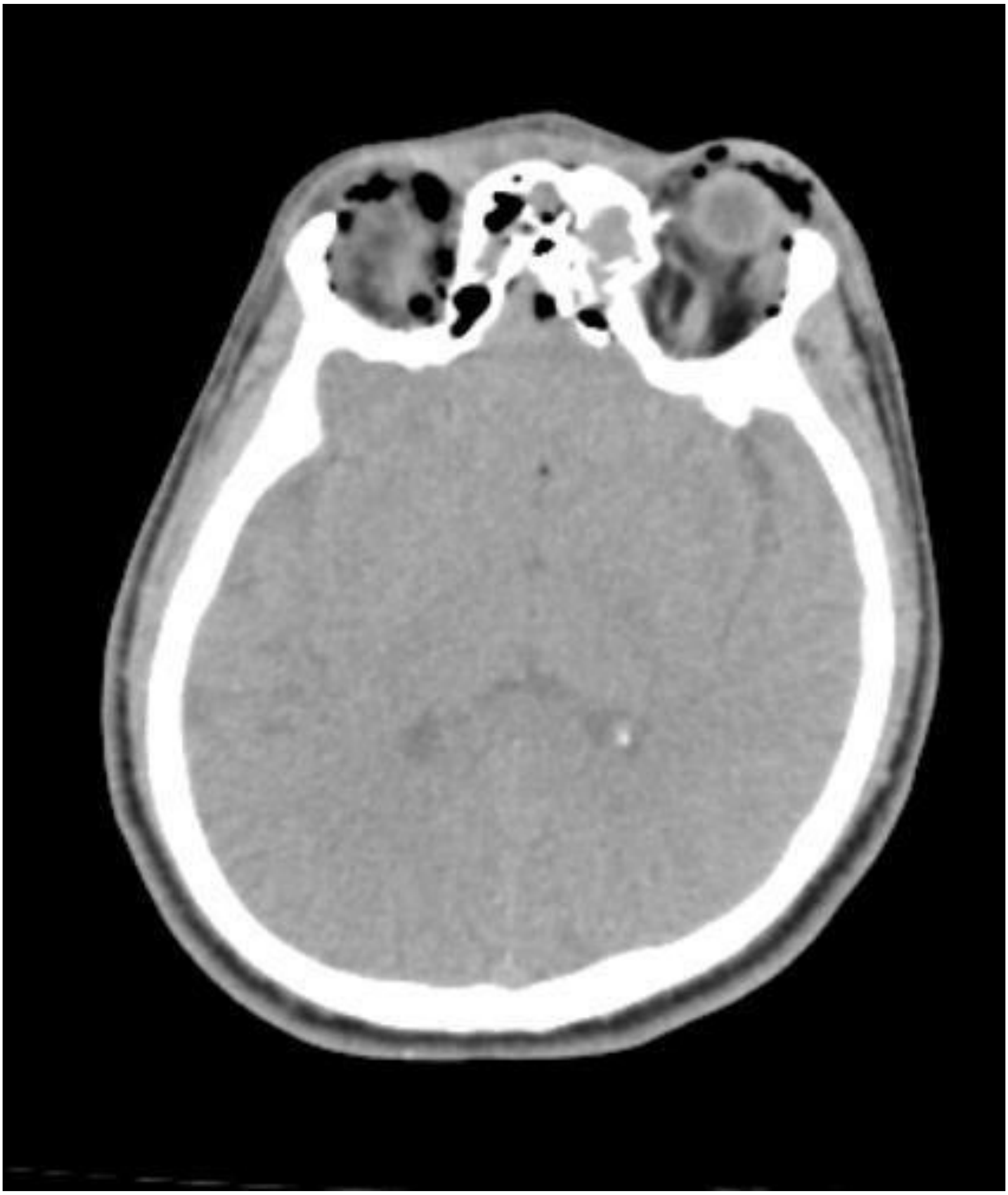
Base of the skull Fractures can be fractures through the anterior or middle or posterior fossa. The important factors to consider when dealing with skull base fractures are: CSF leakage, Infection, and Vessel and nerve injury**[4]**

Figure(1.4):Axial CT scan demonstrates Air in bilateral frontal regions -Tension Pneumocephalus giving "Mountain Fuji "sign

Figure(1.5):Axial CT scan demonstrates Air foci in midline falx –Pneumocephalus



Figure(1.6):Axial CT scan demonstrates Air foci in Bilateral orbits with multiple fracture in the bilateral orbit and nasal bone– Pneumo-orbit



Extra-axial hemorrhages:

Epidural hematomas (EDH) occur between the outer dural layer and calvarium. Subdural haematomas (SDH) occur between the arachnoid and inner (meningeal) layer of the dura . Traumatic subarachnoid hemorrhage (tSAH) occurs within the subarachnoid cisterns and sulci**[5]**

On CT scans, the acute extradural haemorrhages are visualized as a biconvex dense area right below the skull vault. Most common site is temporo-parietal convexity in adults whereas in children, EDH below a fracture of the squamous part of the temporal bone is common**[5]**

Figure(1.7):(a) Axial CT scan brain demonstrates Extradural hemorrhage noted in the left temporal region with (b) Underlying fracture of left temporal bone

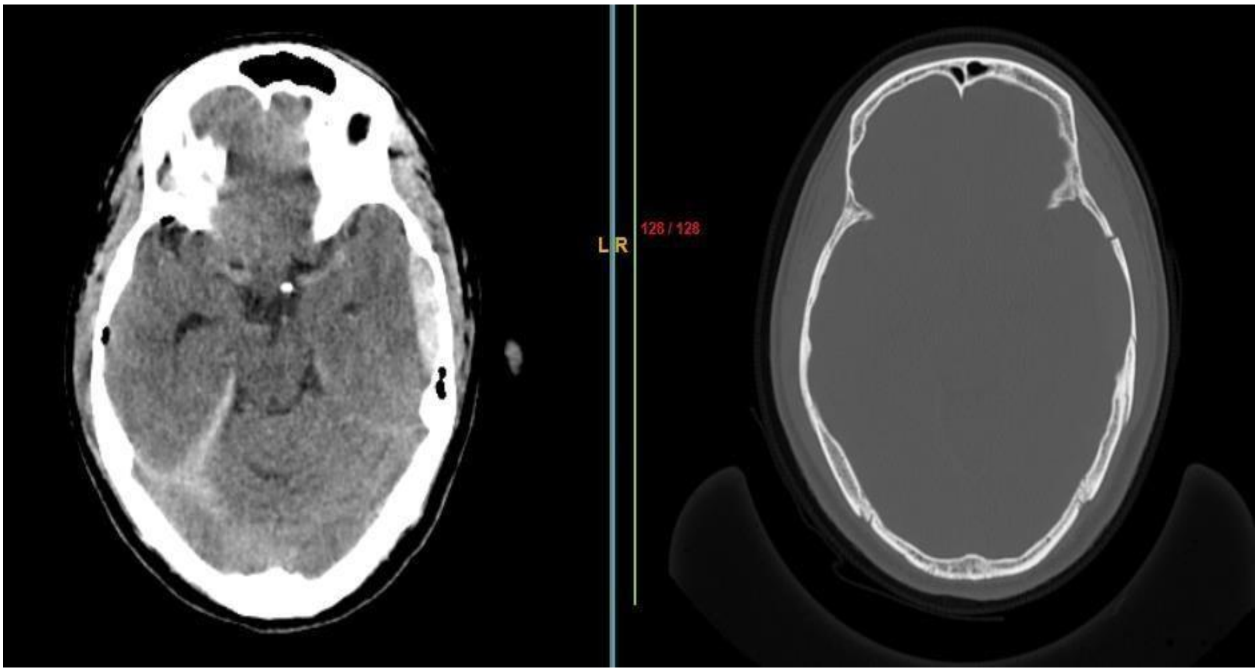
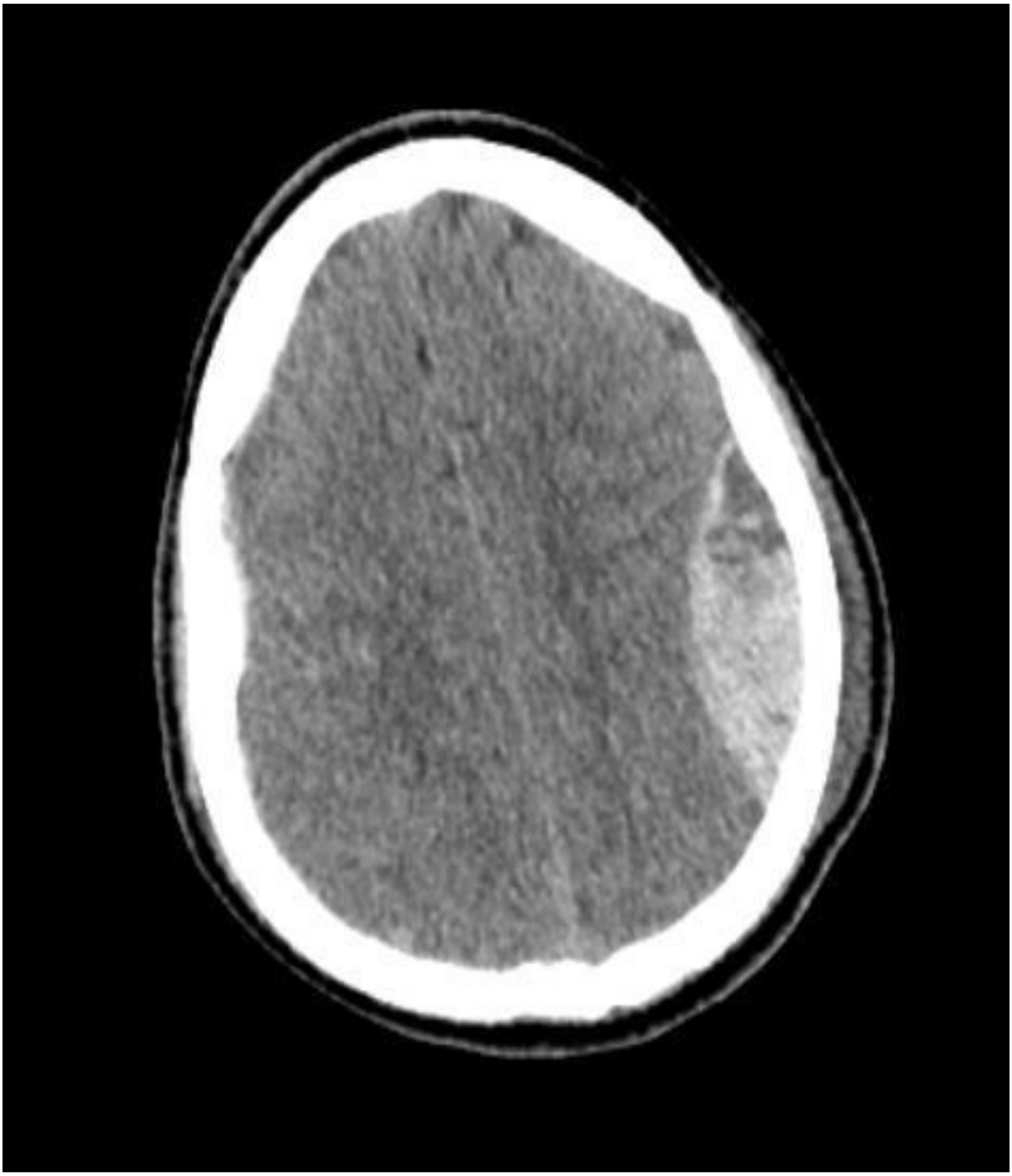


Figure (1.8):Axial CT scan brain demonstrates Extradural hemorrhage in the left parietal region with few hypodense areas within showing "Swirl sign" suggestive of active bleeding



The rupture of veins that cross the subdural space causes subdural hemorrhage; Vault fractures are less likely with subdural Hemorrhage**[6]**
Most common sites for SDH are cerebral convexities under the temporal, occipital lobes and along the falxcerebri.SDH can be extensive and lie in between the arachnoid matter and dura. As the blood is under minimum pressure within them, blood spreads out over the surface of the brain extending an entire cerebral hemisphere**[6].**On axial CT and MRI, the SDH appear concave.

Figure (1.9):Axial CT scan brain demonstrates Subdural hemorrhage in the left Fronto-parietal convexity.

Figure(1.10):Axial CT scan brain demonstrates Subdural hemorrhage in the midline falx, bilateral fronto-parietal convexities.

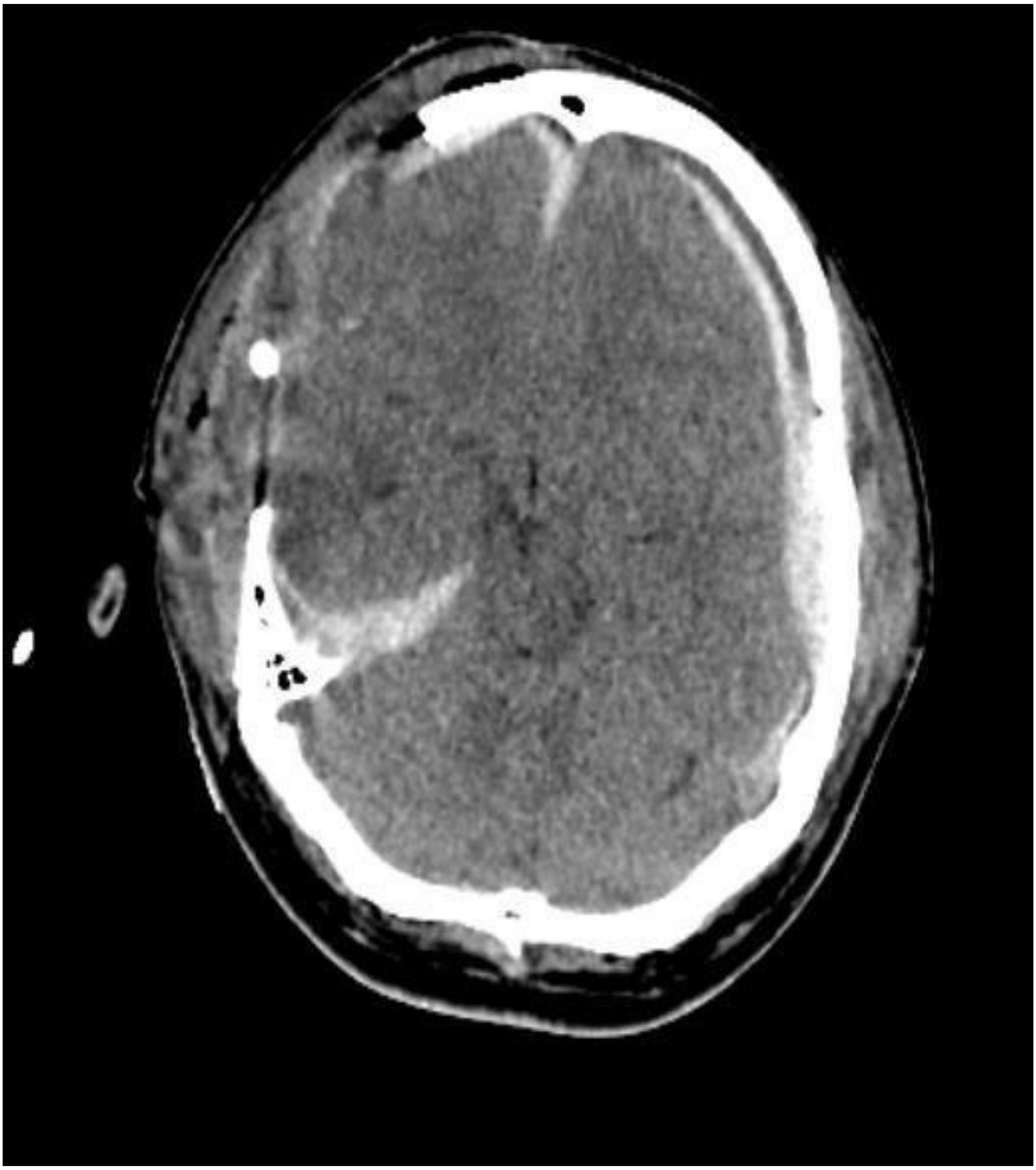


Figure (1.11): Axial CT scan brain demonstrates Subdural hemorrhage in the right tentorium, midline falx. SDH is also noted in Left fronto-temporal convexity. Craniotomy defect is noted in right Frontal bone.

TSAH tends to spare the suprasellar cisterns and is more often seen along the superficial sulci and within sylvian fissures adjacent to cortical contusions in contrast to aneurysmal SAH .Blood layering in the dependent part of the interpeduncular notch is occasionally indicative of subtle tSAH in patients with head injuries**[5]**

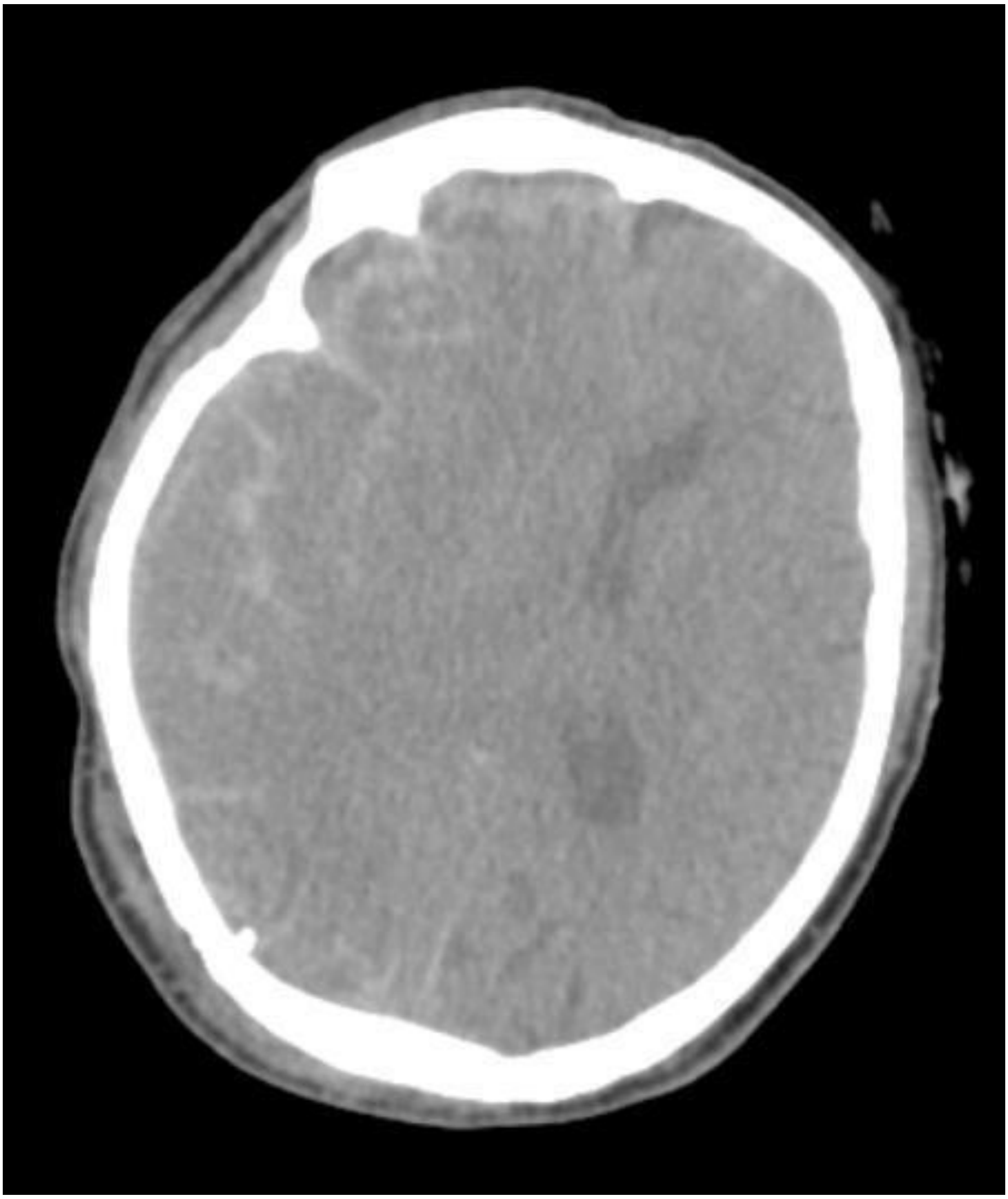


Figure (1.12): Axial CT scan brain demonstrates Acute traumatic subarachnoid haemorrhage in right cerebral hemisphere causing mass effect over adjacent neuroparenchyma

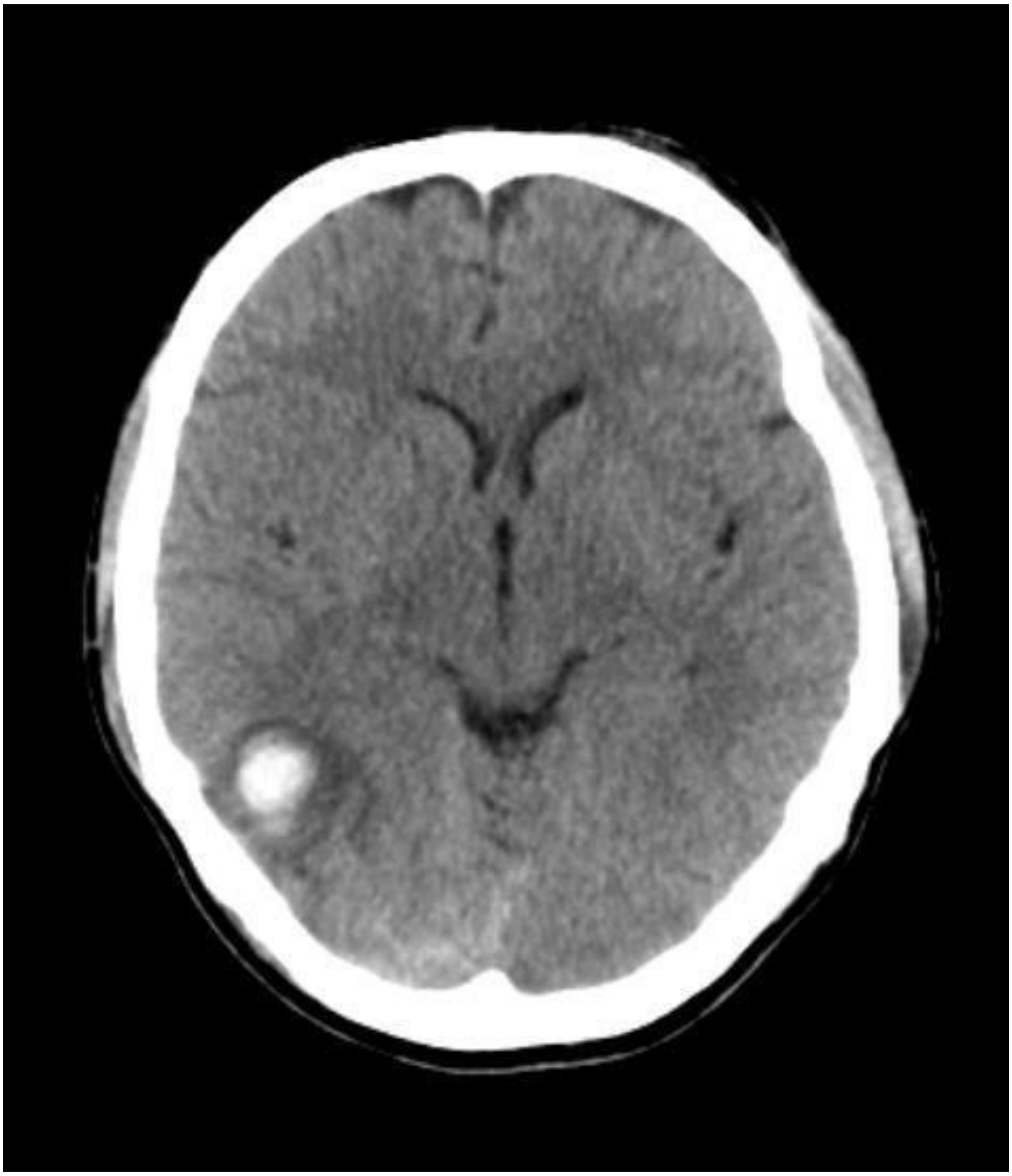
Intra-axial injuries:

Cortical contusions and lacerations, intracerebral hematomas in the subcortical white matter and the basal ganglia, Diffuse axonal injuries (DAI), brainstem injuries, and intra-ventricular hemorrhages are included in intra-axial injuries**[5]**

The most frequent types of parenchymal injury are cortical contusions and lacerations.

Contusions are gyral "crest" injuries which are superficial "brain bruises".

Cortical contusions often progress over time; follow-up imaging is advised as the initial head CT may not always reflect the complete amount of injury**[5]**



Figure(1.13):Axial CT scan brain demonstrates contusion in right occipital lobe with surrounding peri-lesional edema

Figure(1.14):Axial CT scan brain demonstrates contusions in right frontal lobe with surrounding perilesional edema.

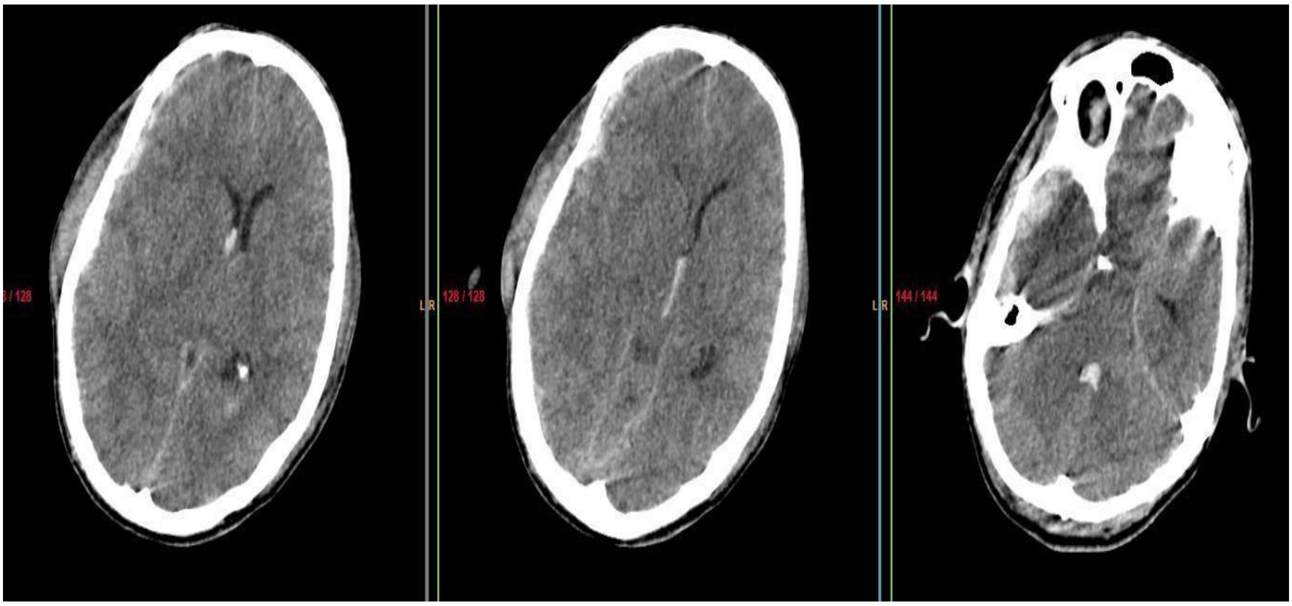


Figure (1.15):Axial CT scan brain demonstrates intraventricular bleed in bilateral lateral ventricles, 3rd ventricle and 4th ventricle

The second most frequent parenchymal lesion detected in traumatic brain injury is diffuse axonal damage (DAI).DAIs are nonimpact injuries, resulting from the differential brain acceleration/deceleration and inertial forces of rotation. Most DAIs are non haemorrhagic and microscopic. Haemorrhagic DAI is seen better on MR with T2* (GRE or DWI imaging).DAI are tiny multi-focal lesions that tend to develop in more or less recognisable locations, including the posterior corpus collosum, the corona radiate, the high parasagittal cerebral white matter, and other regions of the subcortical white matter.. Unless they are hemorrhagic, they are typically not evident on CT; nevertheless, DAI may be better visualized on MRI, hemorrhagic or non hemorrhagic**.[6]**

Gennarelli and colleagues graded the findings in patients with diffuse axonal injury as follows:

Grade 1:-Lesions in cerebral hemispheres para-sagittal white matter;

Grade2:-Grade 1 plus corpus callosum(CC) lesions;

Grade 3:-Grade 2 plus cerebral peduncle lesion.

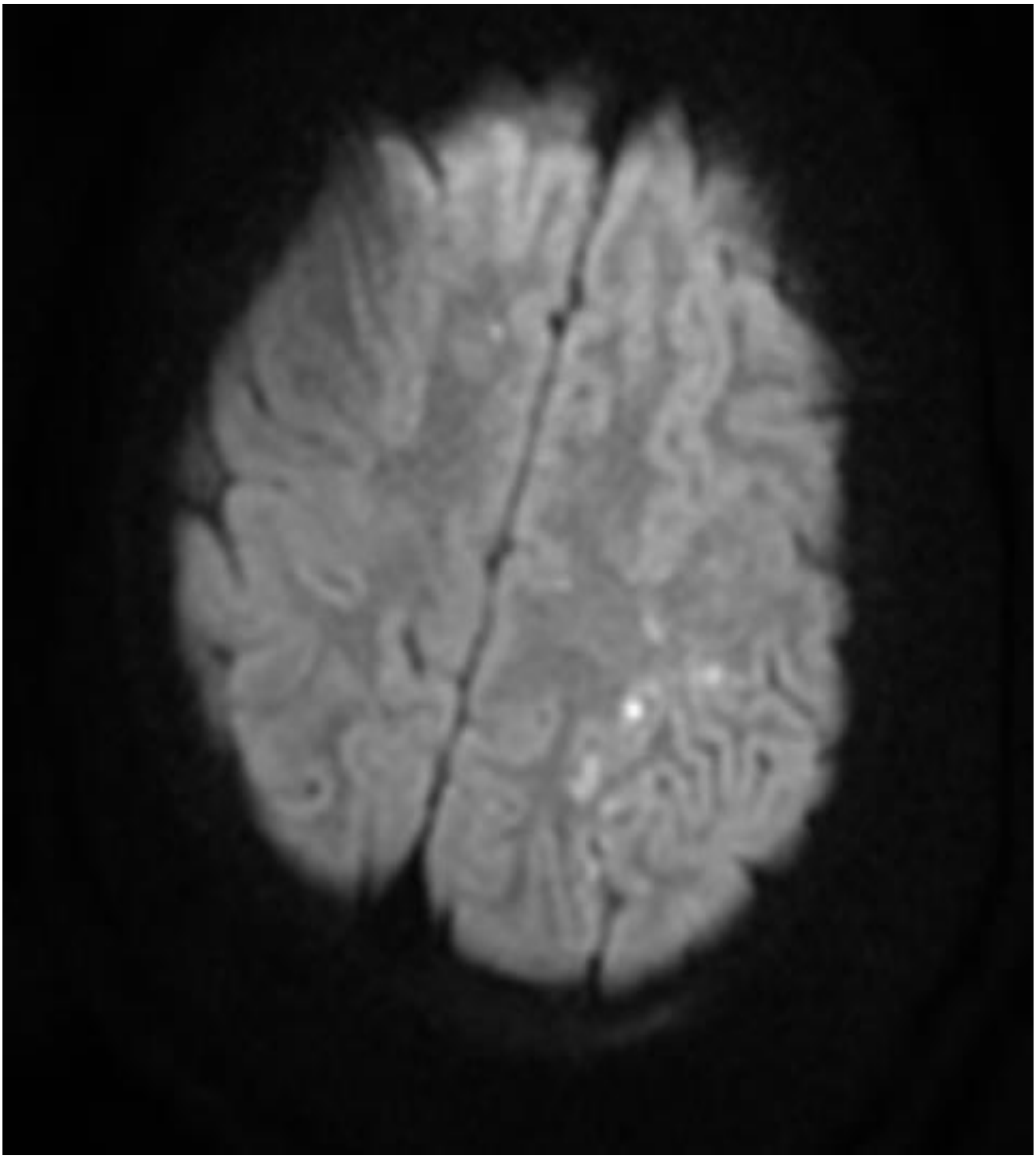


Figure (1.16):Axial MRI brain demonstrates DAI in left parietal lobe.

Secondary Head Injury:

Secondary head injuries are seen following initial brain trauma. Increased intracranial pressure, Brain swelling and herniations are frequently seen.

Cerebral edema, ischemia:

Brain edema brought on by trauma can be in association with the brain contusions or after removal of acute subdural haemorrhage or can be noticed on its own.Vasogenic and cytotoxic edema combine to cause cerebral edema in trauma patients**[4]**

Usually between 24 and 48 hours following trauma, diffuse brain edema begins to appear. Low-density brain showing diminished gray-white differentiation and swollen hemispheres are frequent. Effacement of sulci and subarachnoid spaces is seen**[5]**

Figure (1.17):Cerebral oedema noted in the form of Effacement of frontal horn of bilateral lateral ventricles

Increased intracranial pressure (ICP)

Increased ICP often results in an increase in TBI severity, especially if the pressure is higher than 20 mm Hg**[5].**Additionally, increased pressure can result in brain herniation, hydrocephalus, hydroperfusion, cerebral hypoxia, and cerebral ischemia.

Hydrocephalus

TBI patients are more likely to have communicative hydrocephalus than non-communicating hydrocephalus. The communicative type is commonly brought on by the presence of blood components, which prevent CSF from flowing freely in sub-arachnoid space and from being absorbed by arachnoid villi. Blood flow obstruction by a blood clot at the 3^{rd} or 4^{th}ventricles,interventricular foramen, cerebral aqueduct is a frequent cause of the non-communicating form of hydro-cephalus.

Brain herniation

The cause of supratentorial herniation is either increased intracranial pressure or direct compression by an growing mass.

Supratentorial herniation can occur in the following ways:

- **Sub-falcine herniation:-**Most common Type
  The frontal lobe's cingulate gyrus is pushed beneath the falx-cerebri when an increasing mass lesion causes a medial shift of the ipsilateral cerebral hemisphere.

- **Central trans-tentorial herniation**
  Diencephalon and the surrounding midbrain are forced through the tentorial notch, while the basal nuclei and cerebral hemispheres are pushed downward.

- **Uncal herniation**
  Midbrain Compression is caused by displacement of the medial margin of the uncus and hippocampus gyrus over the same side edge of the tentorium cerebelli foramen. Third nerve can be stretched or compressed.

- **Cerebellar herniation**
  When the cerebellar tonsil is forced into the foramen magnum and compress the medulla, it results in infra-tentorial herniation, which can result in respiratory arrest and bradycardia.

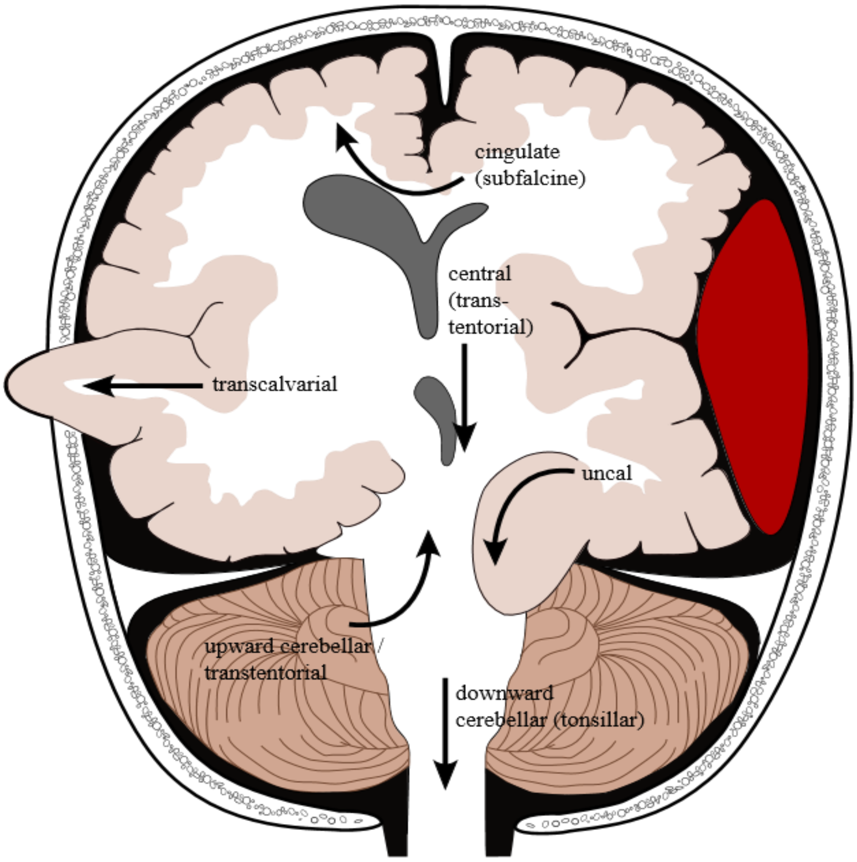


Figure 2:Brain herniations

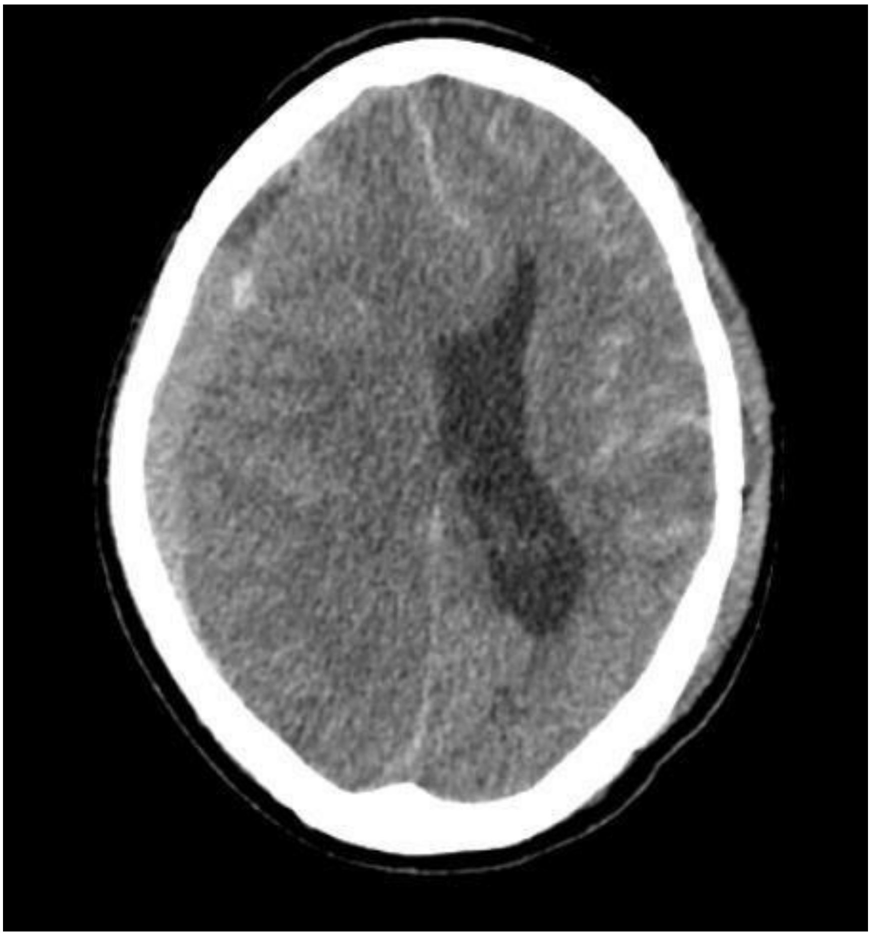


Figure (1.18): Axial CT scan brain demonstrates Subfalcine herniation

Perfusion and metabolic alterations:

In TBI, metabolic abnormalities are frequent. Vascular dysautoregulation is a result of a complicated chain of events that includes oxidative tissue damage, increased reactive nitrogen species, and inflammation. Perfusion changes are also frequent and may be a sign of dysregulated autoregulation. They can range in severity from focal cerebral ischemia to frank infarction and laminar cortical necrosis, and they can be local, regional, or generalised. The most severe perfusion reduction which results from markedly elevated intracranial pressure may result in brain death. Brain function may completely and permanently stop if intracranial pressure surpasses intraarterial pressure.**[5]**

Vascular injuries:

Traumatic vascular manifestations can be either primary (such as vessel laceration, dissection, thrombosis, pseudoaneurysm, or AV shunting) or secondary (such as vascular thrombosis). Vascular blockage and infarction may result from a herniated brain. Unilateral Descending Transtentorial Herniation is most frequently responsible for the posterior cerebral artery territory's involvement (DTH). Perforating arteries from the circle of Willis may get blocked and cause several focal infarcts.**[5]**

Glasgow Coma Scale (GCS):

Scoring systems are commonly used clinically to classify the degree of traumatic brain injury. The severity is determined clinically by the level of consciousness depression as measured by the GCS. (Table I)**[7]**

Table I:Traumatic Brain Injuries (TBI) :GCS

SEVERITY OF THE HEAD INJURY(GCS) GLASGOW COMA SCALE

Mild	**13-15**
Moderate	9-12
Severe	3-8

The GCS (Table II)**[7]:**Includes the sum of scores ranging from 3 - 15 of components like eye opening, verbal and motor responses, each evaluating the various aspects of responsiveness**[5]**In patients with serious injuries, the motor component offers greater discrimination, While the verbal and visual scales are better at differentiating between patients with mild and moderate injuries .The three components need to be reported individually for the severity of each patient's condition.

Table II:Glasgow Coma Scale

Glasgow Coma Scale			
	Standard	*Paediatric version*	
		1–4 years	<1 year
Eye opening			
4	Spontaneous	Open	
3	To speech	To voice	
2	To pain	To pain	
1	None	No response	
Verbal response			
5	Orientated	Oriented, speaks, interacts	Coos, babbles
4	Confused conversation	Confused speech, consolable	Irritable cry, consolable
3	Words (inappropriate)	Inappropriate words, inconsolable	Persistent cry, inconsolable
2	Sounds (incomprehensible)	Incomprehensible, agitated	Moans to pain
1	None	No response	No response
Best motor response			
6	Obey commands	Normal spontaneous movement	
5	Localizes pain	Localizes pain	
4	Flexion, withdraws to pain	Withdraws to pain	
3	Flexion, abnormal to pain	Decorticate flexion	
2	Extension (to pain)	Decerebrate extension	
1	No response	No response	
3–15	*Total score*		

Table III:Pupil Reactivity Score[50]

Pupils Unreactive to Light	Pupil Reactivity Score
Both Pupils	2
One Pupil	1
Neither Pupil	0

Pupil Reactivity Score (PRS) is subtracted from the Glasgow Coma Scale (GCS) total score to obtain GCS-P

GCS-P=GCS minus PRS

GCS-P doesn't replace the traditional assessment by GCS and pupil reactivity but provides a simple concise measure of the severity of a patient's clinical condition and prognosis particularly in more severe
cases.
Therefore, GCS-P is a one -dimensional assessment of clinical severity

Imaging modalities:

Plain Radiography:

Before the widespread use of CT scans, plain skull radiographs were crucial in the investigation of head injuries. The initial examination of brain injury patients using plain radiography has generated controversy in recent years. Master and colleagues created and evaluated a plan that changed the trend of head trauma imaging from radiography to CT **[8].**
To image fractures ,penetrating wounds and radiopaque foreign substances, skull radiography is still helpful. A substantial cerebral hematoma is far more likely to occur if a fracture is visible on plain imaging**.[8]**

Computed Tomography (CT):

CT is recommended in patients with GCS </=15 who present with the following abnormalities within the first three hours after trauma: Age extremes, a focused neurological deficiency, a convulsion, a headache, nausea, forgetfulness, syncope, intoxication, apparent cranial injuries **[9]**
Acute bleeding, ventricular size and structure, bone injuries, and mass effect can all be seen with greater sensitivity on CT scan when evaluating the head injury patient. CT has a wide range of availability, scans quickly, and is compatible with medical equipment. One of its drawbacks is that it is insensitive to minor, non-hemorrhagic lesions like contusions, especially those that are close to bony surfaces. Similar to this, DAI which cause tiny lesions in brain are not seen on CT scans. Increased intracranial pressure, oedema, and the early detection of HIE, which follow

head injury, are difficult to detect with CT. Careful selection of patient for CT and management of radiation dose are necessary given the potential dangers of exposure to ionizing radiation**[10]** Patients who have been categorized as moderate- or high-risk for brain damage should get a non-contrast CT scan as soon as possible to look for any indications of intracerebral haemorrhage, midline shift, or rising intracranial pressure.“TheNewOrleans Criteria”**[11]** found hundred percent identification of an acute traumatic lesions by CT in the context of minor brain injury (GCS 15)with risk factors of vomiting, headache,alcohol/drug intoxication, >60 years old ,short-term memory deficit, supra-clavicular trauma physical findings, seizure .Children's CT Clinical Criterias for Head Injury are less trustworthy than adults, especially for those under the age of 2.**[13]**

It is therefore recommended that paediatric patients get CT scanning more frequently. The higher danger of radiation exposure in young people must be managed by carefully selecting which individuals to scan and controlling the radiation dose**.[14]**

To identify HIE, delayed intra-parenchymal hematoma, cerebral oedema, early and frequent CT scans are necessary, particularly in the first seventy two hours following a head trauma**[15]**

Cerebral Angiography, CTA:

CT angiography has replaced cerebral angiography as the initial evaluation of TBI even though cerebral angiography is the best investigation for determining the cerebral vasculature. When patients have specific neurological abnormalities that cannot be explained by the injuries seen on CT scans, intracranial vascular occlusion or dissection should always be taken into consideration. It can occur in about ten percent of cases in blunt trauma.**[16]**

Magnetic Resonance Imaging (MRI):

Limited availability of MRI, long imaging times, sensitivity to patient’s motion, medical device incompatibility, and insensitivity to SAH all pose challenges for MR imaging in the acute trauma situation. Other considerations include the danger of scanning individuals with indwelling devices such as a cerebral aneurysm clip, a cardiac pacemaker or foreign bodies.**[17]** MR imaging is sensitive in detection and characterization of sub-acute and chronic brain injuries. The prognosis of post-traumatic vegetative state in subacute head injury is determined by MRI**[18].** MRI is used in Acute head-injured patients who are stable and don’t require surgery .Small subacute or chronic hemorrhages are seen with Hemosiderin-sensitive T2-weighted GE sequences. DWI improves the detection rate of acute infarcts associated with head injury. For identification of SAH and for the lesions lined by CSF, FLAIR sequences are more used.**[19].**

The soft tissue details offered by MRI is better than CT for displaying non-hemorrhagic primary lesions like contusions, DAI's, edema ,HIE [20]. MR imaging provides a superior representation of non-surgical lesions that may influence medical care and also predict the extent of neurologic recovery. **[20]**

Immediate cytotoxic edema is depicted by DWI and ADC mapping. Focal contusion and DAI in acute brain trauma ,can show diffusion restriction and can cause atrophy /Encephalomalacia later**[21]**

For disorders involving vascular autoregulation / ischemia, CT /MR Perfusion imaging may be helpful**[22]**

Functional Imaging:

Xenon-enhanced CT, SPECT ,PET, functional MR imaging are used to assess the neuropsychologic/cognitive abnormalities following head trauma and after recovery**[23]**

Relationship between midline shift and GCSP

A retrospective study done by **ChiewvitP ,Tritakarn SO, Nanta-aree S ,Suthipongchai S(2010) [4]** on 216 patients concluded that in patients with head injuries ,increase in degree of midline shift was associated with increase in severity of brain injury :-GCS = 3-12 and this was further related significantly to bad clinical outcome.

A study done by **Farshchian N, Farshchian F, Rezaei M. (2012) [24]** on 432 patients concluded that, subarachnoid hemorrhage ,hemorrhagic contusion and extra-axial hematoma are associated with low GCS scores.

A study done by **Sah SK, Subedi ND, Poudel K, MallikM (2014) [25]** concluded that regardless of the background lesions the presence of mixed lesions and midline shift was related to reduced GCS score in patient of head trauma.

A retrospective study done by **Nayebaghayee H, Afsharian T (2016)[26]** on 200 patients concluded that The GCS score alone may not be adequate for determining the severity of the injury, hence CT findings were also added.. The combination of this scoring method was more useful for stratifying the severity of brain injury.

A study done by **Brennan PM, Murray GD, Teasdale GM (2018) [27]** The Glasgow Coma Scale Pupils Score (GCS-P), which is used to measure patient outcomes, increases the information offered to a degree comparable to that discovered by more sophisticated technique

MATERIALS AND METHODS

Machine:

Multi-detector Computed Tomography (MDCT) scanner SIEMENS SOMATOM SCOPE 32 SLICE CONFIGURATION, G-XL-59289.

Methods: NCCT brain

Inclusion criteria:-

- All closed head injured patients.
- >18 years of either sex.

Exclusion criteria:-

- Poly traumatised patients i.e. patients with injuries other than head injury.
- Patients <18 years of age
- Patients with open head injury
- Patients with depressed skull fracture
- Patient refusal

SOURCE OF DATA

- Patients referred to the Radiology department , SHRI B.M.PATIL MEDICAL COLLEGE AND RESEARCH CENTER, VIJAYAPURA.
- Patients who are admitted in the Department of Neurosurgery, SHRI B.M.PATIL MEDICAL COLLEGE AND RESEARCH CENTER, VIJAYAPURA.
- Those who fulfill the inclusion criteria.

PERIOD OF COLLECTION OF DATA

The study was done on patients, who visited the Department of Radio Diagnosis from January 2021 to June 2022 with prior consent.

STUDY DESIGN:

Hospital based prospective study

In this study, patients who had been admitted to the neurosurgery department with a clinically diagnosed traumatic head injury were taken into consideration.

Each patient's precise information, including name, age, sex ,presenting complaints, time of injury, mode of injury were collected using a predetermined proforma.
Patients underwent routine clinical examinations, local examinations.GCS, pupil reactivity, and the clinical outcomes were recorded.

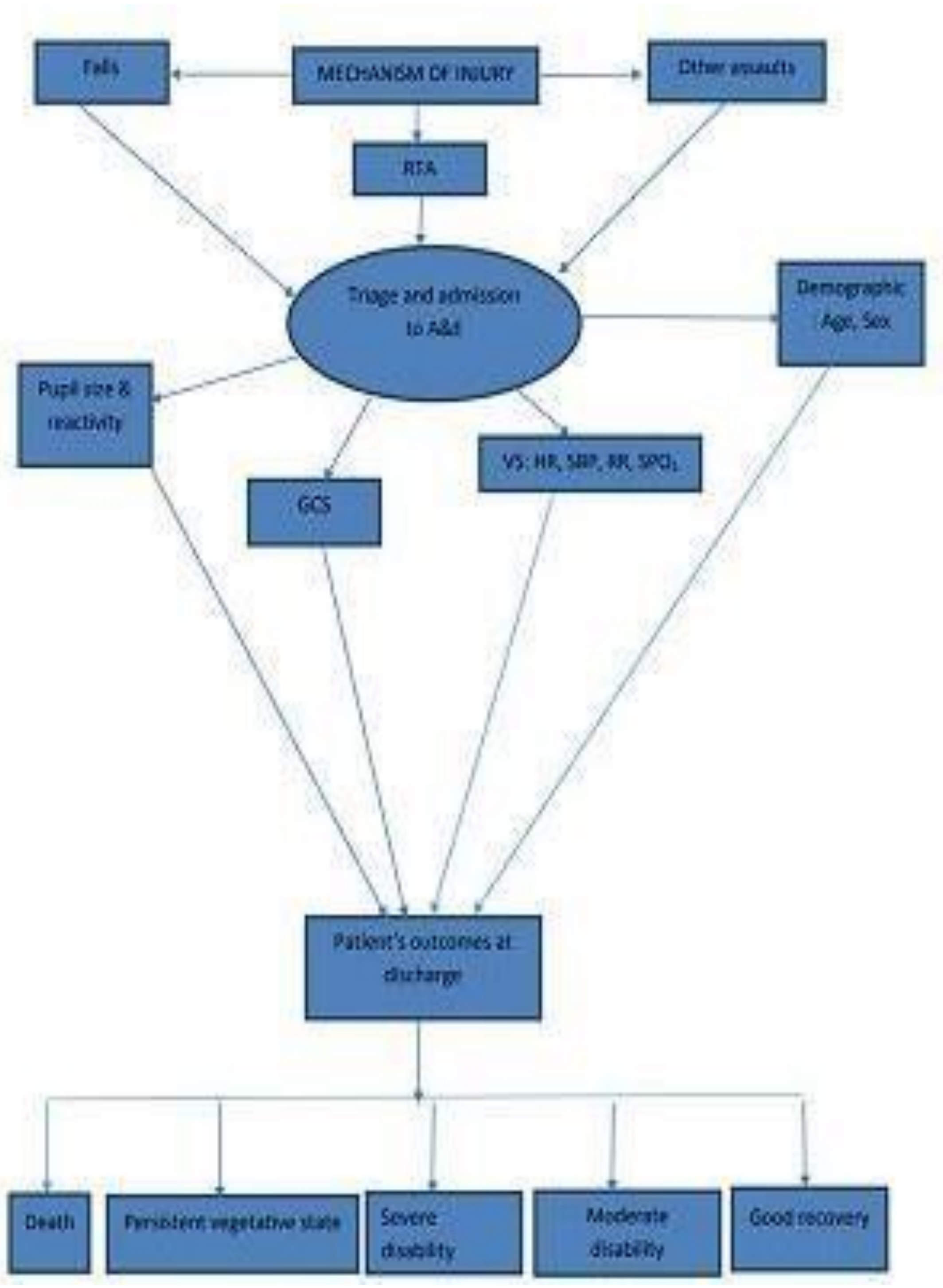
The CT scans for each subject were examined independently of the clinical data. Three categories :-no shifting, midline shifting <5mm, and midline shifting >/=5 mm were used to classify the degree of midline shifting.

Severity of Brain injury is classified as:-

Mild:GCS=15,

Moderate:GCS=13-14,

Severe:GCS=3-12.



MECHANISM OF INJURY
Falls
Other assaults
RTA
Triage and admission to A&E
Demographic Age, Sex
Pupil size & reactivity
GCS
VS: HR, SBP, RR, SPO2
Patient's outcomes at discharge
Death
Persistent vegetative state
Severe disability
Moderate disability
Good recovery

Sample size:-

If 46% of the subjects in the population have the factor of interest, study would need a sample size of:

100

For estimating the expected proportion with 95% confidence and 10% absolute precision With anticipated Proportion of midline shift in cranio-cerebral trauma 46%[ref], the study would require a sample size of 96 patients with 95**%** levels of confidence and 10% of absolute precision**.**

Formula used:-

$$n = \frac{z^2\, p*q}{d^2}$$

Where Z= Z statistic at α level of significance

d^2=Absolute error

P=Proportion rate

q=100-p

Statistical Analysis:-

- The data so obtained will be entered in Microsoft Excel sheet, and the statistical analysis will be performed using statistical package for the social sciences(Version 20).
- Results presented as Mean (Median) ±SD ,counts ,percentages ,diagrams.

IMAGING GALLERY

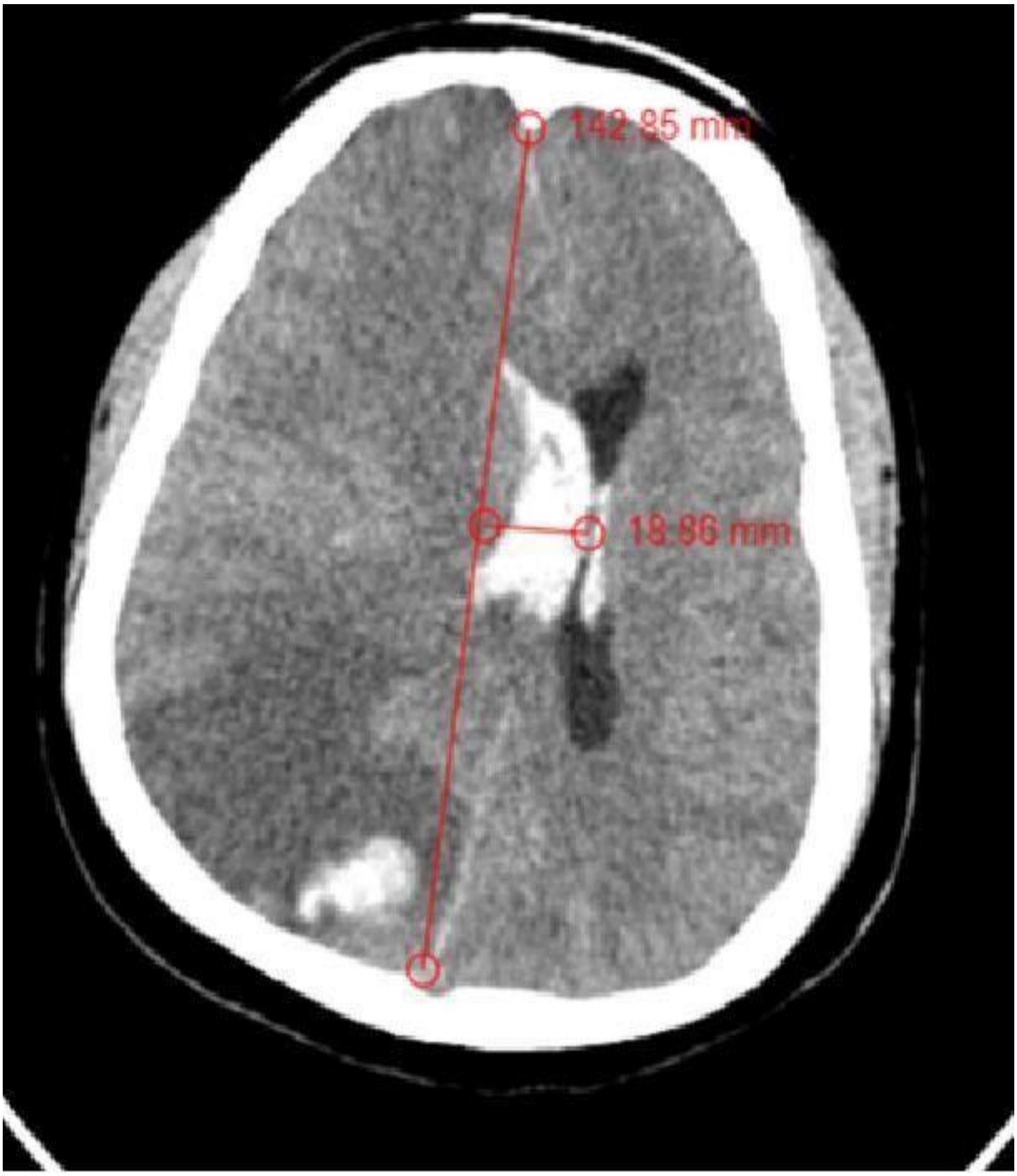


Figure 3.1: Axial non contrast enhanced brain CT showing acute Intra-cerebral hematoma in the right parietal lobe causing mass effect over ipsilateral lateral ventricle and midline shift of 18.8 mm to left

Figure 3.2: Axial non contrast enhanced brain CT showing SDH in the right fronto-parieto-temporal lobe with effacement of the ipsilateral lateral ventricle causing midline shift of 22.7 mm to left and SAH

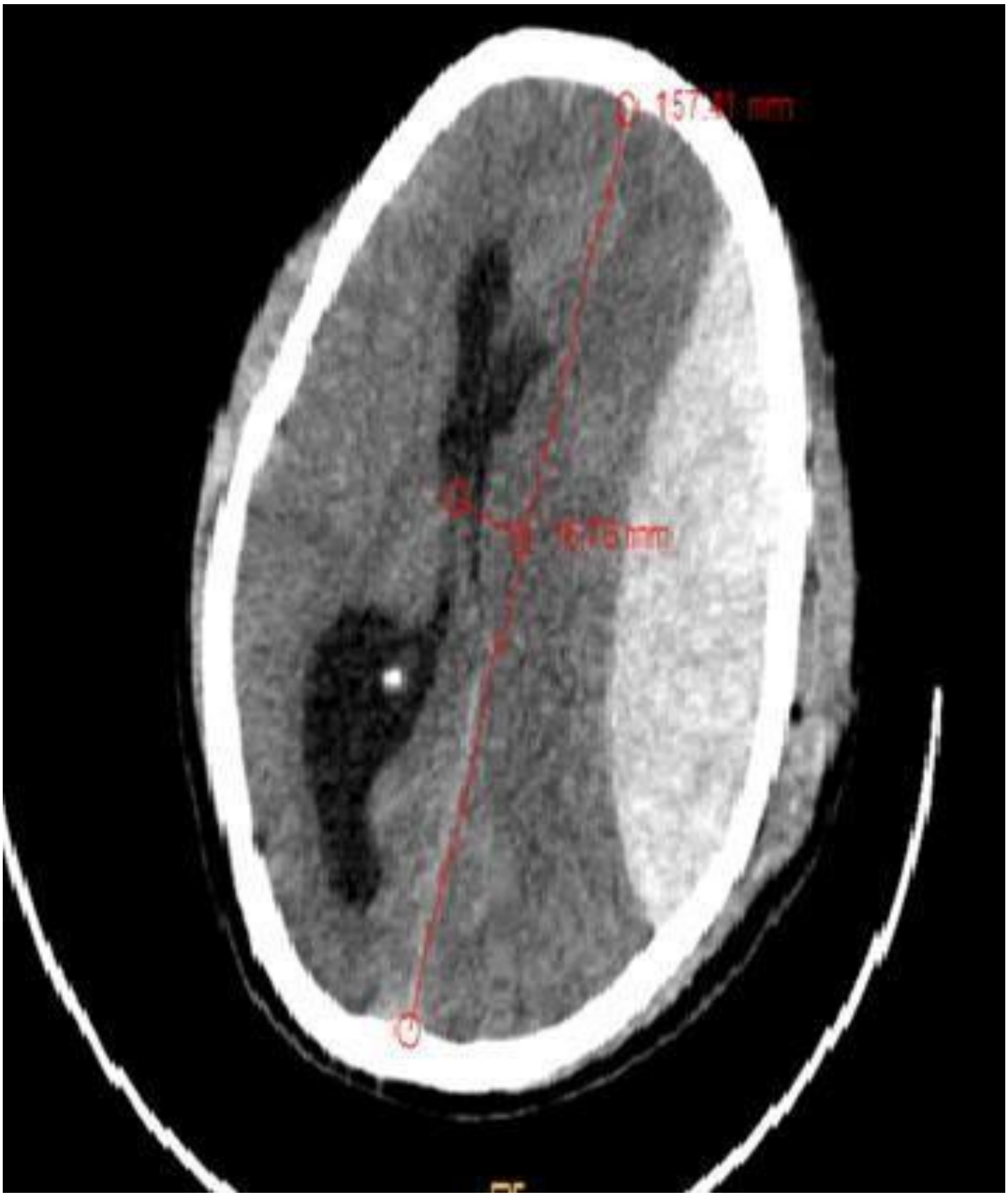


Figure 3.3: Axial non contrast enhanced brain CT showing a large EDH in the left fronto-parieto-temporal lobe causing mass effect over ipsilateral lateral ventricle and midline shift of 18.7 mm to right

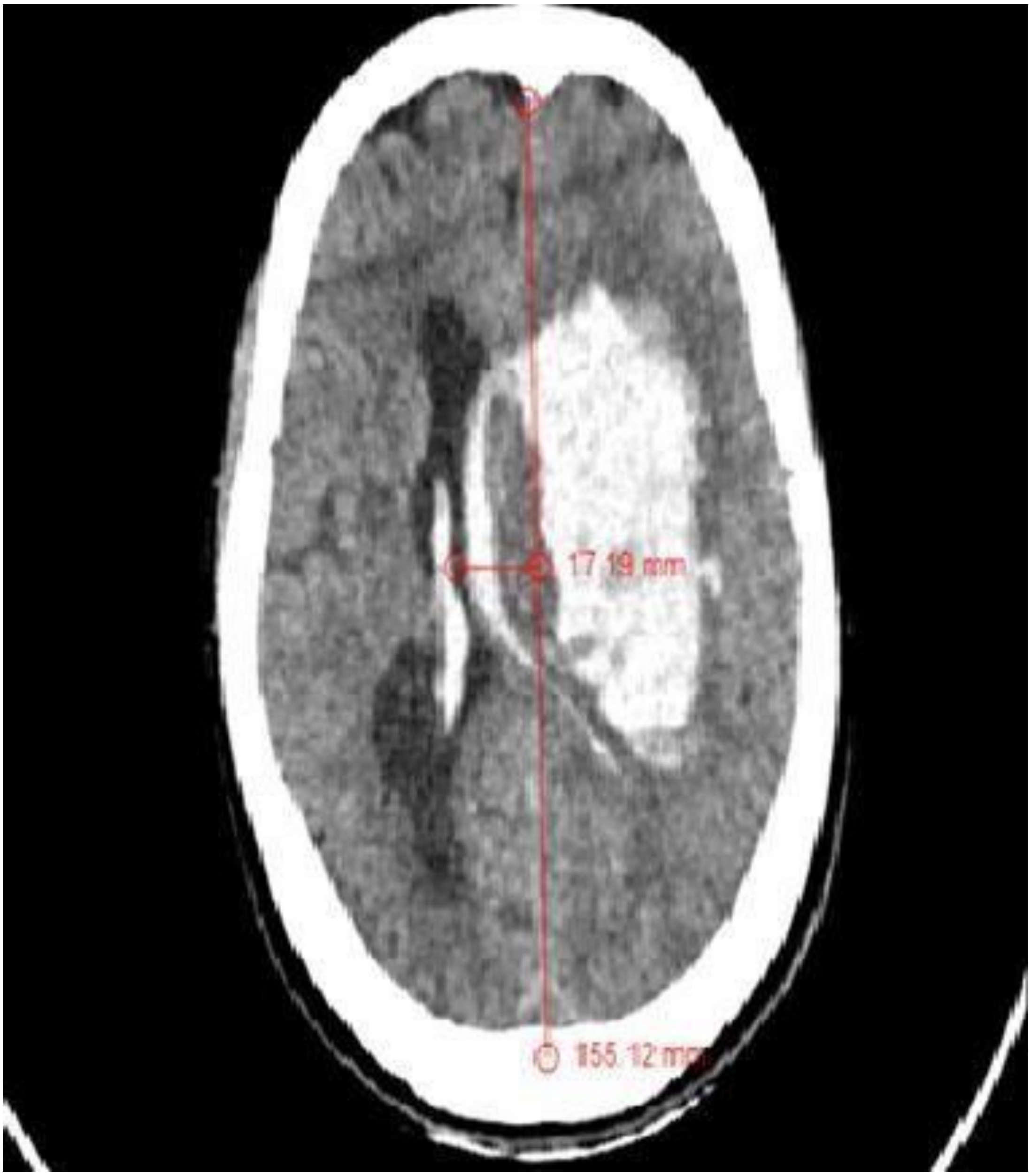


Figure 3.4: Axial non contrast enhanced brain CT showing a large Intra-parenchymal hemorrhage in the left capsulo-ganglionic region causing mass effect over ipsilateral lateral ventricle and midline shift of 17 mm to right

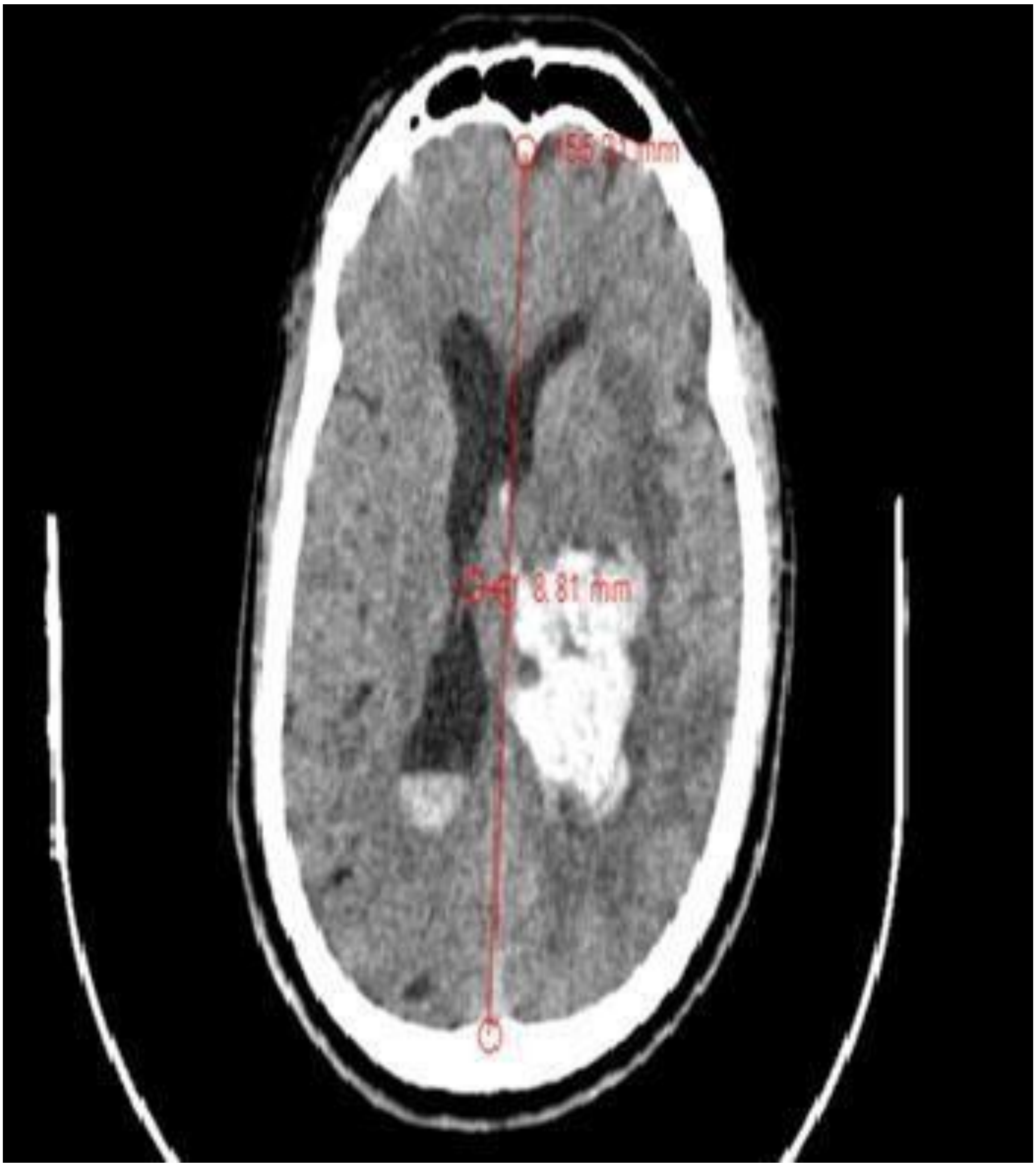


Figure 3.5: Axial non contrast enhanced brain CT showing a large Intra-parenchymal hemorrhage in the left capsulo-ganglionic region causing mass effect over ipsilateral lateral ventricle and midline shift of 8 mm to right with Intraventricular hemorrhage

RESULTS

A data of 100 patients with head injury was used to obtain results. Clinical outcome predictors in head injury like patient's age, gender, etiology of the head injury,type of the brain lesion, midline shift on CT brain, pupillary response and GCS scores were considered.

Road traffic accidents (RTA) were found to be the most frequent cause of head injuries in our study (80%), followed by falls (13%) and assaults (7%).

❖ AGE:

Age groups between 21 and 40 (54%) and between 41 and 60 (26%), respectively, were most frequently involved (TABLE 1).

TABLE 1:AGE WISE DISTRIBUTION

Age	No of Cases	Percent
≤ 20	7	7.0
21-40	54	54.0
41-60	26	26.0
> 60	13	13.0
Total	100	100.0

There were 7 cases < 20 years, 54 cases in 21-40 years, 26 cases in 41-60 years, 13 cases in >60 years age group

GRAPH1:AGE WISE DISTRIBUTION

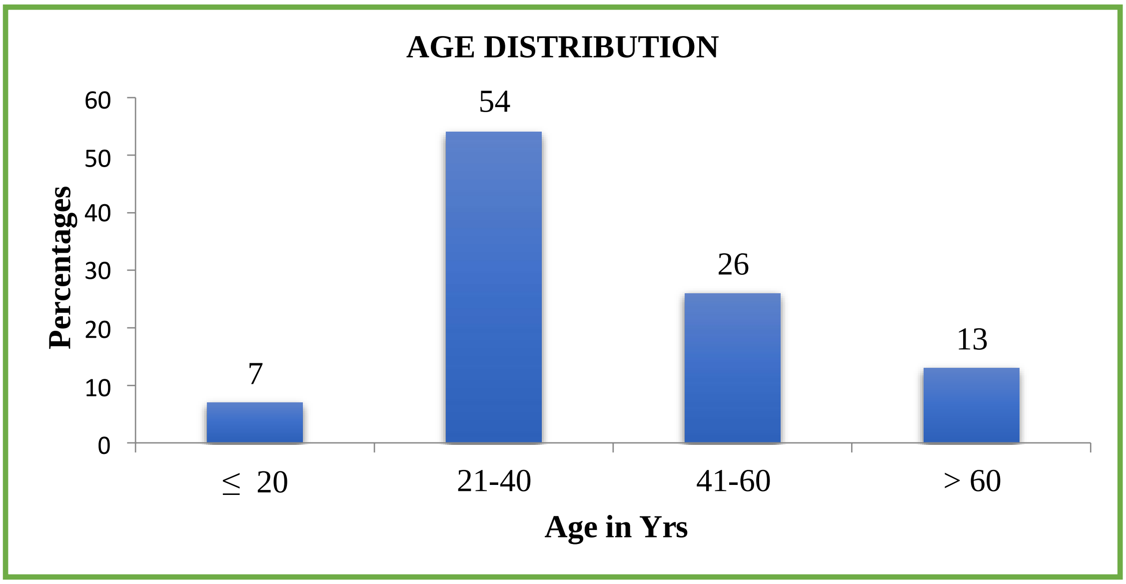


TABLE 2: GENDER WISE DISTRIBUTION

Gender	No of Cases	Percent
Male	80	80
Female	20	20
Total	100	100.0

In this study, Out of 100 patients, 80 were male and 20 were females.

GRAPH 2:GENDER WISE DISTRIBUTION

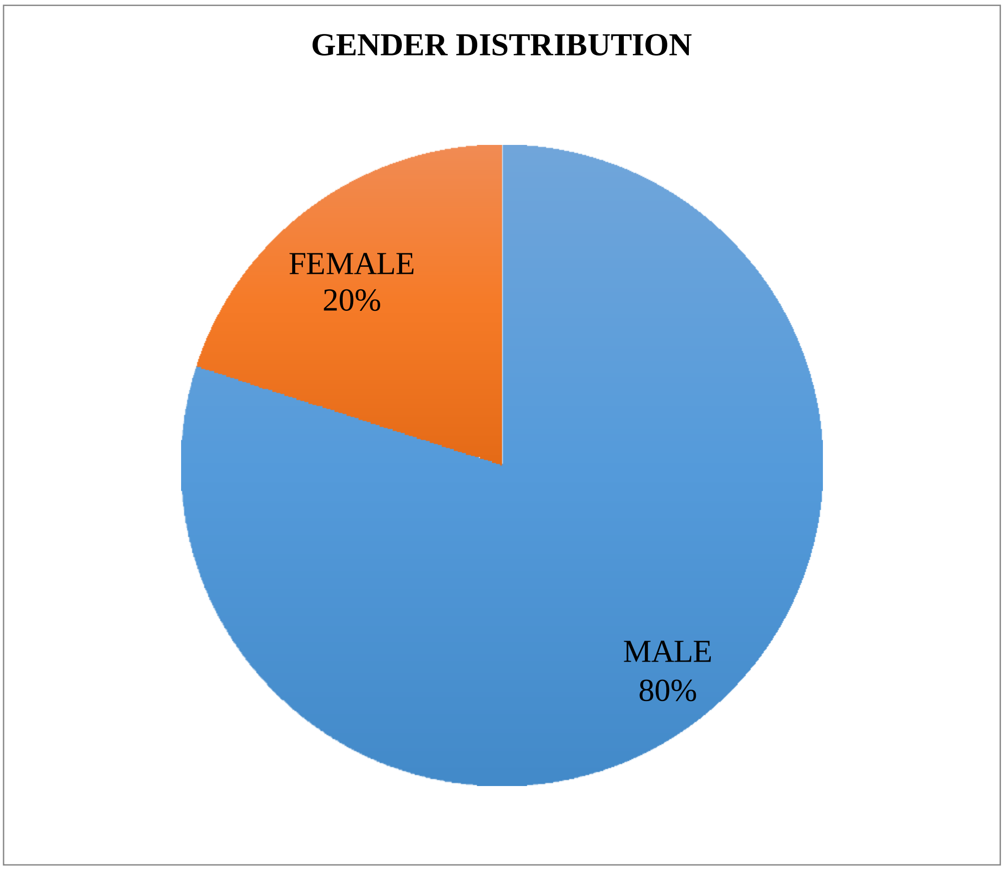


TABLE 3:CT FINDINGS

CT Findings	No of Cases	Percent
SDH	46	46.0
EDH	26	26.0
SAH	9	9.0
ICH	15	15.0
DAI	4	4.0
Total	100	100.0

Multiple lesions were shown in the CT brain. Subdural hemorrhage was noted in 46 cases, extradural hemorrhage in 26 cases, intracerebral hemorrhage was noted in 15 cases, and subarachnoid hemorrhage (SAH) was noted in 9 cases.(Table 3)

GRAPH 3: CT FINDINGS

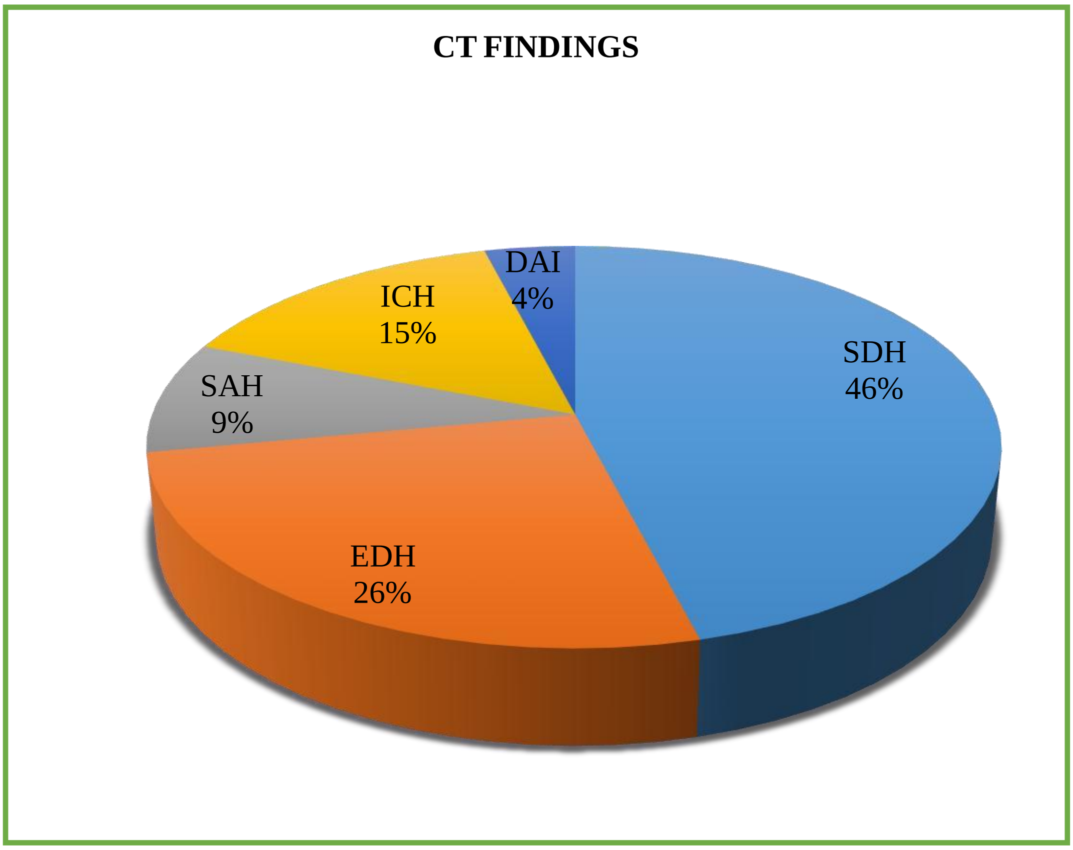


TABLE 4:CT FINDINGS:MIDLINE SHIFT

Midline Shift	No of Cases	Percent
Nil	10	10.0
< 5 mm	55	55.0
≥ 5 mm	35	35.0
Total	100	100.0

In this study, 10 individuals had no midline shift on the brain's CT scan, 55 had shifts under 5 mm, and 35 had shifts greater than or equal to 5 mm (Table 4).

GRAPH 4:MIDLINE SHIFT

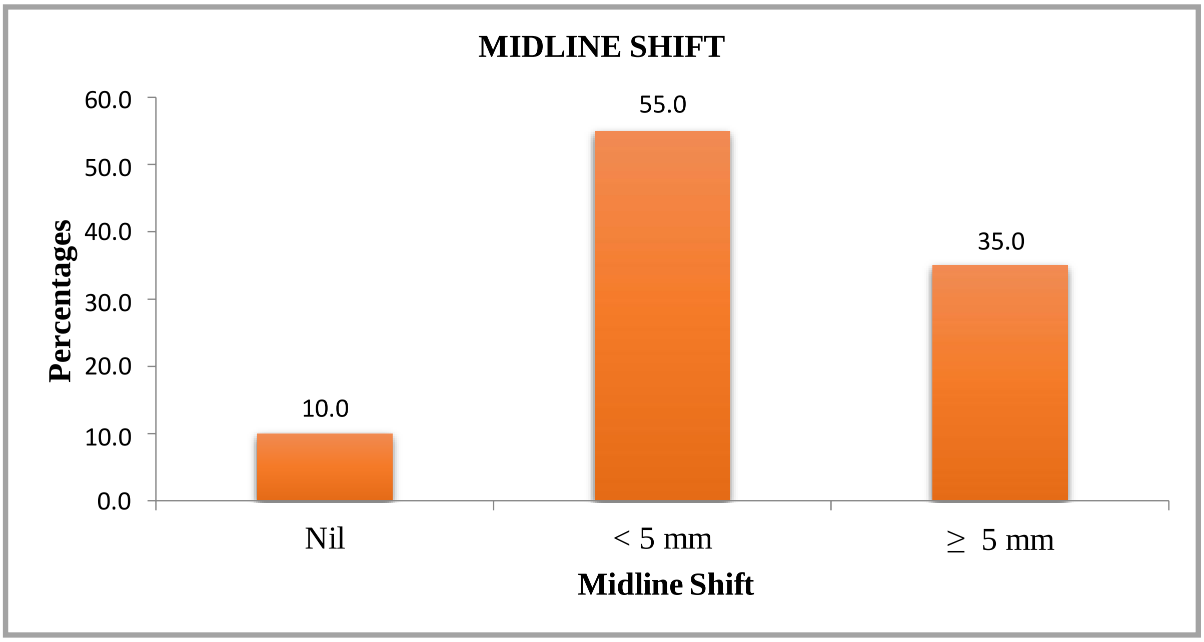


TABLE 5: GCS SEVERITY

GCS Severity	No of Cases	Percent
Mild	33	33.0
Moderate	29	29.0
Severe	38	38.0
Total	100	100.0

33% of cases had mild GCS, 29 % had moderate GCS and 38 % had severe GCS.

GRAPH 5: GCS SEVERITY

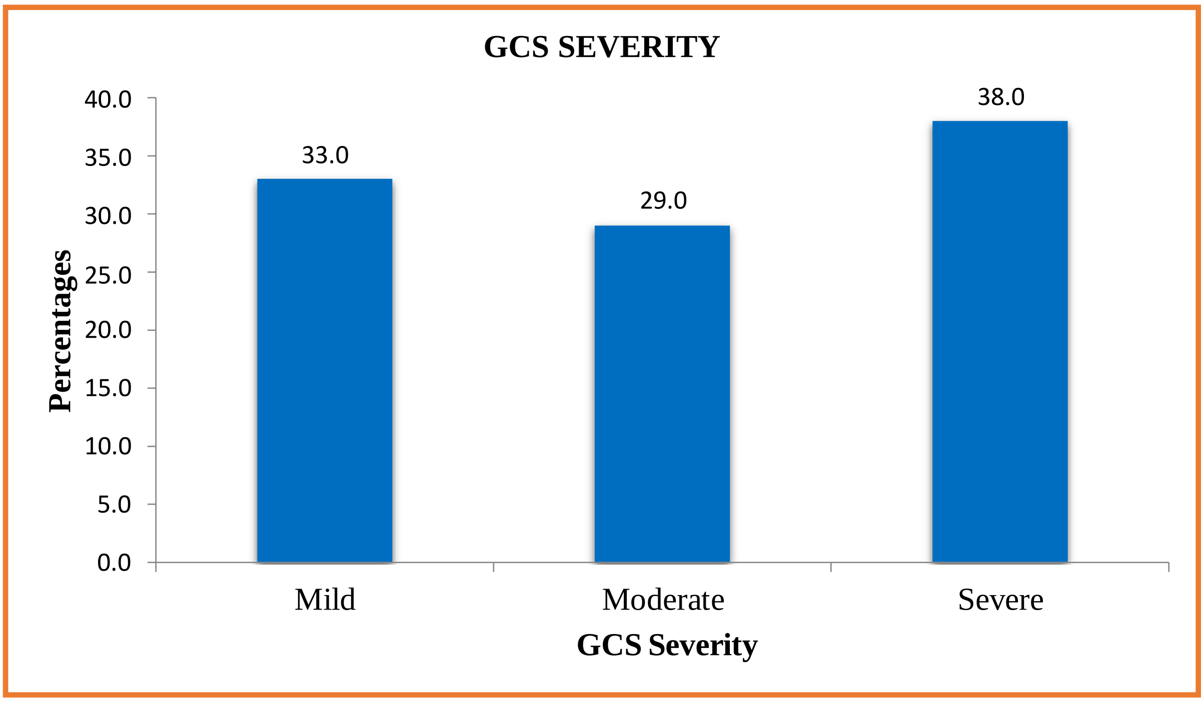


TABLE 6: PUPILLARY REACTION

Pupillary Reaction	No of Cases	Percent
Equal	63	63.0
Unequal	22	22.0
Bilaterally non reacting	15	15.0
Total	100	100.0

63% of cases had bilaterally equal reacting pupils, 22% had bilaterally unequal pupil and 15% had bilateral non reacting pupils

GRAPH 6: PUPILLARY REACTION

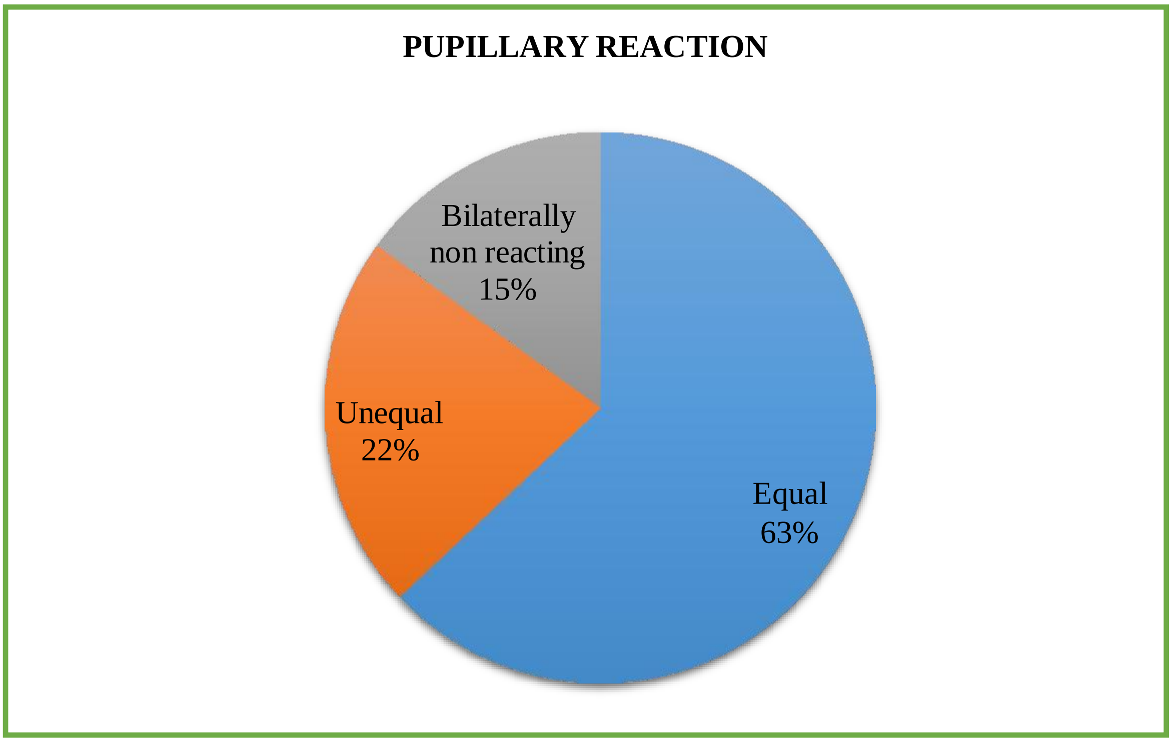


TABLE 7: OUTCOME

Outcome	No of Cases	Percent
Good	80	80.0
Poor	20	20.0
Total	100	100.0

Among 100 cases, 80 % of cases had good outcome and 20% had poor outcome

GRAPH 7: OUTCOME

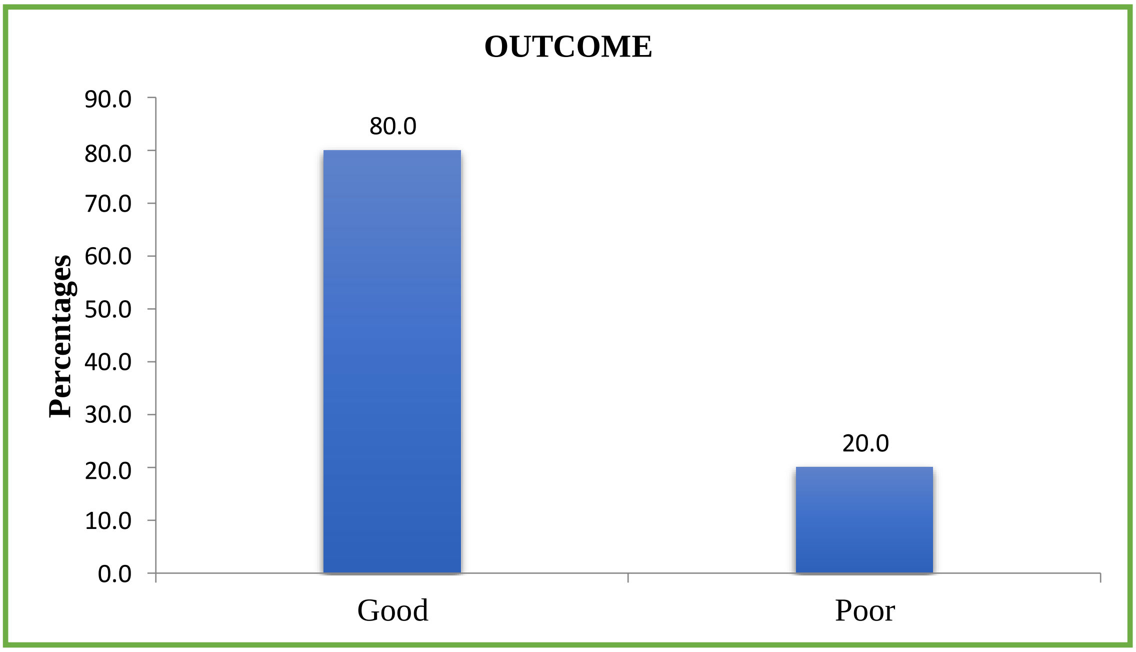


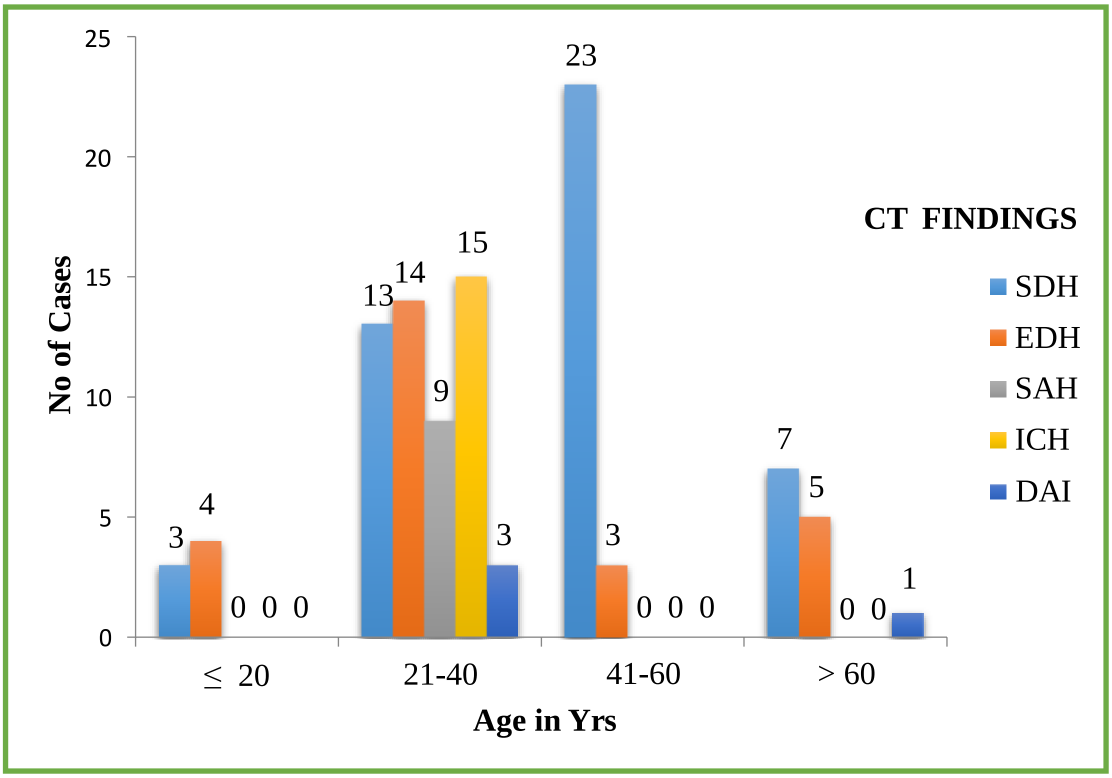
TABLE 8:CORRELATION BETWEEN CT FINDINGS AND AGE GROUP

Age	CT Findings					P Value
	SDH	EDH	SAH	ICH	DAI	
≤ 20	3	4	0	0	0	P<0.001, Sig
21-40	13	14	9	15	3	
41-60	23	3	0	0	0	
> 60	7	5	0	0	1	
Total	46	26	9	15	4	

CT Findings and age group showed significant correlation in this study

EDH was most common in <20 years, ICH and EDH were common in 21-40 years,

SDH was common in 41-60 years and >60 years



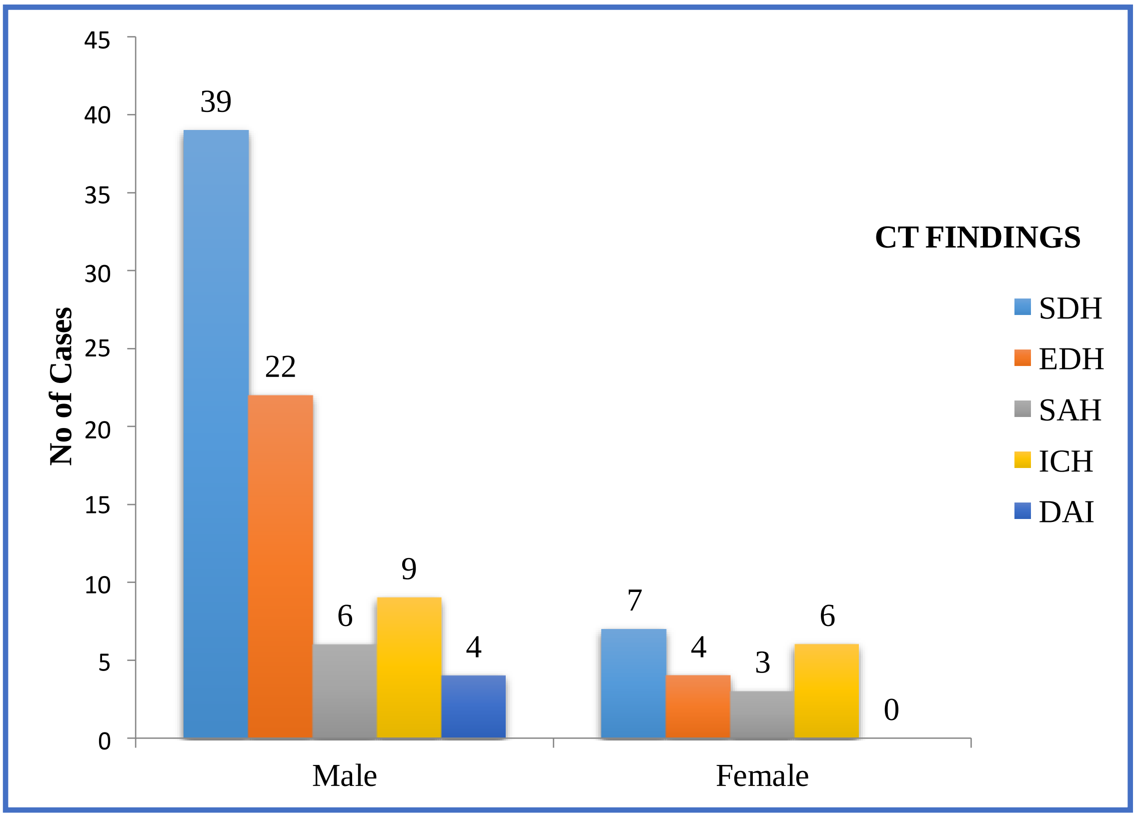
GRAPH 8: CORRELATION BETWEEN CT FINDINGS AND AGE GROUP

TABLE 9:CT FINDINGS AND GENDER CORRELATION:

Gender	CT Findings					P Value
	SDH	EDH	SAH	ICH	DAI	
Male	39	22	6	9	4	0.149, Not Sig
Female	7	4	3	6	0	
Total	46	26	9	15	4	

No significant correlation was noted between the gender and CT findings

SDH is most common lesion in both males and females.

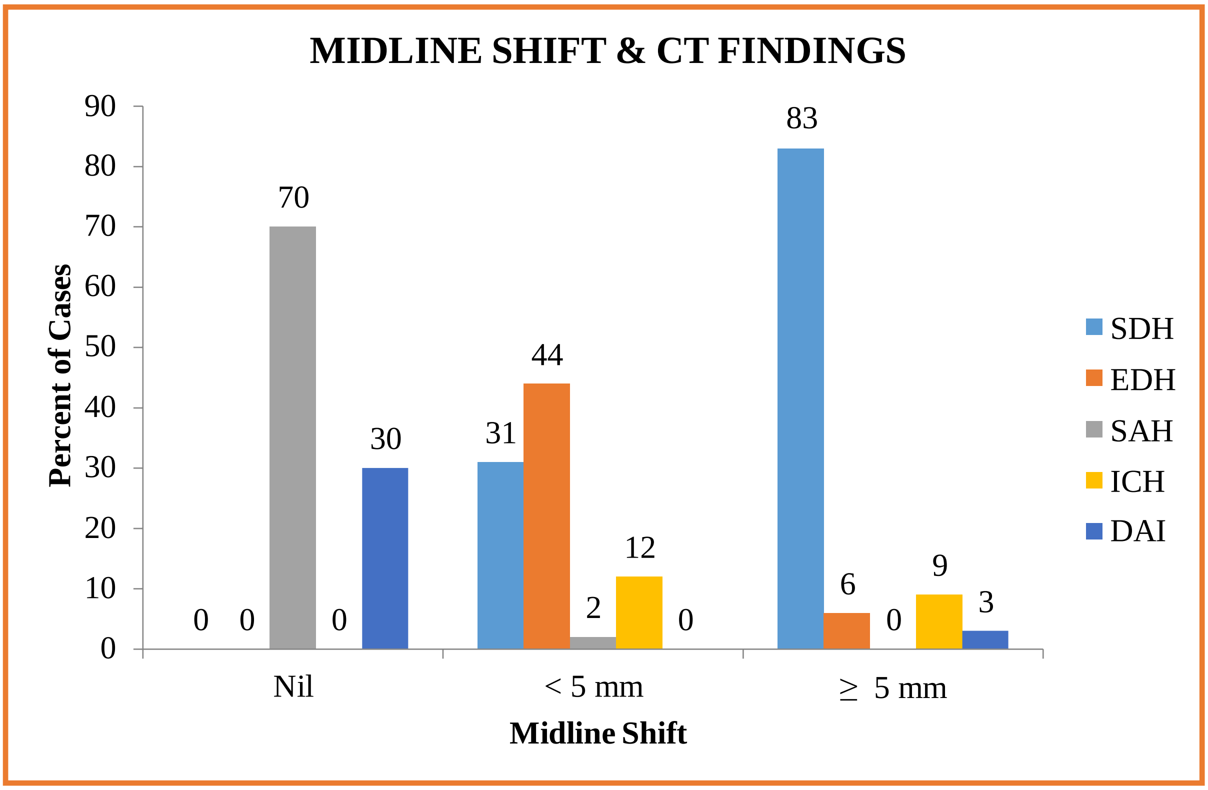


GRAPH 9:CT FINDINGS AND GENDER CORRELATION:

TABLE 10:CORRELATION BETWEEN CT FINDINGS AND MIDLINE SHIFT:

CT Findings	Midline Shift					
	Nil		< 5 mm		≥ 5 mm	
	Count	%	Count	%	Count	%
SDH	0	0	17	31	29	83
EDH	0	0	24	44	2	6
SAH	7	70	2	4	0	0
ICH	0	0	12	22	3	9
DAI	3	30	0	0	1	3
Total	10	100	55	100	35	100
Chi Square Test P<0.001, Sig						

Significant correlation was noted between the CT findings and Midline shift. No shift was noted in SAH and DAI , whereas Shift <5 mm were seen mostly with EDH(44%) followed by SDH(31%), and ICH(22%) .Shift >/=5mm was seen with SDH(83%) followed by ICH(9%) and EDH (6%)

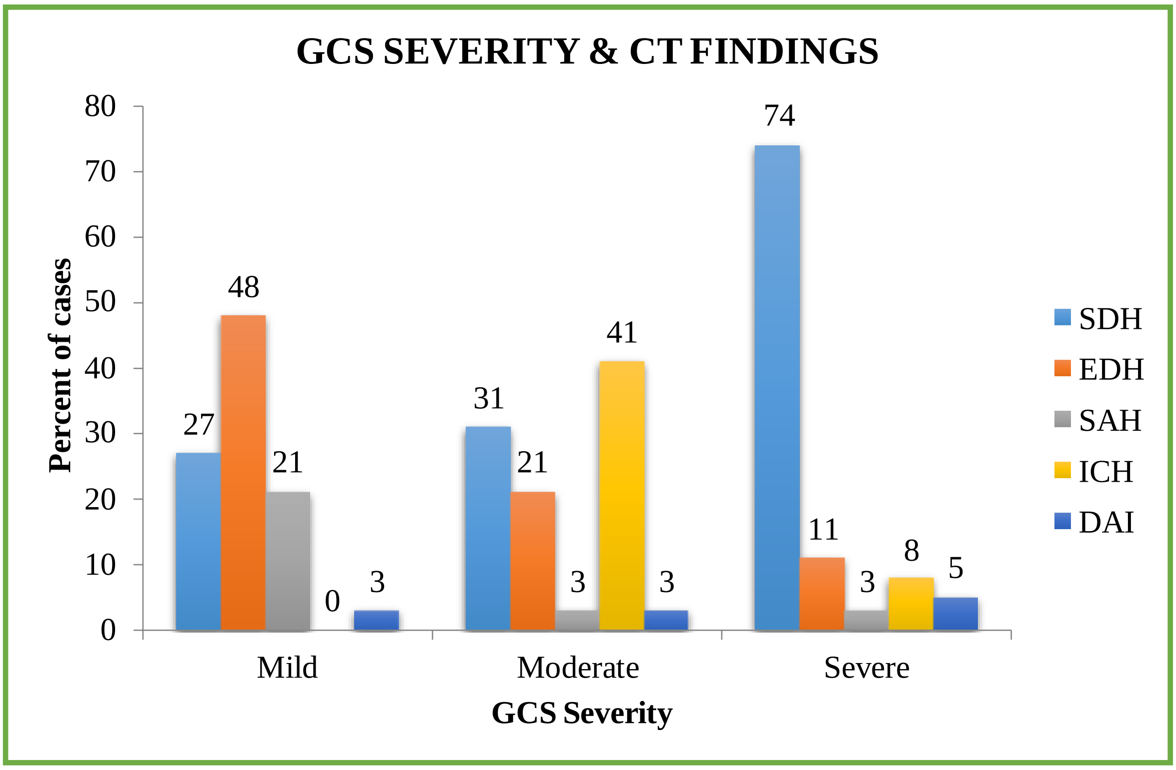


GRAPH 10:CORRELATION BETWEEN CT FINDINGS AND MIDLINE SHIFT

TABLE 11:CORRELATION BETWEEN CT FINDINGS AND GCS:

CT Findings	GCS					
	Mild		Moderate		Severe	
	Count	%	Count	%	Count	%
SDH	9	27	9	31	28	74
EDH	16	48	6	21	4	11
SAH	7	21	1	3	1	3
ICH	0	0	12	41	3	8
DAI	1	3	1	3	2	5
Total	33	100	29	100	38	100
Chi Square Test P<0.001, Sig						

Significant correlation was noted between the CT findings and GCS severity. Mild cases had more number of EDH (48%), while moderate cases had more number of ICH (41%), whereas severe cases had more number of SDH(74 %)

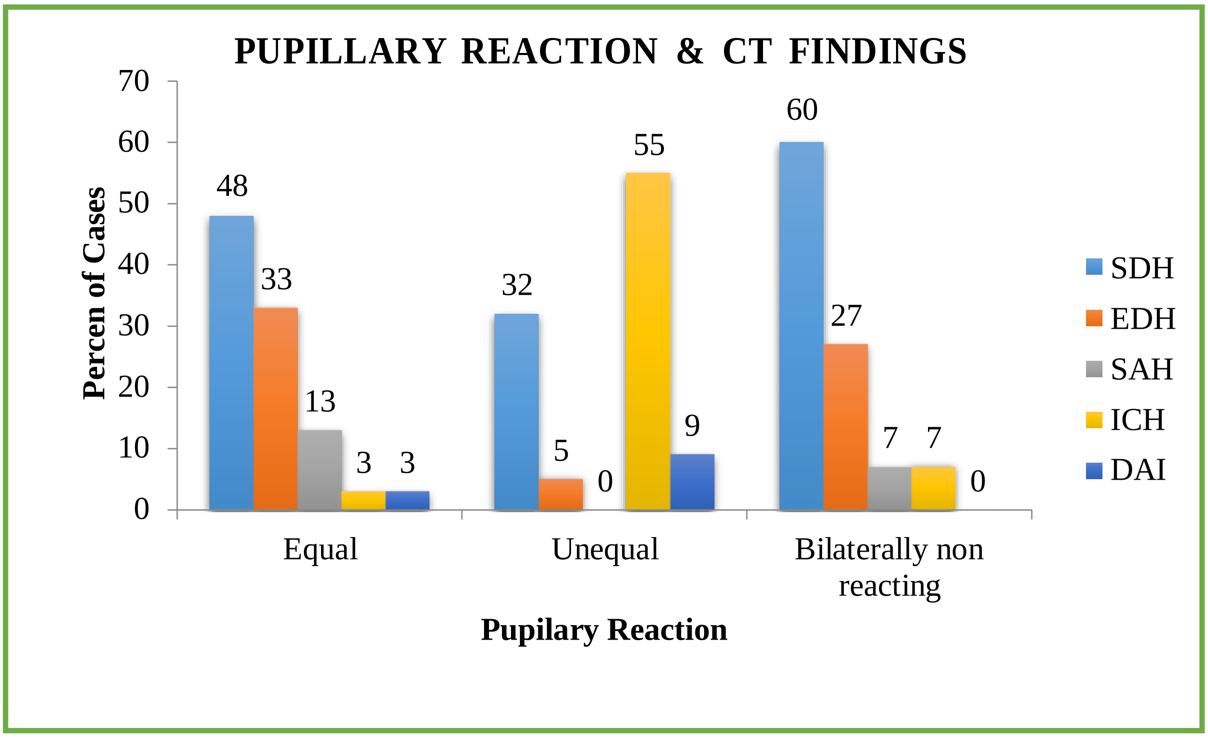


GRAPH 11:CORRELATION BETWEEN CT FINDINGS AND GCS:

TABLE12:CORRELATION BETWEEN CT FINDINGS AND PUPILLARY REACTION

CT Findings	Pupillary Reaction					
	Equal		Unequal		Bilaterally non reacting	
	Count	%	Count	%	Count	%
SDH	30	48	7	32	9	60
EDH	21	33	1	5	4	27
SAH	8	13	0	0	1	7
ICH	2	3	12	55	1	7
DAI	2	3	2	9	0	0
Total	63	100	22	100	15	100
Chi Square Test P<0.001, Sig						

Significant correlation was noted between CT findings and Pupillary reaction.



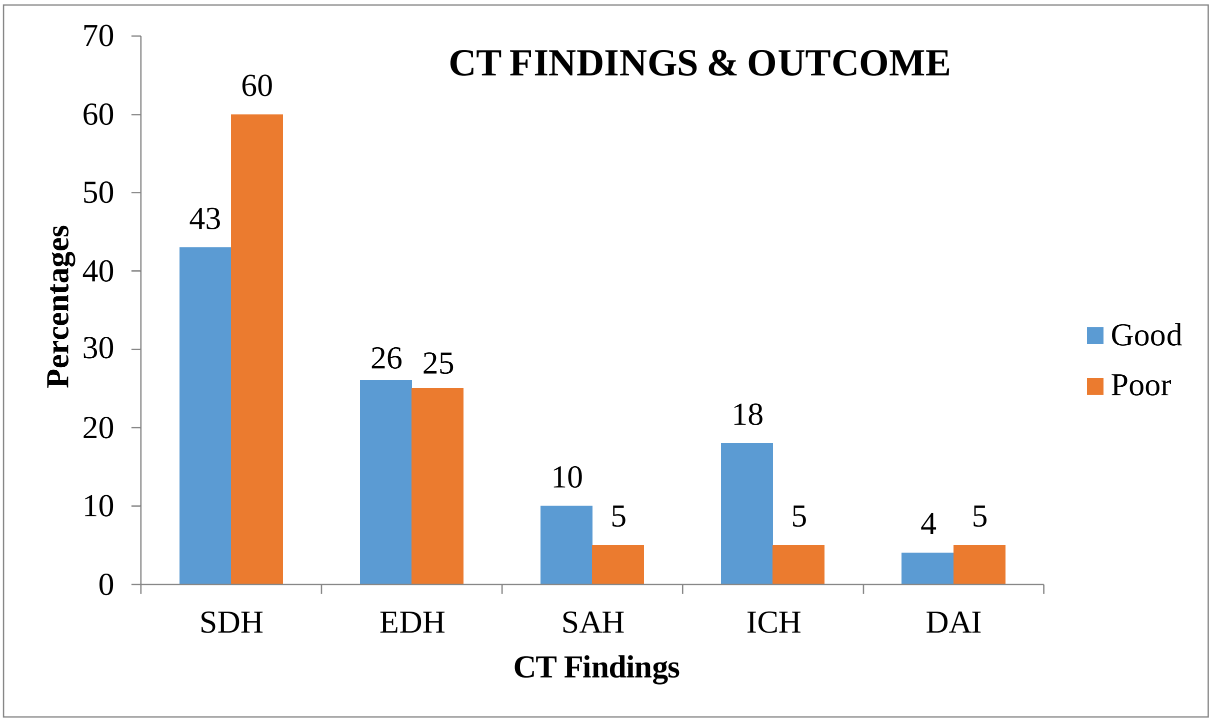
GRAPH 12:CORRELATION BETWEEN CT FINDINGS AND PUPILLARY REACTION:

TABLE 13:CT FINDINGS AND OUTCOME:

CT Findings	Outcome			
	Good		Poor	
	Count	%	Count	%
SDH	34	43	12	60
EDH	21	26	5	25
SAH	8	10	1	5
ICH	14	18	1	5
DAI	3	4	1	5
Total	80	100	20	100

Good outcome was seen in 34 cases with SDH, 21 cases with EDH, 8 cases with SAH, 14 cases with ICH, 3 cases with DAI

Poor outcome was seen in 12 cases with SDH, 5 cases with EDH, 1 case with SAH, 1 case with ICH, 1 case with DAI



GRAPH 13:CT FINDINGS AND OUTCOME:

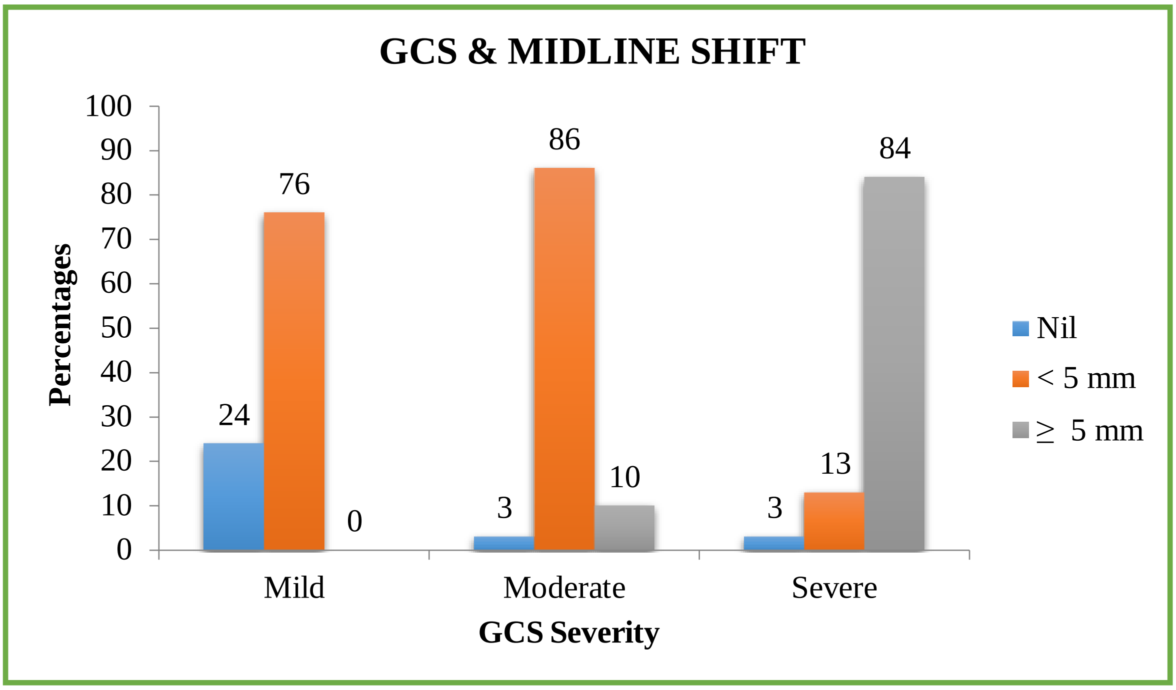
TABLE 14:CORRELATION BETWEEN MIDLINE SHIFT AND GCS

Midline Shift	GCS					
	Mild		Moderate		Severe	
	Count	%	Count	%	Count	%
Nil	8	24	1	3	1	3
< 5 mm	25	76	25	86	5	13
≥ 5 mm	0	0	3	10	32	84
Total	33	100	29	100	38	100
Chi Square Test P<0.001, Sig						

In this study, there is significant correlation between the Midline shift and GCS severity.

More the midline shift more is the severity .32 out of 38 severe cases had midline shift >/=5 mm.

Most of the mild and moderate cases had shift <5 mm



GRAPH 14: CORRELATION BETWEEN MIDLINE SHIFT AND GCS

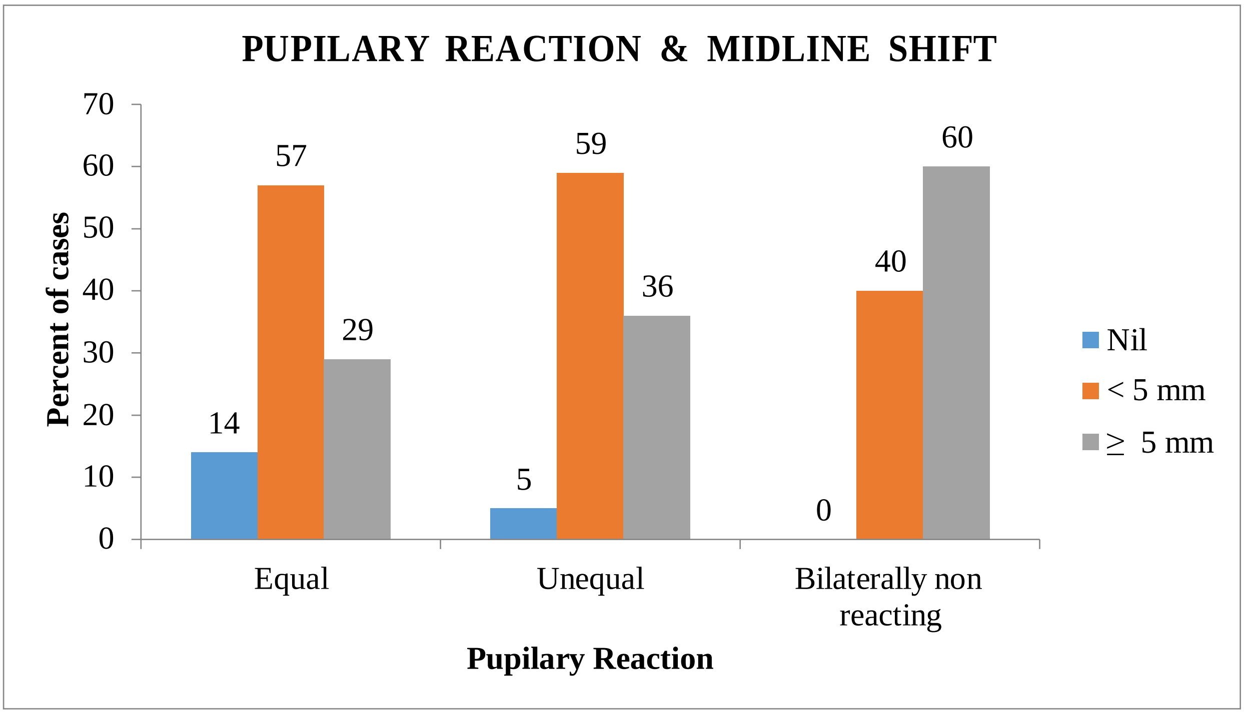
TABLE15:CORRELATION BETWEEN MIDLINE SHIFT AND PUPILLARY REACTION

Midline Shift	Pupillary Reaction					
	Equal		Unequal		Bilaterally non reacting	
	Count	%	Count	%	Count	%
Nil	9	14	1	5	0	0
< 5 mm	36	57	13	59	6	40
≥ 5 mm	18	29	8	36	9	60
Total	63	100	22	100	15	100
Chi Square Test P<0.001, Sig						

In this study, there is significant correlation between the Midline shift and Pupillary reactivity.

Most of the bilaterally equal reacting pupils and unequally reacting pupils had shift <5 mm.

Among Bilaterally non reacting pupils most of the cases had shift >/=5 mm.



GRAPH 15:CORRELATION BETWEEN MIDLINE SHIFT AND PUPILLARY REACTION

TABLE 16:CORRELATION BETWEEN MIDLINE SHIFT AND OUTCOME

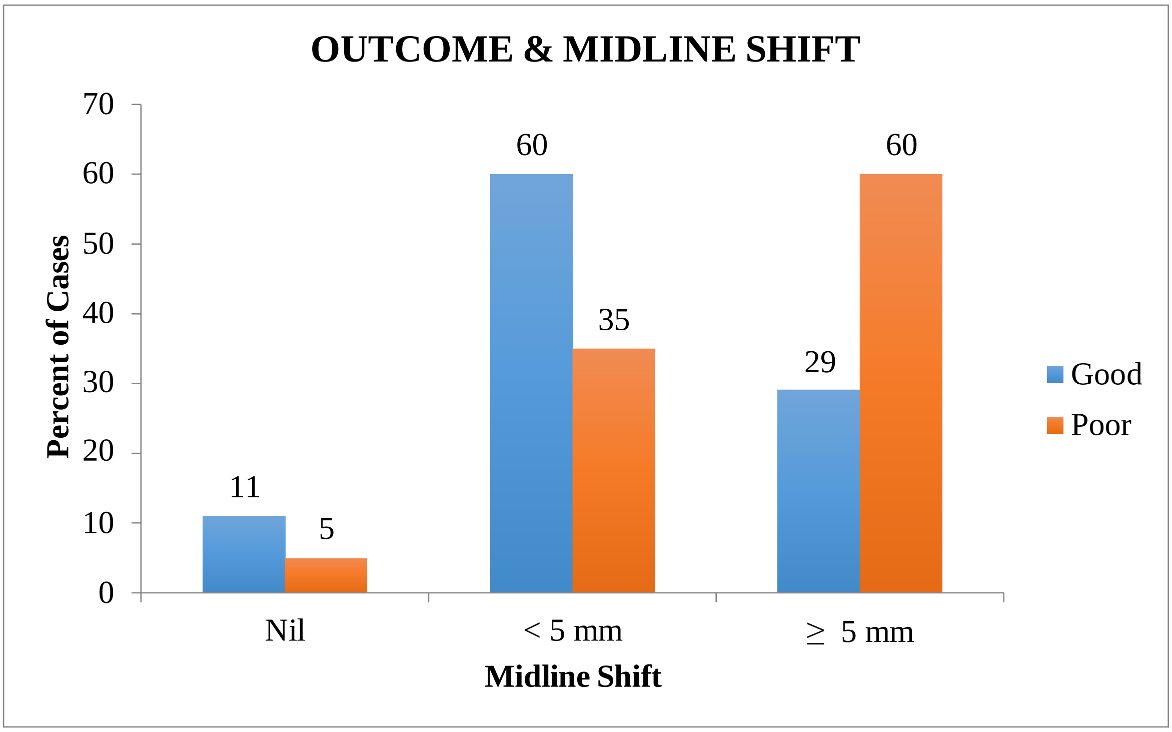
Midline Shift	Outcome			
	Good		Poor	
	Count	%	Count	%
Nil	9	11	1	5
< 5 mm	48	60	7	35
≥ 5 mm	23	29	12	60
Total	80	100	20	100
Chi Square Test P<0.032, Sig				

There is significant correlation between the midline shift and the outcome

9 out of 10 cases with no shift , 48 out of 55 cases with shift <5 mm and 23 out of 35 cases with shift >/=5 mm had good outcome.

1 out of 10 cases with no shift , 7 out of 55 cases with shift <5 mm and 12 out of 35 cases with shift >/=5 mm had poor outcome.

Therefore, poor outcome was seen more with shift >/= 5 mm.



GRAPH 16:CORRELATION BETWEEN MIDLINE SHIFT AND OUTCOME

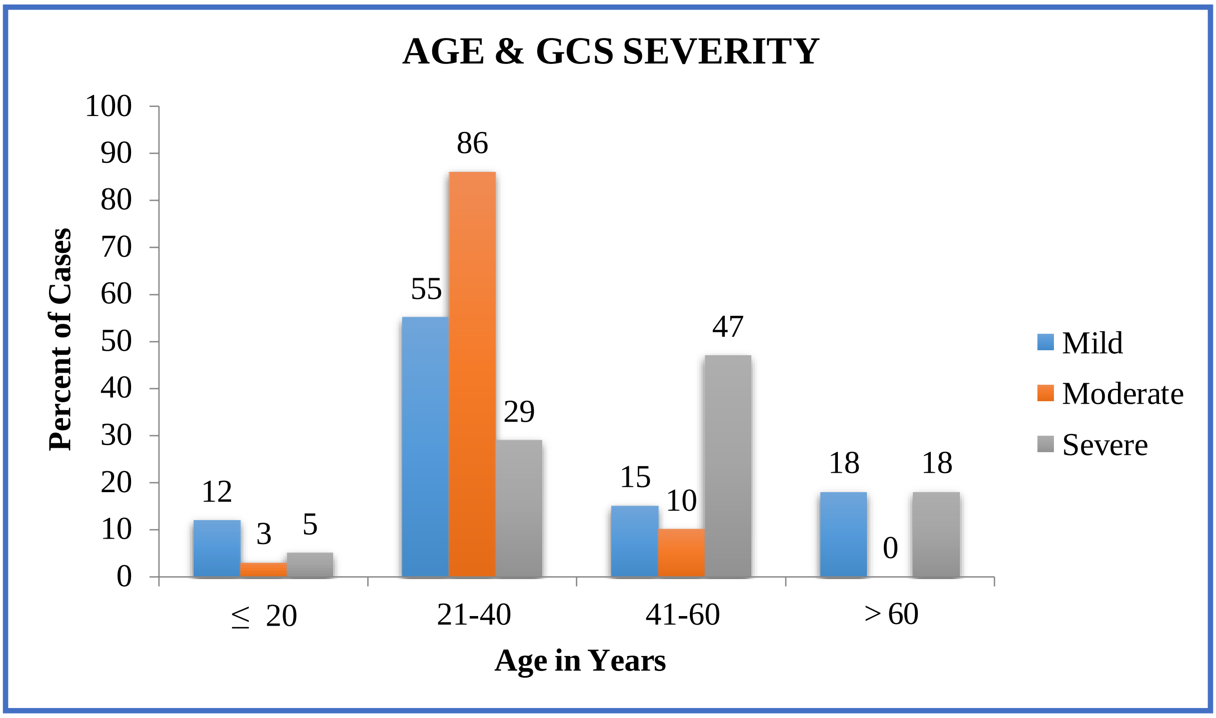
TABLE 17:CORRELATION BETWEEN AGE AND GCS SEVERITY

Age	GCS Severity					
	Mild		Moderate		Severe	
	Count	%	Count	%	Count	%
≤ 20	4	12	1	3	2	5
21-40	18	55	25	86	11	29
41-60	5	15	3	10	18	47
> 60	6	18	0	0	7	18
Total	33	100	29	100	38	100
Chi Square Test P<0.001, Sig						

There is significant correlation between the Age group and GCS severity

In <20 years age group maximum cases had mild GCS severity, in 21-40 years age group maximum cases had moderate GCS , in 41-60 years maximum had severe GCS and >60 years age group maximum of severe GCS

Therefore , more the age group more severe are the injuries.



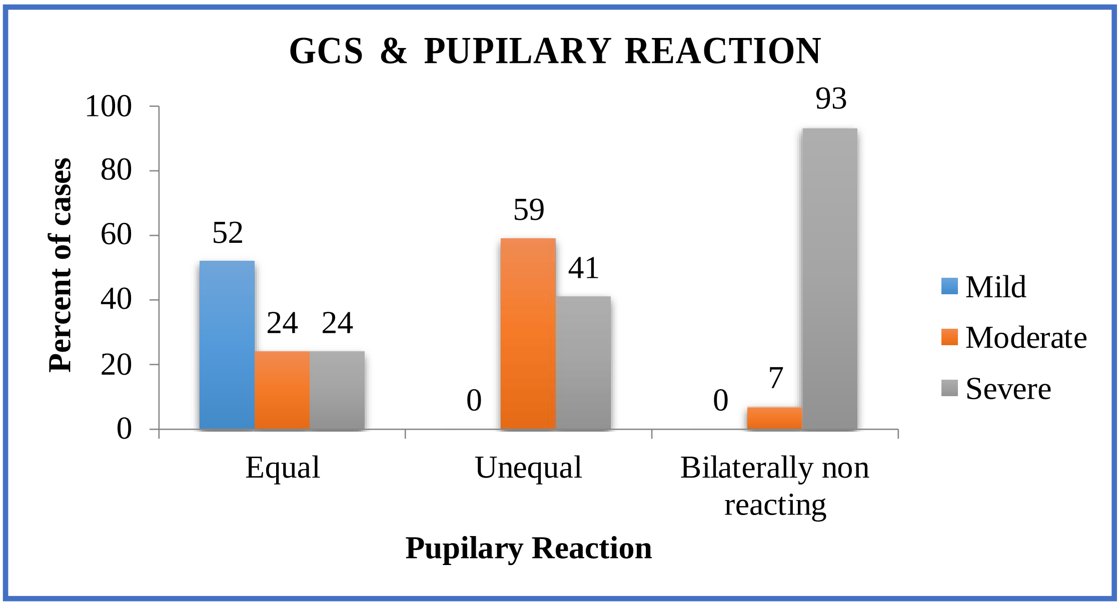
GRAPH 17:CORRELATION BETWEEN AGE AND GCS SEVERITY

TABLE 18: CORRELATION BETWEEN GCS SCORE AND PUPILLARY REACTION

GCS Score	Pupillary Reaction					
	Equal		Unequal		Bilaterally non reacting	
	Count	%	Count	%	Count	%
Mild	33	52	0	0	0	0
Moderate	15	24	13	59	1	7
Severe	15	24	9	41	14	93
Total	63	100	22	100	15	100
Chi Square Test P<0.001, Sig						

There is significant correlation between the GCS score and pupillary reaction.

Most of the cases with bilateral equal reacting pupils were seen in mild cases, whereas most of the bilaterally unequal reacting pupills were seen in moderate severity cases and cases with bilaterally nonreactive pupils were seen moslty in severe cases



GRAPH 18: CORRELATION BETWEEN GCS SCORE AND PUPILLARY REACTION

TABLE 19:CORRELATION BETWEEN GCS SCORE AND OUTCOME:

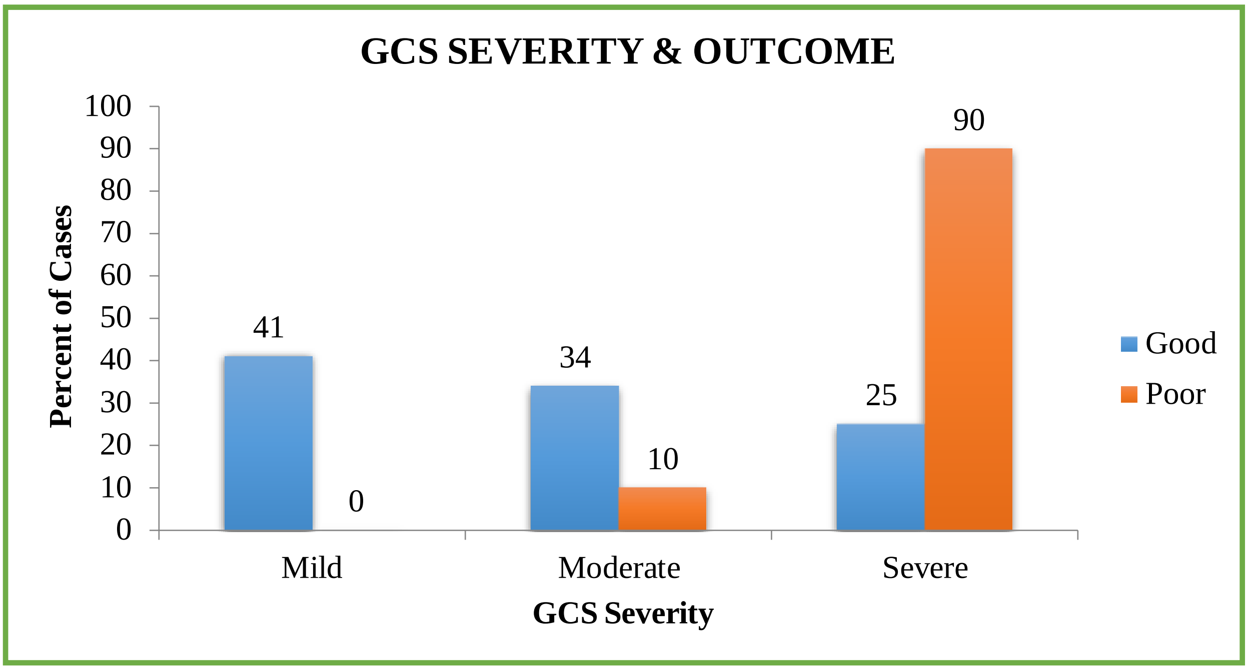
GCS Score	Outcome			
	Good		Poor	
	Count	%	Count	%
Mild	33	41	0	0
Moderate	27	34	2	10
Severe	20	25	18	90
Total	80	100	20	100
Chi Square Test P<0.001, Sig				

There is significant correlation between GCS and the outcome.

Among the good outcome group, 33(41%) were mild severity cases, 27(34%) were moderate severity cases, 20(25%) were severe cases.

Among the poor outcome, 2 (10 %) were moderate severity cases and 18(90 %) cases were having severe GCS

Therefore, more severe is the GCS more poor is the outcome.



GRAPH 19:CORRELATION BETWEEN GCS SCORE AND OUTCOME:

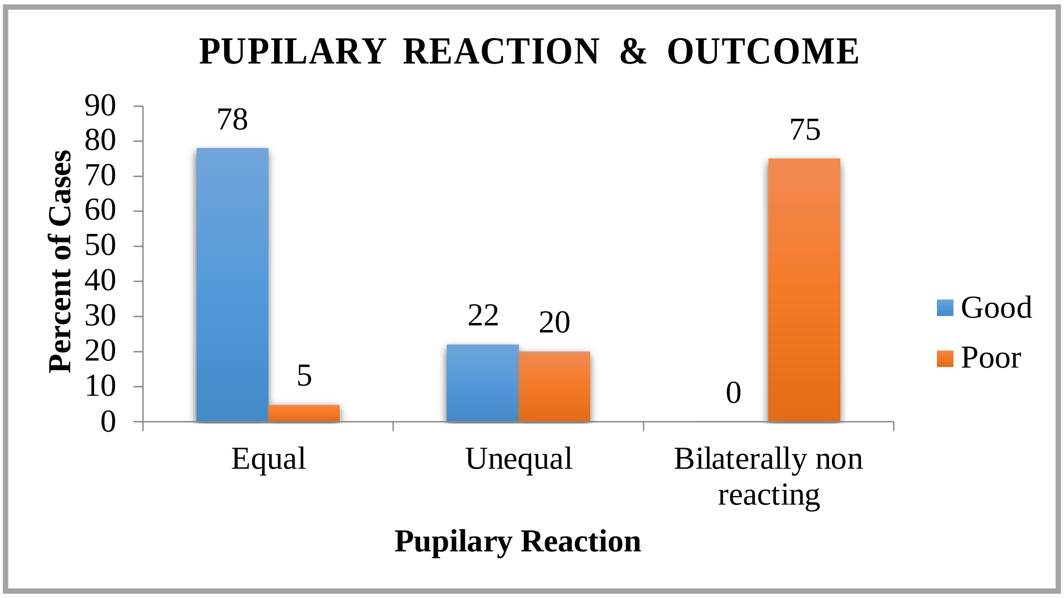
TABLE 20: CORRELATION BETWEEN PUPILLARY REACTION AND OUTCOME

Pupillary Reaction	Outcome			
	Good		Poor	
	Count	%	Count	%
Equal	62	78	1	5
Unequal	18	22	4	20
Bilaterally non reacting	0	0	15	75
Total	80	100	20	100
Chi Square Test P<0.001, Sig				

There is significant correlation between papillary reaction and outcome

62/63 of patients with bilaterally equal reacting pupils, 18/22 of bilaterally unequal reacting pupils had good outcomes. Whereas, 1/63 of patients with bilaterally equal reacting pupils, 4/22 of bilaterally unequal reacting pupils, 15/15 of bilaterally non-reacting pupils had poor outcomes.

Therefore, most of the non- reacting pupils had poor outcome.



GRAPH 20: CORRELATION BETWEEN PUPILLARY REACTION AND OUTCOME

In our study, 35 out of 100 head injury patients underwent a craniotomy.Out of the 35 patients, 16 had subdural hematoma, 15 had EDH, and 4 had intra-parenchymal bleed/contusion. Surgical management was decided based on presence of clot size >30 mL,severe GCS score,anisocoria in patients with midline shift <5mm .Neurological outcome was divided into good and poor outcome based on the GOS score. In the current study, following a brain injury, 80 patients had a good outcome (GOS 4 and 5) and 20 patients had a poor outcome (GOS 1, 2, and 3)

DISCUSSION

Traumatic brain injury (TBI) is an interruption of normal brain function brought on by an extrinsic mechanical force. Early identification and treatment of craniocerebral lesions in acute head injury is of utmost importance as they cause high mortality and morbidity. Early GCS score, pupil reactivity, patient's age, and CT scan findings are the most significant predictive factors for predicting outcomes after traumatic brain injury. CT scan is the initial screening tool for evaluation of patients with acute head injury. Initial GCS of patients is a crucial decision-making element regarding the course of treatment and potential long-term side effects. Therefore, the purpose of this study was to investigate the reliability of Midline shift on CT with GCSP scores in predicting outcomes for patients with traumatic brain injury.

Road traffic accidents (RTA) were found to be the most frequent cause of head injuries in current study (80%), followed by falls (13%) and assaults (7%) similar to study conducted by **Motah et al. (2021) [28], Sah SK et al [25]**

A study by **Capizzi et al. (2020) [29]** stated that, more than two-thirds of all TBI cases were males .Eighty percent of TBI patients in the current study were men. Males outnumbered females by a large margin despite the fact that both sexes had to meet the same admission criteria. This can be explained as males are exposed in a larger extent to the risk factors for TBI such as road traffic accidents, assaults. However, in current study, there was no significant correlation between the gender and outcome because of the fact that overall number of males were more than the females. Similar conclusions were made **by Cancelliere et al. (2016) [30]** in a study that sought to identify gender differences in the prognosis and recovery following TBI in adults. They discovered that gender is not a reliable or strong predictor of TBI recovery.

According to **Biswas et al (2017) [31]** study, "Effect of sex and age on traumatic brain damage" The age range between 25 and 58 years constituted more than half of the sample, whereas the age range beyond 59 years represented less than half. In the current study, majority of TBI cases occurred in young individuals (21-40 years) and only 13% patients were older than 60 years. The lower incidence of TBI in the age group older than 60 years compared with those younger than 60 years is attributed to the fact that the age of patients in the former group are less exposed to some causes of brain trauma, such as RTA and violence. Even though the incidence is less but when elders are affected the severity is more as the comorbidities due to old age ,senile changes in brain like greater plasticity and cerebral atrophy**[32-35].**

According to **Mohamed OM et al [36],** key component of evaluating patients with traumatic brain injury is the Glasgow Coma Scale. In current study Most of the poor outcome cases had lower GCS similar to study conducted by **Becker et al [37]**

Talari et al. (2019) [38] found that CT is a strong independent outcome predictor with excellent sensitivity and specificity. Also **Nayebaghayee and Afsharian's (2016)**,concluded that computed tomography (CT) scans were the gold standard for classifying the severity of brain injury**[26]**On CT scans, SDH was most common finding in this study followed by EDH and ICH. EDH was most common in <20 years, ICH and EDH were common in 21-40 years, SDH was common in 41-60 years and >60 years

According to the severity of TBI (i.e. according to GCS scores) in the present study, the brain CT scan findings differed from patient to another. The incidence of mild TBI was 33% , while moderate TBI was observed in 29%, and severe TBI was observed in 38% of the patients. Mild cases had more number of EDH (48%) in present study. Regarding moderate TBI, multiple studies stated that, the most prevalent findings were SDH, skull fractures and cerebral contusion **[39-43],** Whereas in this study most common were ICH, SDH, EDH. All the 38 patients that presented with severe TBI were presented with abnormal findings in the emergency brain CT scan and the most common findings were as follow: Subdural hemorrhage(SDH), Extradural hemorrhage(EDH), Intracranial hemorrhage .Such data were present with higher incidence in severe cases of TBI and these CT findings had poor outcome in cases of severe TBI, as described by other studies **[44,45].**

Jacobs et al. [46] came to the conclusion that mid-line shift is a major outcome predictor after analysis of 605 individuals with moderate to severe head injuries. They also came to the conclusion that the type of lesion mattered in determining the outcome. Patients with extradural hematomas had a better prognosis than those with acute subdural hematomas in individuals with identical mid-line shift following intra-cranial trauma. 32 out of 38 severe cases in current study had midline shift >/=5 mm, while most of the mild and moderate cases had shift <5 mm. Therefore, in current study degree of midline shift was a significant outcome predictor i.e More the midline shift more is the severity similar to studies by **Chiewvit P et al [4], Farshchian N et al [24].**

Brennan et al. (2018) [47] concluded in their study that overall mortality increased from less than a third when both pupils reacted to more than one third when one pupil did not react, to half when neither pupil reacted, Which was similar to current study where there was a correlation between poorer outcomes in TBI with abnormal or absent pupillary reactions. Patients who had shift, compressed cisterns had pupil abnormalities.

In the present study, patients that presented with midline shift >/= 5mm and low GCS were observed to have multiple CT findings and to be haemodynamicaly unstable, and these were associated with worst prognosis, in agreement with other studies **[47-49].**

CONCLUSION

It was concluded from this study that:

1- The severity of the brain injury was directly correlated with the degree of midline shift i.e More the midline shift More severe is the brain injury.

2- Severe brain injury patients had lower GCS score.

3- Degree of midline shift was significantly related to the GCSP scores

4- Significant numbers of CT scan findings (multiple CT findings) were associated with severe cases of TBI with predominance of SDH, EDH and ICH

5- Therefore we suggest CT Scan and GCSP scores both should be considered for predicting final prognosis.

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ANNEXURES

PROFORMA

BLDEU'S SHRI B.M.PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, VIJAYAPUR

CORRELATION OF MIDLINE SHIFT ON CT WITH GLASGOW COMA PUPILS SCORE (GCS-P) IN PREDICTING PROGNOSIS IN CRANIOCEREBRAL TRAUMA

1. Name:

2. Age/Sex:

3. Phone number and address:

4. Hospital No.:

5. Relevant complaints & history:

Time of injury:

Time of casualty consultation:

6. Clinical findings:

Pulse Rate: **BP:** **Spo2:** **GCS-P score:**

7. CT Findings:

8. Radiological Diagnosis:

9. Follow-up (Glasgow Outcome Score):

CONSENT FORM

CORRELATION OF MIDLINE SHIFT ON CT WITH GLASGOW COMA PUPILS SCORE (GCS-P) IN PREDICTING PROGNOSIS IN CRANIOCEREBRAL TRAUMA

GUIDE : DR. SATISH D. PATIL

CO-GUIDE : DR.BASAVARAJ .T BADADAL

P.G. STUDENT : DR. SHRADDHA PATIL

PURPOSE OF RESEARCH:

I have been informed that the purpose of this study is to evaluate correlation of midline shift on CT with Glasgow Coma Pupils Score(GCS-P) in predicting prognosis in craniocerebral trauma

PROCEDURE:

I understand that I will undergo history, clinical examination and CT scanning

RISKS AND DISCOMFORTS:

I understand that there is no risk involved in the above study.

BENEFITS:

I understand that my participation in this study will help to assess the correlation of midline shift on CT with Glasgow Coma Pupils Score(GCS-P) in predicting prognosis in craniocerebral trauma

CONFIDENTIALITY:

I understand that the medical information produced by the study will become a part of hospital record and will be subjected to confidentiality and privacy regulations of hospital. If the data is used for publications the identity of the patient will not be revealed.

REQUEST FOR MORE INFORMATION:

I understand that I may ask for more information about the study at any time.

REFUSAL OR WITHDRAWL OF PARTICIPATION:

I understand that my participation is voluntary and I may refuse to participate or withdraw from study at any time

INJURY STATEMENT:

I understand in the unlikely event of injury to me during the study I will get medical treatment but no further compensations. I will not hold the hospital and its staff responsible for any untoward incidence during the course of study.

Date:

DR. SHRADDHA PATIL (Investigator)

DR. SATISH D. PATIL (Guide)

DR. BASAVARAJ.T BADADAL (Co-Guide)

STUDY SUBJECT CONSENT STATEMENT:

I/my ward confirm that Dr. Shraddha Patil has explained to me the purpose of this research, the study procedure that I will undergo and the possible discomforts and benefits that I may experience, in my own language.

I/my ward have been explained all the above in detail in my own language and I understand the same. Therefore, I agree to give my consent to participate as a subject in this project.

______________________________ __________________

(Participant/ Guardian) Date

______________________________ __________________

(Witness to above signature) Date

B.L.D.E. (DEEMED TO BE UNIVERSITY) IEC/No-09/2021 Date - 22/01/2021

(Declared vide notification No. F.9-37/2007-U.3 (A) Dated 29-2-2008 of the MHRD, Government of India under Section 3 of the UGC Act, 1956)

The Constituent College

SHRI. B. M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Institutional ethical committee of this college met on 11-01-2021 at 11-00 am to scrutinize the synopsis of Postgraduate students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has been accorded Ethical Clearance

Title: Correlation of midline shift on CT with Glasgow coma pupils score (GCS-P) in predicting prognosis in craniocerebral trauma

Name of PG student: Dr Sharaddha Patil, Department of Radiology

Name of Guide/Co-investigator: Dr Satish D Patil Assoc.Professor of Radiology

DR .S.V.PATIL
CHAIRMAN, IEC
Institutional Ethical Committee
B L D E (Deemed to be University)
Shri B.M. Patil Medical College,
VIJAYAPUR-586103 (Karnataka)

Following documents were placed before Ethical Committee for Scrutinization:

1. Copy of Synopsis / Research project
2. Copy of informed consent form
3. Any other relevant documents.

MASTERCHART

SR.NO	AGE	SEX	CT FINDINGS					MIDLINE SHIFT			GCS			PUPIL REACTION			OUTCOME	
			SDH	EDH	SAH	ICH	DAI	NO SHIFT	SHIFT<5MM	SHIFT>/=5MM	MILD	MODERATE	SEVERE	B/L EQUALLY REACTIVE	B/L UNEQUALLY REACTIVE	NON REACTIVE	GOOD	POOR
1	19	M		1					1		1			1			1	
2	20	M		1					1		1			1			1	
3	19	M		1					1		1			1			1	
4	18	M	1						1			1				1		1
5	19	M	1							1			1	1			1	
6	20	M	1							1			1		1		1	
7	62	M	1							1			1		1		1	
8	63	M	1							1			1		1		1	
9	64	M					1			1			1		1		1	
10	65	M	1							1			1		1			1
11	66	M		1					1		1			1			1	
12	67	M		1					1		1			1			1	
13	68	M		1					1		1			1			1	
14	70	M		1					1		1			1			1	
15	69	M		1					1		1			1			1	
16	42	M	1							1			1	1			1	
17	48	M	1							1			1	1			1	
18	49	M	1							1			1	1			1	
19	46	FEMALE	1						1		1			1			1	
20	45	M	1						1		1			1			1	
21	47	M	1							1			1	1			1	
22	49	M	1							1			1	1			1	
23	50	M	1							1			1	1			1	
24	52	M	1							1			1	1			1	
25	55	M	1							1			1	1			1	
26	56	M	1							1			1	1			1	
27	57	M	1							1			1	1			1	
28	55	M	1							1		1		1			1	
29	52	M	1							1			1	1			1	
30	48	M		1					1		1			1			1	
31	50	M		1					1		1			1			1	
32	46	M	1							1		1		1			1	
33	43	M	1							1		1		1			1	
34	41	M		1					1		1			1			1	
35	18	M		1					1		1			1			1	
36	44	M	1							1			1		1			1
37	49	M	1							1			1		1			1
38	52	M	1							1			1			1		1
39	54	M	1						1				1			1		1
40	55	M	1							1			1			1		1
41	52	M	1							1			1			1		1
42	54	M	1						1				1			1		1
43	68	M	1						1		1			1			1	
44	69	FEMALE	1							1			1			1		1
45	77	M	1							1			1			1		1
46	70	FEMALE	1							1			1			1		1
47	24	M	1						1		1			1			1	
48	22	FEMALE	1						1		1			1			1	
49	29	M	1						1		1			1			1	
50	28	M	1						1		1			1			1	

51	22	M		1					1		1			1			1		
52	23	FEMALE		1					1		1			1			1		
53	24	M		1					1		1			1			1		
54	25	FEMALE	1						1		1			1			1		
55	26	M		1					1		1			1			1		
56	27	M	1						1		1			1			1		
57	28	M		1					1			1		1			1		
58	29	FEMALE	1						1			1		1			1		
59	30	M		1					1			1		1			1		
60	31	M	1						1			1		1			1		
61	32	M					1	1				1		1			1		
62	33	M	1							1			1	1			1		
63	34	M	1						1			1		1			1		
64	35	M	1							1			1	1			1		
65	36	M	1						1			1		1			1		
66	37	FEMALE		1					1				1			1		1	
67	38	M		1					1			1		1			1		
68	39	M			1			1			1			1			1		
69	40	M			1			1			1			1			1		
70	22	FEMALE			1			1			1			1			1		
71	23	M			1			1			1			1			1		
72	24	M			1				1			1		1			1		
73	25	M			1			1			1			1			1		
74	26	M			1			1			1			1			1		
75	27	FEMALE			1			1			1			1			1		
76	28	M				1				1			1	1			1		
77	29	FEMALE				1			1			1			1		1		
78	30	M				1				1			1		1		1		
79	31	FEMALE				1			1			1			1		1		
80	32	M				1			1			1			1		1		
81	33	M				1			1			1		1			1		
82	34	FEMALE				1			1			1			1		1		
83	35	FEMALE		1						1			1			1		1	
84	36	M				1			1			1			1		1		
85	37	FEMALE	1						1			1			1		1		
86	38	M				1			1			1			1		1		
87	39	FEMALE				1			1			1			1		1		
88	40	M				1			1			1			1		1		
89	31	FEMALE				1				1			1			1		1	
90	32	FEMALE			1				1				1			1		1	
91	33	M				1			1			1			1		1		
92	34	FEMALE				1			1			1			1		1		
93	35	M				1			1			1			1		1		
94	36	FEMALE		1					1			1			1		1		
95	37	M		1					1			1		1				1	
96	38	M		1					1				1			1		1	
97	39	M		1					1			1		1			1		
98	40	M					1	1					1		1			1	
99	28	M		1						1			1			1		1	
100	29	M					1	1			1			1			1		