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Research Article

STUDY OF "MAGNETIC RESONANCE IMAGING IN STROKE PATIENTS AT A TERTIARY HEALTH CARE CENTER"

SRI RAMAMURTHY[1], DINESH M[1], SOMASHEKAR R[1]*, UMA MAHESHWARA ROA[2]

[1]Department of Radiodiagnosis, Shrisatyasai Medical College and Research Institute, Chennai, Tamil Nadu, India. [2]Department of Radiodiagnosis, Government Hospital, Srikakulum, Andhra Pradesh, India.
*Corresponding author: Sri Ramamurthy; Email: drsomashekar11933@gmail.com

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ABSTRACT

Objective: One of the main causes of mortality and disability worldwide is stroke. Cerebral infarction, non-traumatic subarachnoid hemorrhage, primary intracranial hemorrhage, and various dural sinus/cerebral vein obstruction are the different types of stroke. About 80–90% of strokes are ischemic strokes, which are the most frequent form of stroke.

The aim of this study was to study "Magnetic resonance imaging in stroke patients at a tertiary health care center."

Methods: This was 18-month cross-sectional research conducted in the Department of Radiodiagnosis at the Shrisatyasai Medical College and Research Institute in Chengalpattu, Tamil Nadu, from December 2020 to June 2021.

Results: In the present study, middle cerebral artery is 43.3%, posterior cerebral artery (PCA) is 16.7%, anterior cerebral artery is 13.3%, lacunar infarcts is 16.7%, multiple infarcts is 8.3%, and basilar excluding PCA is 1.7% in the present study. About 73.3% of the patients (44/60) had infarcts, 10% had hemorrhage (6/60), and 16.7% had stroke mimics (10/60).

Conclusion: DWI is a better imaging method than conventional MRI in detecting early ischemic lesions in stroke patients with Sensitivity of 94% and specificity of 100% was observed among acute infarct patients.

Keywords: Magnetic resonance imaging lacunar infarct, Hemorrhage, MR spectroscopy.

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INTRODUCTION

Cerebrovascular illnesses are the main cause of mortality for women and the second-leading cause of death for men in affluent nations [1-3]. Another important factor contributing to dementia and cognitive impairment is cerebrovascular illness [3]. Stroke is the most common cardiovascular disease, causing most of the impairment in functioning. About 90% of stroke patients have neurological after effects, and 30% are unable to return to their pre-stroke level of daily functioning [1,2].

When selecting a course of therapy during the acute phase of an ischemic stroke, multimodal magnetic resonance imaging (MRI) can be useful [4]. During the acute phase, it is crucial to recognize ischemic stroke early and distinguish it from stroke mimics [5].

The causes of strokes are revealed by MRI sequence imaging data, which is important for therapeutic decisions since it affects prognosis. MRI lesion mismatch profiles help us evaluate the potential benefits and dangers of thrombolysis by providing information on salvageable tissue or ischemic lesion age [6]. MRI may be preferable to the initial computed tomography (CT) scan in stroke patients for a number of reasons. More precise information obtained from MRI on the location, timing, or subtype of stroke may result in more appropriate treatment decisions [7]. It is been proposed that a graphic depiction of myocardial infarction will improve patient education and adherence to recommended preventive actions.

Aim of the study

The aim of this study was to study "MRI in stroke patients at a tertiary health care center."

METHODS

Study design

This was a cross-sectional study.

Study period

This was 18 months (December 2016–June 2018).

Study setting

This was Department of Radiodiagnosis, Sree Mookambika Institute of Medical Science, Kulasekharam, Kanyakumari (District), Tamil Nadu.

Study population

Patients of all age groups irrespective of sex clinically suspected of stroke.

Inclusion criteria

The following criteria were included in the study:

- Patient willing to participate in the study
- All age groups irrespective of sex
- Clinically suspected of stroke.

Exclusion criteria

The following criteria were excluded from the study:

- Patients not consenting for study
- Patients with intracranial tumors
- Individuals who have already had metallic implant surgery, pacemaker insertion, aneurysm clipping, or prosthetic valve implantation.

Equipments/Instruments

The Institutional Human Ethical Committee and the Institutional Research Committee authorized the study. Using a head coil, 1.5T Siemens ESSENZA 16 channel MRI brain scans were carried out.

Table 1: Clinical presentation

Clinical presentation	Percentages
Aphasia	13.3
Facial palsy	10.0
Gait disturbance	15.0
Headache	13.3
Hemiplegia	25.0
Vertigo	15.0
Visual disturbances	3.3
Vomiting	5.0

Table 2: Vascular territory of infarcts (n=44)

Vascular territory	Percentage
MCA	43.3
Lacunar infarcts	16.7
PCA	16.7
ACA	13.3
Multiple infarcts	8.3
Basilar except PCA	1.7

MCA: Middle cerebral artery , PCA: Posterior cerebral artery , ACA: Anterior cerebral artery

Table 3: MCA territory infarcts (n=26)

Siteof involvement	No. of cases	Percentage
Right	7	26.92
Left	18	69.23
Bilateral	1	3.85

MCA: Middle cerebral artery

Table 4: PCA territory infarcts (n=10)

Site of involvement	No. of cases	Percentage
Right	7	70.0
Left	3	30.0
Bilateral	0	0

PCA: Posterior cerebral artery

Table 5: ACA territory infarcts (n=8)

Site of involvement	No. of cases	Percentage
Right	3	37.5
Left	5	62.5
Bilateral	0	0.00

ACA: Anterior cerebral artery

Table 6: Categories of infarct-related stroke (n=44)

Categories	No. of cases	Percentage
Large vessel disease	16	36.36
Cardio embolic disease	15	34.09
Small vessel	12	27.27
Vasculitis	1	2.27

Selection of patients

The study comprised patients who met the inclusion criteria. All of the chosen patients were given a thorough explanation of the process before providing their written informed permission. A brain MRI examination was conducted. Every MRI brain scan was carried out utilizing a head coil on a 1.5T Siemens ESSENZA 16 channel machine.

Procedure

The following MRI brain sequences were carried out on all patients who gave their informed consent: T1W, T2W, fluid-attenuated inversion recovery, diffusion-weighted imaging (DWI), GRE, 3D TOF MR angiography, and MR spectroscopy sequences. For the investigation, results on these sequences were correlated.

Data analysis

Microsoft Excel 2010 was used to enter the data. The following software was utilized for the statistical analysis: The SPSS program (20.0 trial version) was used to analyze the data.

RESULTS

The majority in the current research, or 35%, were between the ages of 31 and 40. 33.3% of those in the 51–60 age range were the next most prevalent age group. 20–30 years made up 8.3%, 41–50 years made up 15%, 61–70 years made up 6.6%, and 71–80 years had one instance.

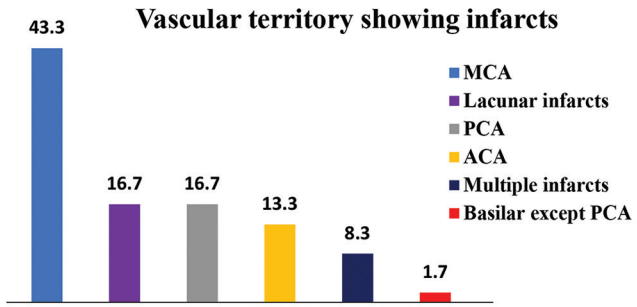
There were 31.6% females and 68.3% men. 2:1 is the M: F ratio.

A history of hypertension (HTN) was reported in 31.7% of the patients. Of the patients, 33.3% had diabetes mellitus (DM). About 35% of patients had hyperlipidemia, 38.18% had smoking, 15% had DM and HTN, and 9.0% had cardiovascular disease.

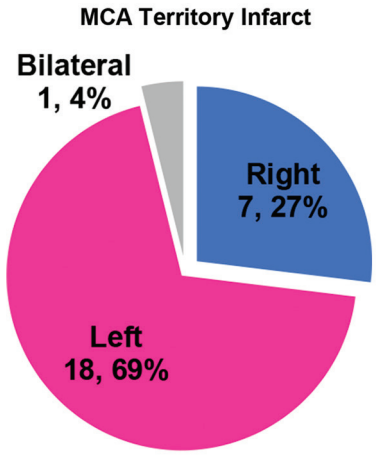
Infarcts were seen in 73.3% of the study's participants (44/60), hemorrhage in 10% (6/60), and stroke mimics in 16.7% of the participants (10).

The present study found that 25% of patients had hemiplegia, 15% had gait disturbance and vertigo, 3.3% had visual problems, 13.3% had aphasia, 5.0% had vomiting, and 10.0% had facial palsy.

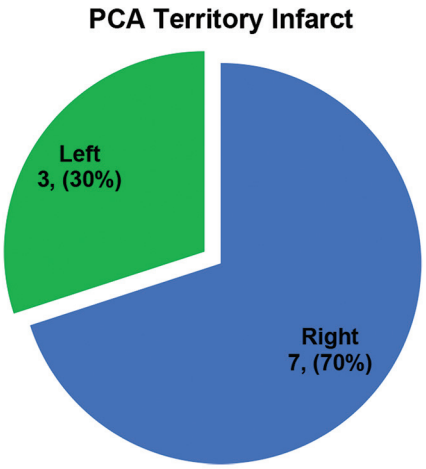
The present study found that middle cerebral artery (MCA) accounted for 43.3%, lacunar infarcts for 16.7%, posterior cerebral artery (PCA) for 16.7%, anterior cerebral artery (ACA) for 13.3%, multiple infarcts for 8.3%, and basilar excluding PCA.



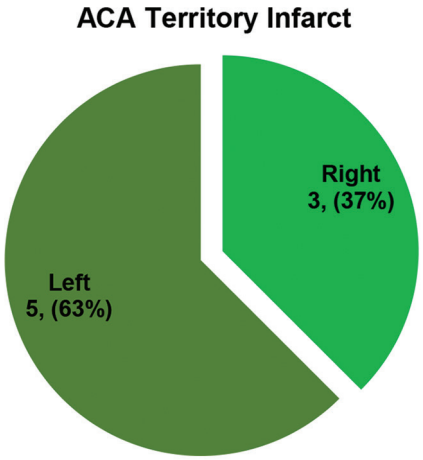
According to MCA, 26.92% of the study's participants had involvement on the right side, 69.2% on the left, and one instance was bilateral.



According to PCA, 70% of the participants in the present study included their right side, while 30% involved their left.



According to ACA, 37.5% of the participants in this study included the right side and 62.5% the left.



Large vessel disease accounted for 36.6% of patients in the current research, followed by cardioembolic disease (34.0%), small vessel disease (15%), and vascular disease (1%).

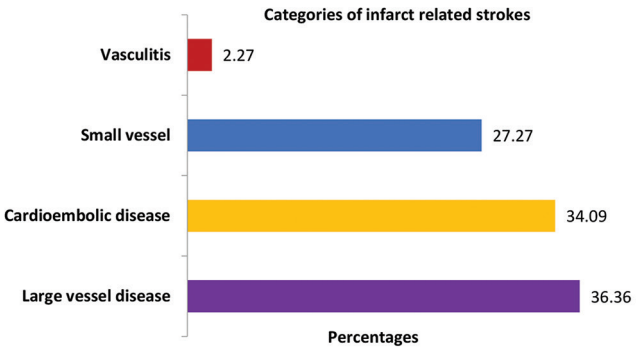
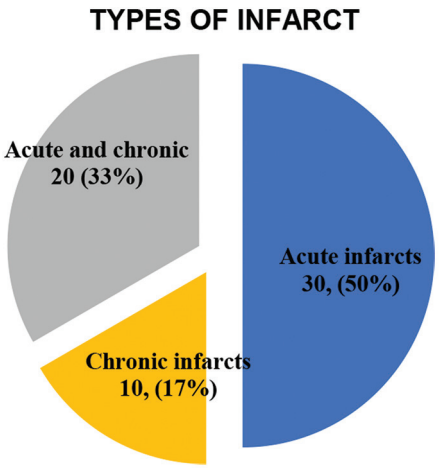


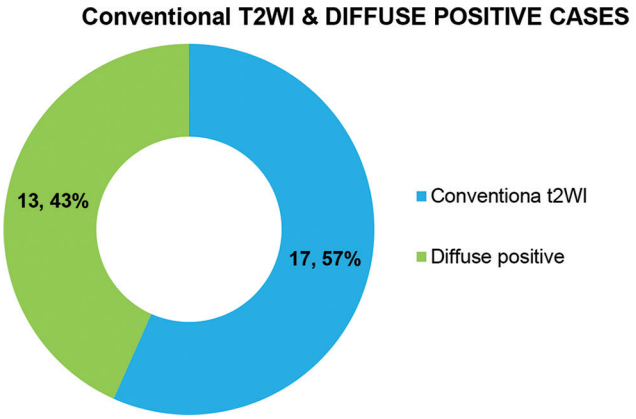
Table 7: Types of infarct

Types	No. of cases	Percentage
Acute infarcts	30	50.0
Chronic infarcts	10	16.7
Acute and chronic	20	33.3

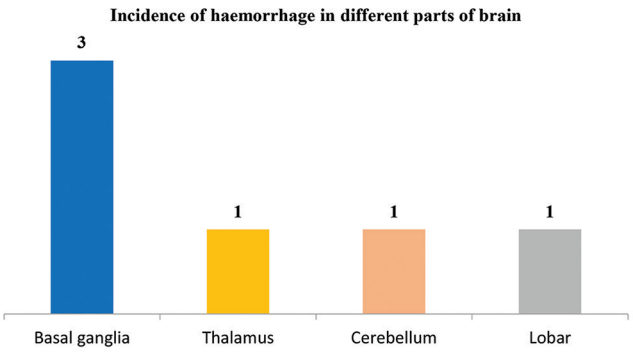
In this study, there were 50% acute infarcts, 16.7% chronic infarcts, and 333.7% acute and chronic infarcts.



In the present study, 56.6% of the instances were conventional and diffusion positive, whereas 43.3% of the cases were conventional negative and diffusion positive.



In the present study, hemorrhage in basal ganglia 50%, lobar, cerebellum, and thalamus in 16.7%.



In the present study, hemorrhage subarachnoid hemorrhage (SAH) in 40% cases and cerebral venous thrombosis in 60% cases.

Table 8: Comparison of imaging characteristics between DWI and conventional T2WI in acute infarcts (n=30)

Conventional and diffusion positive cases	17	56.67
Conventional negative and diffusion positive cases	13	43.33

DWI: Diffusion-weighted imaging, T2WI: T2-weighted image

Table 9: Incidence of hemorrhage in different parts of the brain (n=6)

Area	No. of cases	Percentage
Basal ganglia	3	50.00
Thalamus	1	16.67
Cerebellum	1	16.67
Lobar	1	16.67

Table 10: Stroke mimics (n=5)

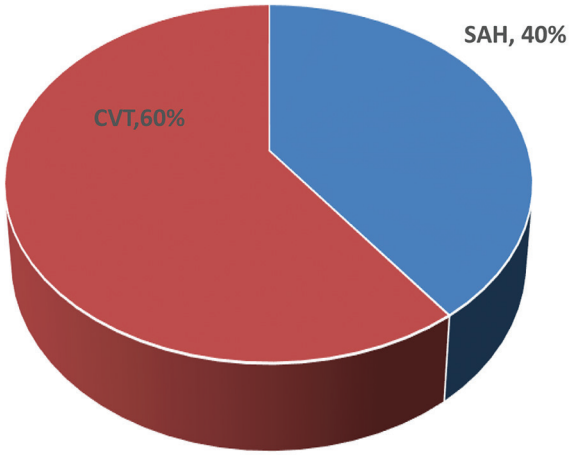
Stroke mimics	No. of cases	Percentage
SAH	4	40.00
CVT	6	60.00

SAH: Subarachnoid hemorrhage, CVT: Cerebral venous thrombosis

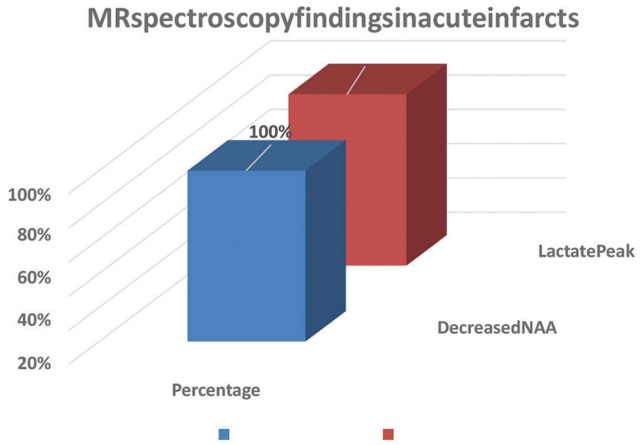
Table 11: MR spectroscopy finding in acute ischemic stroke (n=31)

S. No	MR spectroscopy finding	No. of cases	Percentage
1	Decreased NAA	30	100.00
2	Lactate peak	30	100.00

MR: Magnetic resonance



In the current MR spectroscopy investigation, 30% of the patients showed a decreased NAA, and 30% showed a lactate peak.



The results of our investigation indicate a statistical link between the occurrence of a stroke with both conventional T2-weighted image (T2WI) positive and negative, with p<0.001.

Table 12: conventional MRI

conventional MRI	Stroke present	Stroke absent	Chi-square, p-value
Conventional T2WI positive	34	01	24.35, <0.001
Conventional T2WI negative	10	15	

T2W1: T2-weighted image

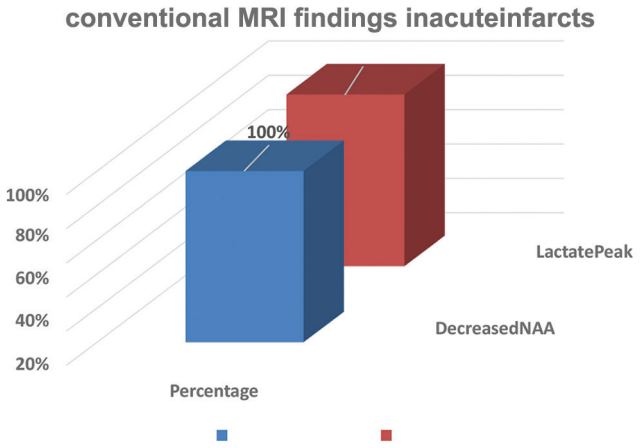
Table 13: MR spectroscopy

MR spectroscopy	Stroke present	Stroke absent	Chi square, p-value
DWI Positive	44	03	45.638
DWI negative	0	13	<0.001

DWI: Diffusion-weighted imaging, T2WI: T2-weighted image

Our investigation demonstrates a significant link between the existence of stroke and DWI positive and conventional, with p<0.001.

Sensitivity of 77% and specificity of 94% were reported in the 44 stroke patients seen in the research using conventional MRI, but among patients with acute infarct, DWI showed sensitivity of 94% and specificity of 100%.



In the current MR spectroscopy investigation, 30% of the patients showed a decreased NAA, and 30% showed a lactate peak.

DISCUSSION

The purpose of this study was to assess the use of MRI in identifying stroke mimics, ischemia, and hemorrhage in individuals who had a clinical suspicion or diagnosis of stroke.

We looked at the shared domain of vascular involvement in ischemic stroke as well as the shared risk factors for stroke. We looked more closely at the MR spectroscopy results in individuals who had an acute ischemic stroke. Sixty individuals with a clinical suspicion of stroke were recruited for the study. These patients were referred to the Department of Radio Diagnosis for an MRI scan of the brain.

Comparative studies related to cause of stroke

The present study found that MCA accounted for 43.3%, PCA for 16.7%, ACA for 13.3%, lacunar infarcts for 16.7%, multiple infarcts for 8.3%, and basilar excluding PCA. Similar to our analysis, the Mumbai stroke registry data indicated 17.7% (81 out of 401) hemorrhagic stroke

patients and 80.2% (366 out of 407) ischemic stroke cases [8]. About 82.2% of infarct cases were reported in the Lausanne stroke registry [9].

Comparative studies related to risk factors

In our study, 31.7% patients were presented with history of HTN. Of the patients, 33.3% had DM. About 35% of patients had hyperlipidemia, 38.18% had smoking, 15% had DM and HTN, and 9.0% had cardiovascular disease. The outcomes of this investigation were comparable to those of earlier research conducted by Kertesz *et al.* [10]. In contrast to previous research, the incidence of DM in this study group was shown to be greater (45%). According to Kuller *et al.* [11], stroke occurred 2.5–4 times more frequently in those with diabetes.

A thorough evaluation was carried out by Takeshemi *et al.* [12] to acquire data about the use of MRIs to predict gait ability in stroke patients. They claimed that MRIs can predict gait ability based on the results of eight structure- or function-based MRI examinations. They also showed that the best way to scan for the location and magnitude of a stroke as well as to estimate the patient's gait capability was by MRI. According to Akbarzadeh *et al.* [13], MRI is more accurate in ruling out cerebral hemorrhage, while MRI with DWI is more reliable at identifying acute ischemic stroke. CT, on the other hand, is favored in the majority of healthcare environments due to its speedier acquisition time and ease of use.

Multimodal MRI is a useful tool for diagnosing ischemic stroke and determining the location and size of the infarct area, both of which are critical details that can help clinicians choose the best interventions and manage stroke patients effectively, according to a related study by Kakkar *et al.* [14]. Perfusion-weighted imaging is used to measure the size of the ischemic penumbra, DWI and susceptibility-weighted imaging are used to assess stroke, and SWI is used to identify cerebral hemorrhage in the diagnosis and treatment of stroke.

In our investigation, sensitivity of 77% and specificity of 94% were reported in the 44 stroke patients seen in the research using conventional MRI, but among patients with acute infarct, DWI showed sensitivity of 94% and specificity of 100%.

CONCLUSION

We conclude that DWI is a more reliable imaging method than MRI in detecting ischemic lesions in acute stroke patients. Lesion size, as measured on DWI scans, appears to be a potential parameter for predicting clinical outcome in acute stroke patients. DWI is a better imaging method than conventional MRI in detecting early ischemic lesions in stroke patients with Sensitivity of 94% and specificity of 100% was observed among acute infarct patients.

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