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"THE ROLE OF CT AND MRI IN ACUTE STROKE EVALUATION: A COMPARATIVE STUDY"

Radio-Diagnosis

Dr. Sanchit Gupta — Pg: Junior Resident, Department Of Radiodiagnosis, Jaipur National University Institute For Medical Sciences And Research Centre.

Dr. Tanya Kathuria — Pg: Junior Resident, Department Of Radiodiagnosis, Jaipur National University Institute For Medical Sciences And Research Centre.

Dr. Rajeev Mudkavi — Professor, Department Of Radiodiagnosis, Jaipur National University Institute For Medical Sciences And Research Centre.

Dr. Anand Prakash Verma — Professor And Hod, Department Of Radiodiagnosis, Jaipur National University Institute For Medical Sciences And Research Centre.

Dr. Naveen Meena — Professor, Department Of Radiodiagnosis, Jaipur National University Institute For Medical Sciences And Research Centre.

ABSTRACT

Introduction: Imaging of the brain provides a solid foundation upon which clinical interpretations can be made, which can then be used to address individual patient management in an acute stroke context. CT and MRI both are used for imaging brain during the disease. The present study was conducted to compare Brain imaging CT vs MRI in diagnosis of acute stroke. **Material and Methods:** The comparative study after the approval by the Ethics Committee of Jaipur National University Institute of Medical Sciences and Research Centre, and the experimental protocols were performed in accordance with the approved guidelines. Informed consent were obtained from all the participants before the study. The subject underwent NCCT head in Jaipur National University, Institute for Medical Sciences and Research in Toshiba Alexion 16 slice helical CT Scanner working on a compact mechanism and the images was processed on Alexion software.. The subject also undergoes MRI brain in the Radiology Department of Jaipur National University Institute of medical sciences and research. The study were done by using 1.5 tesla 8 - Channel superconducting magnate, MAGNETOM SEMPRA SEIMENS. **Results:** The distribution of age groups reveals that individuals aged 61-70 years comprised the largest proportion (31.3%). Male (59.4%) were more in number as compared to females. Hemiplegia emerges as the most common clinical presentation, affecting a significant majority of cases (76.6%). The study identifies hypertension as the most prevalent risk factor among participants, affecting a vast majority of cases (92.2%). Diabetes also emerges as a common risk factor, affecting 60.9% of participants. Radiological findings showed various abnormalities, with hypodensity being the most common on NCCT Head (32.8% had no identifiable abnormalities), and imaging characteristics On MRI brain indicating hypointensity on T1 (95.3%), hyperintensity on T1 (4.7%), hyperintensity on T2 (95.3%) and FLAIR (95.3%), restriction on DWI (93.8%), and blooming on GRE or SWI (34.4%). **Conclusion:** It found that MRI, especially when employing diffusion-weighted imaging (DWI) sequences, demonstrated greater sensitivity in identifying strokes compared to CT scans. MRI provided more comprehensive information regarding stroke subtypes and the presence of hemorrhagic transformation.

KEYWORDS

Stroke, Brain Ischemia, Intracranial Haemorrhages, Imaging, MRI, DWI

INTRODUCTION

Imaging of the brain provides a solid foundation upon which clinical interpretations can be made, which can then be used to address individual patient management in an acute stroke context. A computed tomography (CT) or magnetic resonance imaging (MRI) scan of the brain is always required for all patients with a possible stroke or transient ischemic attack. The use of thrombolytic therapy is often regarded as the single most crucial component of acute stroke treatment. The presence or absence of intracranial haemorrhage (ICH) and early signs of an infarct are not the only things that stroke imaging has to provide information about.

An appropriate diagnosis will determine whether or not a patient is given thrombolytics or other acute interventions, whether or not the patient is admitted to a stroke unit, and whether or not secondary prevention therapies are initiated. A mistake in diagnosis may deprive the patient of therapeutic interventions or unnecessarily put the individual in a position where they are exposed to treatments that may be potentially harmful. In accordance with the most recent recommendations, patients who want to be treated with intravenous alteplase for acute stroke must first undergo a CT or MRI scan in order to rule out the possibility of intracranial haemorrhage (ICH) or another type of disease. Since noncontrast CT is a more widely accessible and readily available imaging modality than MRI, it is the imaging technique that is most frequently utilised for this objective. The use of thrombolytic therapy is widely regarded as the single most crucial component of acute stroke management; nonetheless, the majority of decisions made in acute stroke situations are unrelated to thrombolysis. In the situation of an acute stroke, imaging must, as a result, give information that goes beyond the presence or absence of ICH. Both multimodal CT, which includes CT angiography (CTA) and CT perfusion (CTP), as well as multimodal MRI, can offer information regarding the hemodynamic and vascular patho physiological changes that are produced by cerebrovascular illness. [1]

Patients who present themselves to the emergency room with symptoms that are consistent with stroke could have cerebrovascular disease (ischaemic or hemorrhagic) or a variety of other conditions that are not related to the cardiovascular system. The optimum imaging modality for the assessment of individuals who have suffered an acute stroke should be able to properly detect both cerebral ischaemia and intracranial bleeding, as well as differentiate cerebro vascular causes from other causes. [1]

The most common imaging technique that is used to evaluate people who may have had a stroke is computed tomography (CT). This approach is more readily available than MRI, and it is also quicker, simpler, and more affordable. However, CT is sensitive to acute intracranial haemorrhage, but it is not sensitive to acute ischemic stroke despite its sensitivity to the former. The use of MRI in the evaluation of acute stroke has a number of advantages. Changes of acute ischemic injury can be detected sooner with MRI than with CT, particularly with diffusion-weighted imaging; furthermore, the diagnosis of ischaemic stroke using MRI has superior interobserver and intraobserver reliability than CT, even in readers with limited expertise. The historical concerns that MRI is not sufficiently sensitive to detect acute intracranial haemorrhage in the earliest hours from the onset have been addressed by studies that show gradient-echo MRI is as accurate as CT in patients with focal stroke symptoms within six hours of the onset of symptomatology. These studies show that MRI can detect acute intracranial haemorrhage in the earliest hours from the onset.[1]

Hence the present study was conducted to compare Brain imaging CT vs MRI in diagnosis of acute stroke.

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MATERIALS AND METHODS

The comparative study was conducted at Department of Radiodiagnosis at Jaipur National Institute, Institute of Medical Sciences and Research, Jaipur for a period of two year from August 2022-February 2024 among patients of acute stroke. Approval for the study was taken from the Ethics Committee of Jaipur National University Institute of Medical Sciences and Research Centre, and the experimental protocols were performed in accordance with the approved guidelines. Informed consent were obtained from all the participants before the study.

Sample size - A confidence level of 95% and an error rate of 0.05 were used in the calculation.

$n=Z^2 P(1-P)/d^2$

where,

- n= sample size
- Z= Z stastic for a level of confidence, for the level of confidence of 95% which is conventional Z value is 1.96.
- P= expected prevalence or proportion (in proportion of one; if 95.7% P=0.957)
- D=precision (in proportion of one ; if 5%nd=0.05)

$n= 1.96x1.96x0.957x0.043/0.05^2$

n=63.2

in the study sample size taken was 64 and the patients were selected on the basis of following criteria-

Inclusion criteria:

1. Patients who are willing to participate and give consent for study.

Patients who are admitted with diagnosis of acute stroke (acute stroke as defined by WHO).

2. Patients who present to the hospital with symptoms of acute stroke such as unilateral/bilateral motor or sensory impairment ,aphasia/dysphasia, hemianopia, ataxia of acute onset and dysarthria.

Exclusion criteria:

1. Causes of hemorrhage other than acute ischemic stroke like cerebral amyloid angiopathy.
2. Patients in whom MR imaging is clinically indicated, but cannot be performed due to conditions like cardiac pacemaker, cochlear implants, and other routine contraindications for MRI.

Methodology-

The subject underwent NCCT head in Jaipur National University, Institute of Medical Sciences and Research in Toshiba Alexion 16 slice helical sCT Scanner working on a compact mechanism and the images were processed on Alexion software. Since the study excludes the use of contrast medium, the subjects need not require a Kidney Function Test prior to the scan.Using Multiplanar Reconstruction, the images are processed in axial, coronal and sagittal views.

The subject undergoes MRI brain in the Radiology Department of Jaipur National University Institute of medical sciences and research.

The study were done by using 1.5 tesla 8 - Channel superconducting magnate, MAGNETOM SEMPRA SEIMENS.

The following MRI sequences were used in the study

1. Apparent diffusion coefficient
2 Diffusion weighted
3 FLAIR
4 T1-Weighted
5 T2-Weighted
6 Susceptibility weighted or gradient-echo

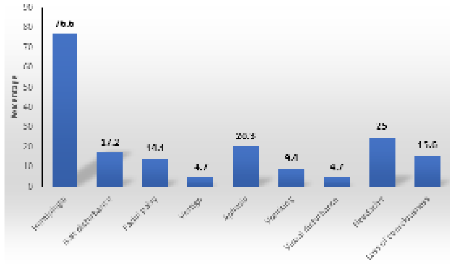
Statistical analysis- The entire data were validated by checking for and correcting any unusual values and typographic errors. All the quantitative variables were checked for compliance with normal distribution, within each study group by using visual inspection against various graphs and charts. Skewness and Kurtosis Z- values and Shapiro-wilk test P-values were used for this purpose. The association between categorical variable and normally distributed numerical outcome variables were assessed by comparing the mean values using unpaired T test. The association between two categorical values were assessed by chi- square test/fisher's exact test.

RESULTS

Table 1: Distribution of age and gender among the study participants (N=64)

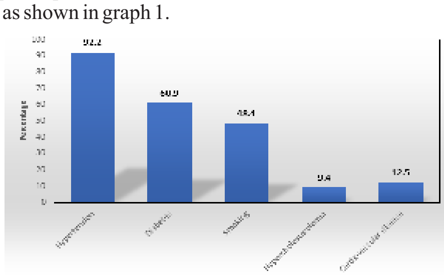
Variable		Frequency	Percentage
Age	13-18	3	4.7
	19-30	2	3.1
	31-40	1	1.6
	41-50	11	17.2
	51-60	16	25.0
	61-70	20	31.3
	71-80	8	12.5
	>80	3	4.7
Gender	Female	26	40.6
	Male	38	59.4

Mean age of the study participants were 58.2215.22 years. Individuals aged 61-70 years comprised the largest proportion, accounting for 31.3% of the sample, followed closely by those aged 51-60 years at 25.0%. Participants aged 71-80 years and 41-50 years constituted 12.5% and 17.2%, respectively, while individuals aged 13-18, 19-30, and >80 years each comprised smaller proportions ranging from 3.1% to 4.7%. Male patients were higher in number (59.4%) as compared to female patients (40.6%) as shown in table 1.



Graph 1: Distribution of clinical presentations among the study participants (N=64)

The clinical presentations among the study participants with hemiplegia being the most common, observed in 76.6% of cases. Gait disturbance was reported in 17.2% of participants, followed by facial palsy at 14.1%. Aphasia was present in 20.3% of cases, while vomiting and visual disturbance were less frequently encountered, each comprising 9.4% and 4.7%, respectively. Headache was reported in 25% of participants, and loss of consciousness was observed in 15.6% of cases as shown in graph 1.



Graph 2: Distribution of risk factors among the study participants (N=64)

Among the identified risk factors, hypertension was the most prevalent, affecting 92.2% of the participants. Diabetes was also common, with 60.9% of participants affected. Smoking was reported in 48.4% of cases, while hypercholesterolemia and cardiovascular disease were less frequently observed, each comprising 9.4% and 12.5%, respectively as shown in graph 2.

Table 2: Distribution of NCCT head findings among the study participants (N=64)

Sl no	Variable	Frequency	Percentage
1.	Acute infarct in right MCA territory	1	1.6
2.	Acute infarct in right PCA territory	1	1.6
3.	Acute infarcts in bilateral cerebellar hemispheres and left occipital lobes	1	1.6
4.	Acute right MCA territory infarct	1	1.6
5.	Acute to subacute infarct in right pre and post central gyri	1	1.6
6.	Acute to subacute left PCA territory infarct	1	1.6

7.	Chronic infarcts involving left corona radiata and left parietal temporal lobe	1	1.6
8.	Hypodense area at gray white matter junction of left parieto-occipital region	1	1.6
9.	Hypodensity in bilateral thalami	1	1.6
10.	Hypodensity in left centrum semiovale and left corona radiata — subacute infarct	1	1.6
11.	Hypodensity in left cerebellar hemisphere with hemorrhagic transformation	1	1.6
12.	Hypodensity in left gangliocapsular region	2	3.1
13.	Hypodensity in left MCA - PCA watershed territory	1	1.6
14.	Hypodensity in left parietal region	1	1.6
15.	Hypodensity in periventricular region of right parietal lobe	1	1.6
16.	Hypodensity in right cerebellar hemisphere, left temporal parietal and bilateral frontal lobes	1	1.6
17.	Hypodensity in right precentral gyrus, right occipital, right posterior cerebellar hemispheres	1	1.6
18.	Hypodensity in right temporal, parietal, right extenal capsule and corona radiata	1	1.6
19.	Hypodensity involving both gray white matter in right superior frontal gyrus	1	1.6
20.	Hypodensity involving both gray white matter of bilateral posterior inferior cerebellar hemisphere	1	1.6
21.	Hypodensity involving left frontal lobe	1	1.6
22.	Hypodensity seen in bilateral thalami with hyerdense internal cerebral veins	1	1.6
23.	Hypodensity seen in right occipital lobe	1	1.6
24.	Ill defined hypodense area in left parietal region	1	1.6
25.	Ill defined hypodensity in right parietal lobe	1	1.6
26.	Intraparenchymal bleed in left temporo-parietal region with mild mass effect	1	1.6
27.	Intraparenchymal hematoma in left capsuloganglionic region	1	1.6
28.	Left fronto-parietal venous bleed with left subdural hematoma	1	1.6
29.	Old lacunar infarcts in bilateral gnagliocapsular region	1	1.6
30.	Posterior circulation infarcts	1	1.6
31.	Right thalamic hemorrhage with minimal IVH in right lateral ventricle	1	1.6
32.	Small hypodense area in left thalamus	1	1.6
33.	Small hypodensities in left thalamo-capsular, right ganglio-capsular and left medial temporal lobe	1	1.6
34.	Small hypodensity in left gangliocapsular region	1	1.6
35.	Small ill defined hypodensities in left corona radiata, centrum semiovale and external capsule	1	1.6
36.	Subacute to chronic infarct involving left fronto-parietal lobe	1	1.6
37.	Subtle hypodense area in left temporo-parietal lobe	1	1.6
38.	Subtle hypodensity at left putamen	1	1.6
39.	Subtle hypodensity in right temporal lobe	1	1.6
40.	Suspicious hypodensity in right frontal region	1	1.6
41.	Watershed infarcts involving bilateral frontal and parieto-occipital region	1	1.6
42.	Wedge shaped hypodense area in right parietal right temporal region	1	1.6
43.	NIL	21	32.8

The distribution of radiological findings among patients including acute infarcts in various cerebral territories, chronic infarcts, hypodensities, intraparenchymal bleeds, and hemorrhages. The most common findings included hypodensity in different cerebral regions, with various degrees of involvement and characteristics such as ill-defined or subtle hypodensities. Hemorrhagic transformations and intraparenchymal bleeds were also observed, albeit less frequently. Interestingly, a substantial proportion of patients (32.8%) had no identifiable radiological abnormalities (NIL).

Table 3 : Distribution of various MRI findings among the study participants (N=64)

Variable		Frequency	Percentage
T1 findings	Hyperintense	3	4.7
	Hypointense	61	95.3
T2 findings	Hyperintense	61	95.3
	Hypointense	3	4.7
Flair	Hyperintense	61	95.3
	Hypointense	3	4.7
DWI (Restriction)	Present	60	93.8
	Absent	4	6.3
GRE/SWI (blooming)	Present	22	34.4
	Absent	42	65.6
Hemorrhagic transformation	Present	18	28.1
	Absent	46	71.9
Arterial infarct	Present	60	93.8
	Absent	4	6.3
venous infarct	Present	2	3.1
	Absent	62	96.9
MCA right	Present	11	17.2
	Absent	53	82.8
MCA left	Present	21	32.8
	Absent	43	67.2
PCA right	Present	6	9.4
	Absent	58	90.6
PCA left	Present	10	15.6
	Absent	54	84.4
ACA right	Present	2	3.1
	Absent	62	96.9
ACA left	Present	6	9.4
	Absent	58	90.6
SCA right	Present	4	6.3
	Absent	60	93.8
SCA left	Present	4	6.3
	Absent	60	93.8
PICA right	Present	4	6.3
	Absent	60	93.8
PICA left	Present	4	6.3
	Absent	60	93.8
Watershed infarcts	Present	7	10.9
	Absent	57	89.1
BA except PCA	Present	2	3.1
	Absent	62	96.9
Lacunar infarcts	Present	2	3.1
	Absent	62	96.9
Multiple infarcts	Present	34	53.1
	Absent	30	46.9

Among the T1 findings in patients with hypointensity was predominant, observed in 95.3% of cases, indicating a common imaging characteristic. Conversely, hyperintensity was less frequently encountered, comprising only 4.7% of the findings. In the T2 findings of patients with hyperintensity was the predominant observation, noted in 95.3% of cases. Conversely, hypointensity was less frequently observed, comprising only 4.7% of the findings. In the FLAIR (Fluid-Attenuated Inversion Recovery) imaging findings of patients hyperintensity was the predominant observation, noted in 95.3% of cases. Conversely, hypointensity was less frequently observed, comprising only 4.7% of the findings. In Diffusion-Weighted Imaging (DWI) findings of patients with the presence of restriction, indicative of restricted diffusion, was observed in the majority of cases, accounting for 93.8%. Conversely, absence of restriction was less frequently noted, comprising only 6.3% of the findings. In Gradient-Recalled Echo (GRE) or Susceptibility-Weighted Imaging (SWI) findings of patients the presence of blooming, indicative of susceptibility artifacts, in about 34.4%. Conversely, absence of blooming was more frequently noted, comprising 65.6% of the findings. Among patients, the occurrence of hemorrhagic transformation was observed in 28.1% of cases, while it was absent in the majority, accounting for 71.9%. Around 93.8% of cases had arterial infarcts present, while only 6.3% had arterial infarcts absent. Only 2 cases (3.1%) exhibited venous infarcts, while the vast majority, comprising 62 cases (96.9%), did not present with venous infarcts. Among the cases where MCA involvement was present, a total of 11 cases (17.2%) exhibited involvement on the right side of the brain, while 21 cases (32.8%) showed involvement on the left side. On the other hand, in cases where MCA involvement was absent, a larger proportion of cases were observed: 53 cases (82.8%) lacked involvement on the right side, and 43 cases (67.2%) lacked involvement on the left side of the brain.Among cases where PCA involvement was present, 6 cases (9.4%) were observed with PCA involvement on the right side of the brain, while 10 cases (15.6%) exhibited involvement on the left side. Conversely, in cases where PCA involvement was absent, the majority of instances were recorded: 58 cases (90.6%) did not demonstrate involvement on the right side, and 54 cases (84.4%) did not exhibit involvement on the left side. Among cases where ACA involvement was present, only 2 cases (3.1%) showed involvement on the right side of the brain, while 6 cases (9.4%) demonstrated involvement on the left side. Conversely, in cases where ACA involvement was absent, the vast majority were recorded: 62 cases (96.9%) did not display involvement on the right side, and 58 cases (90.6%) did not exhibit involvement on the left side. Among cases where SCA involvement was present, there were 4 cases (6.3%) with involvement on the right side of the brain, and an equal number of cases (4, also 6.3%) with involvement on the left side. Conversely, in cases where SCA involvement was absent, the majority were recorded: 60 cases (93.8%) did not display involvement on the right side, and 60 cases (93.8%) did not exhibit involvement on the left side. Among cases where PICA involvement was present, there were 4 cases (6.3%) with involvement on the right side of the brain, and an equal number of cases (also 4, also 6.3%) with involvement on the left side. Conversely, in cases where PICA involvement was absent, the majority were recorded: 60 cases (93.8%) did not display involvement on the right side, and 60 cases (93.8%) did not exhibit involvement on the left side. 7 instances (10.9%) were identified where watershed infarcts were present. Conversely, the majority of cases, 57 instances (89.1%), did not exhibit watershed infarcts. There were 2 instances (3.1%) where basilar artery involvement, excluding the posterior cerebral artery, was present. Conversely, the majority of cases, 62 instances (96.9%), did not exhibit involvement of the basilar artery excluding the posterior cerebral artery. There were 2 instances (3.1%) where lacunar infarcts were present. Conversely, the vast majority of cases, 62 instances (96.9%), did not exhibit lacunar infarcts.There were 34 instances (53.1%) where multiple infarcts were present. Conversely, there were 30 instances (46.9%) where multiple infarcts were absent.

Table 4: Distribution of final diagnosis based on MRI among the study participants (N=64)

Slno	Variable	Frequency	Percent
1.	Acute / early subacute intraparenchymal hemorrhage in left temporal lobe cortex	1	1.6
2.	Acute hemorrhagicinfacts in right MCA PCA territories	1	1.6
3.	Acute hemorrhagic infarct in left ACA territory	1	1.6
4.	Acute hemorrhagic infarct in left MCA territory	1	1.6
5.	Acute hemorrhagic infarcts in bilateral fronto-parietal periventricular white matter and bilateral parieto-occipital cortex	1	1.6
6.	Acute hemorrhagic infarcts in left MCA, right PCA and left PICA territories	1	1.6
7.	Acute hemorrhagic infarcts in right MCA territory	1	1.6
8.	Acute infarct in bilateral MCA and left PCA territory	1	1.6
9.	Acute infarct in bilateral MCA territories	2	3.1
10.	Acute infarct in bilateral thalami due to deep venous thrombosis	1	1.6
11.	Acute infarct in bilateral thalami, mid brain and right side of pons	1	1.6
12.	Acute infarct in left ACA / MCA watershed territory	1	1.6
13.	Acute infarct in left cerebellar hemisphere	1	1.6
14.	Acute infarct in left corona radiata	1	1.6
15.	Acute infarct in left globus pallidus, corpus callosum, bilateral periventricular and subcoritcal white matter, right cerebellar hemisphere and medulla oblongata	1	1.6
16.	Acute infarct in left hemi pons	1	1.6
17.	Acute infarct in left MCA territory	9	14.1
18.	Acute infarct in left MCA- ACA and MCA- PCA watershed zones	1	1.6
19.	Acute infarct in left MCA- PCA watershed zone	1	1.6
20.	Acute infarct in left thalamus	1	1.6
21.	Acute infarct in right ACA territory	1	1.6
22.	Acute infarct in right anterior temporal lobe	1	1.6
23.	Acute infarct in right fronto-parietal cortex subcortical white matter and corona radiata	1	1.6
24.	Acute infarct in right MCA territory	3	4.7
25.	Acute infarct in right occipital cortex and right fronto-parietal subcoritcal and periventricular deep matter	1	1.6
26.	Acute infarct in right PCA territory	1	1.6
27.	Acute infarct in right thalamus, medial occipital lobe and pons	1	1.6
28.	Acute infarcts in bilateral fronto-parietal and left medial temporal lobe with hyperacute hemorrhage in right cerebellar hemisphere	1	1.6
29.	Acute infarcts in bilateral MCA, PCA and SCA territories	1	1.6
30.	Acute infarcts in bilateral PICA territories	1	1.6
31.	Acute infarcts in left frontal parietal occipital lobes including cerebellar vermis	1	1.6
32.	Acute infarcts in left MCA territory with left ACA/ MCA & MCA / PCA watershed territories	1	1.6
33.	Acute infarcts in left parietal temporal as well as periventricular white matter	1	1.6
34.	Acute infarcts in multiple arteries of posterior circulation	1	1.6
35.	Acute infract in left ACA territory	1	1.6
36.	Acute infract in left MCA-PCA watershed zone	1	1.6
37.	Acute infract in posterior circulation in bilateral PCA, SCA and PICA territories	1	1.6
38.	Acute lacunar infarct in right gangliocapsular region	1	1.6
39.	Acute lacunar infarcts in left thalamus and left occipital lobe	1	1.6
40.	Acute to early subacute intraparenchymal hematoma in left gangliocapsular region	1	1.6
41.	Autehemorrhage in right thalamus with extension into occipital horn of bilateral lateral ventricles	1	1.6
42.	Early subacute infarct in left PICA territory	1	1.6
43.	Multiple acute infarct in bilateral MCA, PCA and SCA territories	1	1.6
44.	Multiple acute infarct in left PCA territory and MCA /ACA watershed zone with hemorrhagic transformation	1	1.6
45.	Multiple acute infarcts in bilateral anterior circulation	1	1.6
46.	Multiple acute infarcts in posterior cirulation territories with hemorrhagic transformation in right hemi pons	1	1.6
47.	Right MCA subacute infarct	1	1.6
48.	Small acute infarct in left precentral gyrus	1	1.6
49.	Small acute infarct in left putamen and adjacent white matter	1	1.6
50.	Small acute infarct in right PICA territory	1	1.6
51.	Small cortical subcortical acute infarct in right parieto-temporal and left parietal lobe	1	1.6
52.	Small sub acute infarct in left posterior putamen	1	1.6
53.	Venous infarct with hemorrhagic transformation involving high parietal region	1	1.6

Among the findings, acute or early subacute intraparenchymal hemorrhages were observed in the left temporal lobe cortex, constituting 1 case (1.6%) of the total. Acute hemorrhagic infarcts were noted in specific territories such as the right middle cerebral artery (MCA) and posterior cerebral artery (PCA), with each representing 1 case (1.6%). Additionally, acute infarcts were identified in diverse brain regions, including the left anterior cerebral artery (ACA) territory, left MCA territory, and bilateral thalami, each comprising 1 case (1.6%). Notably, the presence of venous infarct with hemorrhagic transformation involving the high parietal region accounted for 1 case (1.6%) of the total population studied as shown in table 4.

DISCUSSION

The mean age of the study participants, 58.22 ± 15.22 years, suggests a broad range of ages represented in the sample. The distribution of age groups reveals that individuals aged 61-70 years comprised the largest proportion (31.3%), followed closely by those aged 51-60 years (25.0%). This distribution reflects the demographics commonly associated with cerebrovascular diseases, with an increased prevalence observed in older age groups. However, it's worth noting the presence of participants across a wide age range, indicating the relevance of cerebrovascular pathologies across different life stages. In a study by Chalela et al[2] the median age of the participants were 76 years. In another study by Vajpayee et al[3] the mean age of the participants were 54.6 years.

Hemiplegia emerges as the most common clinical presentation, affecting a significant majority of cases (76.6%). This finding underscores the profound impact of cerebrovascular events on motor function and highlights the importance of assessing motor deficits in individuals with suspected cerebrovascular pathology. Other notable clinical presentations include gait disturbance (17.2%), facial palsy (14.1%), aphasia (20.3%), and headache (25%). These findings reflect the multifaceted nature of cerebrovascular diseases, affecting various aspects of neurological function and manifesting with a range of symptoms.

The study identifies hypertension as the most prevalent risk factor among participants, affecting a vast majority of cases (92.2%). Diabetes also emerges as a common risk factor, affecting 60.9% of participants. Additionally, smoking is reported in nearly half of the cases (48.4%), highlighting its association with cerebrovascular pathology. These findings underscore the importance of managing modifiable risk factors to prevent or mitigate the risk of cerebrovascular events. The high prevalence of hypertension and diabetes underscores the need for effective management strategies to control these conditions and reduce the burden of cerebrovascular diseases. According to the findings of a study conducted by Vajpayee and colleagues[3], the percentage of patients who had hypertension was 44.07% and 43.42%, respectively. Additionally, the percentage of patients who smoked was 30.26% and 34.21%, those who had diabetes mellitus was 27.63% and 38.15%, those who had hyperlipidemia was 55.26% and 50%, those who had ischemic heart disease was 15.78% and 13.15%, those who chewed tobacco was 60.52% and 57.89%, alcohol consumption was 28.94% and 23.68%, and the percentage of patients who had a history of previous stroke was 19.73% and 18.42%.

The study provides detailed insights into the distribution of specific types of infarcts and hemorrhages among participants. Arterial infarcts are more common than venous infarcts, with the majority of arterial infarcts involving the left MCA territory (93.8%). This finding underscores the predilection of cerebrovascular diseases for specific arterial territories and highlights the importance of considering arterial anatomy in the evaluation of cerebrovascular pathology. The distribution of infarcts across different arterial territories, including the ACA, PCA, SCA, and PICA, provides valuable insights into the diverse manifestations of cerebrovascular diseases and their underlying etiologies. In a study by Chalela et al[3]acute stroke was the ultimate clinical diagnosis for roughly two-thirds of the 356 individuals who were referred because of clinical suspicion of having a stroke. Using MRI, acute stroke was identified in 185 of 356 patients (52%; 95% CI 47-58), while using CT, it was found in 59 of 356 patients (17%; 13-21).

Gradient echo MRI (Magnetic Resonance Imaging) has emerged as a valuable tool in the detection of acute hemorrhagic stroke, offering advantages over traditional imaging methods like CT (Computed Tomography). Hemorrhagic strokes, characterized by bleeding into the brain parenchyma or surrounding spaces, pose significant diagnostic challenges due to their potentially life-threatening nature and the need for rapid and accurate detection to guide appropriate management.

One of the primary advantages of gradient echo MRI in detecting acute hemorrhagic stroke is its superior sensitivity to blood products. Gradient echo sequences are highly sensitive to paramagnetic substances such as deoxyhemoglobin, methemoglobin, and hemosiderin, which are characteristic of hemorrhagic lesions. This sensitivity allows gradient echo MRI to detect even small amounts of blood with high spatial resolution, facilitating the early identification of hemorrhagic strokes.

In contrast, conventional CT imaging, while widely available and often used as the initial imaging modality in acute stroke evaluation, may have limitations in detecting acute hemorrhage, especially in the early stages. CT relies on the density differences between tissues to generate images, and blood may not be readily distinguishable from surrounding brain tissue in the acute phase of hemorrhagic stroke. This limitation can lead to false-negative findings, delaying diagnosis and potentially impacting patient outcomes.

In our study, we made a significant observation regarding the detection of acute ischemic stroke using diffusion-weighted MRI (DWI) compared to CT imaging. Specifically, we found that 32.8% of patients with acute ischemic stroke were identified through DWI MRI, a proportion that surpassed the detection rate achieved by CT imaging. This finding underscores the superiority of DWI MRI in identifying acute ischemic stroke lesions when compared directly to CT scans.

In a study conducted by Bang et al., a total of 65 patients who had anterior circulation infarcts that were confirmed by DWI experienced recurrences during the follow-up period. The DWI pattern of the recurrent infarcts was the same as the pattern of the index stroke (34 out of 65 patients, or 52.3%). This finding suggests that the DWI lesion pattern of the index stroke determined that of the recurrent stroke. This could be due to the fact that the recurrence rate and types of recurrence are greatly dependent on subtypes of the index stroke.[4,5]In a large, randomized trial of ischemic stroke patients, approximately half of the recurrent strokes were caused by the same mechanisms as the index stroke.[5]

Moreover, the utility of gradient echo MRI (GRE MRI) became evident when considering cases where these ischemic infarcts underwent hemorrhagic transformation. Hemorrhagic transformation refers to the conversion of ischemic infarcts into hemorrhagic lesions, a critical complication that may not be readily apparent on CT scans. However, GRE MRI is particularly adept at detecting such transformations, thus highlighting its superiority over CT imaging in this aspect.[6]

Gradient echo MRI is well-suited to detect hemorrhagic transformation, allowing clinicians to monitor patients at risk and adjust treatment strategies accordingly.[7]

The gradient echo MRI plays a crucial role in the evaluation of acute hemorrhagic stroke, offering superior sensitivity to blood products compared to CT imaging. Its ability to detect even small amounts of blood with high spatial resolution makes it invaluable in the early diagnosis and management of hemorrhagic stroke patients. Despite the widespread availability of CT, the unique advantages of gradient echo MRI underscore its importance in the comprehensive evaluation of patients with suspected hemorrhagic stroke.[8]

The findings of this study have several implications for clinical practice and research. Firstly, the identification of common clinical presentations and risk factors highlights the importance of comprehensive clinical assessment and risk factor management in individuals with suspected cerebrovascular pathology. Secondly, the diverse radiological findings underscore the importance of multimodal imaging approaches in characterizing cerebrovascular lesions and guiding clinical decision-making. Future research efforts may focus on elucidating the underlying mechanisms driving the observed radiological findings and their association with clinical outcomes.

CONCLUSION

The study aimed to assess the diagnostic efficacy of CT and MRI in acute stroke cases. It found that MRI, especially when employing diffusion-weighted imaging (DWI) sequences, demonstrated greater sensitivity in identifying strokes compared to CT scans. Even when CT scans appeared normal, MRI was capable of detecting stroke-related abnormalities, underscoring its superior diagnostic potential. Additionally, MRI provided more comprehensive information regarding stroke subtypes and the presence of hemorrhagic transformation. Overall, the study concluded that MRI, with its advanced imaging techniques and superior sensitivity, should be the preferred modality for evaluating acute stroke cases. Its ability to provide detailed anatomical and pathological insights makes it invaluable in the comprehensive assessment and management of stroke patients. Ischemic conditions like Crossed Cerebellar Diaschisis, Artery of Percheron Territory infarct and Binswanger disease (Subcortical Arteriosclerotic encephalopathy or small vessel dementia) could also be diagnosed more effectively with DWI MRI following the routine CT scans.

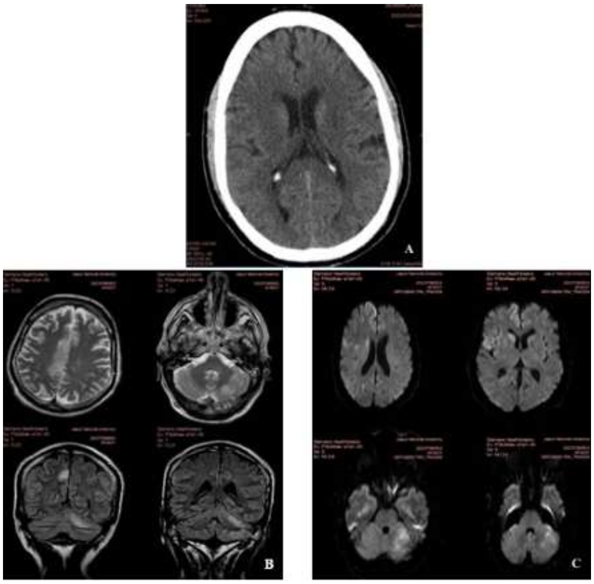


Figure 1: Crossed Cerebellar Diaschisis

A case of 53 year old male showing Crossed Cerebellar Diaschisis NCCT head image (A) showing normal scan T2 weighted MRI brain images (B) show hyperintensities in right frontal lobe and left cerebellar hemisphere which also show diffusion restriction (C).

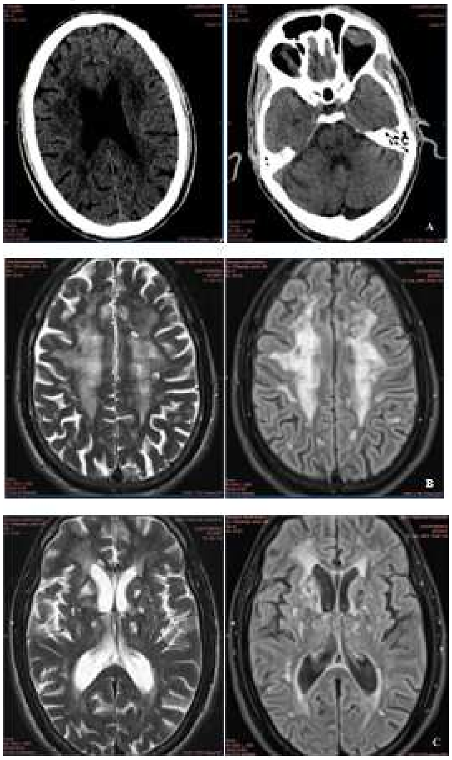


Figure 2: Binswanger disease

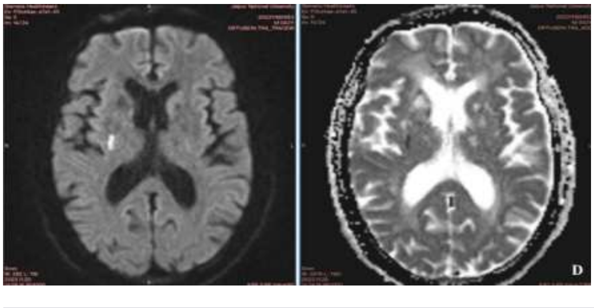


Figure 2 (contd.): Binswanger disease

A 43 year old male with history of Chronic hypertension and dementia A NCCT head images (A) show age related atrophic changes with periventricular small vessel ischemic demylination and a small hypodense area in pons. T2 weighted MRI brain images (B) show marked confluent symmetrical hypertintensities in bilateral periventricular and bilateral centrum semiovale which are also hyperintense on FLAIR (C) representing chronic ischemic changes. Chronic lacunar infarcts are noted in bilateral capsule ganglionic region, pons and thalamus. (D) Focal area of diffusion restriction is noted in right capsuloganglionic area representing Acute infarct.

Generalized age related corticerebral atrophy is seen.

This is typical case of Subcortical arteriosclerotic encephalopathy/ Binswanger disease or small vessel dementia.

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