



## IMAGING-BASED ASSESSMENT OF TRANSIENT ISCHEMIC ATTACK: CT VS. MRI

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**ABSTRACT** **Background:** A transient ischemic attack (TIA) is a brief neurological impairment that frequently precedes an ischemic stroke. A timely diagnosis is critical for optimal therapy and stroke prevention. This study examines the diagnostic value of CT and MRI imaging in TIA patients. **Materials and Methods:** Sixty TIA patients who met strict inclusion criteria underwent CT and MRI imaging. CT scans were utilized to rule out hemorrhage, while MRI, particularly diffusion-weighted imaging (DWI), was employed to identify acute ischemia lesions. The data was analyzed using chi-square tests, t-tests, and ANOVA, with a significance level of  $p < 0.05$ . **Results:** Out of 60 patients, 78.4% had negative CT findings and 21.6% had abnormalities. MRI detected positive results in 53.3% of patients, indicating greater sensitivity than CT. CT and MRI results were significantly correlated ( $p < 0.05$ ), with 32% of CT-negative patients displaying positive MRI findings. **Conclusion:** MRI has higher sensitivity than CT in detecting ischemia alterations in TIA patients, implying a critical role in TIA evaluation and therapy. These findings highlight the potential for MRI to inform therapy decisions, particularly when CT results are negative.

**KEYWORDS :** Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Stroke, Transient ischemic attack(TIA)

## INTRODUCTION

Stroke, also known as a cerebrovascular accident, is defined as the sudden development of a neurologic deficit caused by a specific vascular etiology because of the brain's complex structure and vascular, the clinical signs of stroke vary greatly. Cerebral ischemia is a decline in blood flow lasting more than a few seconds, Neurological symptoms appear within seconds because neurons lack glycogen, resulting in fast energy failure. If the flow stops for more than a few minutes, the brain tissue suffers an infarction or dies. When blood flow is rapidly restored, brain tissue can recover completely and the patient's symptoms only transient: this is called a transient ischemic attack (TIA), and Stroke has occurred if the neurologic signs and symptoms persist for more than 24 hours or if a brain infarction is detected<sup>1</sup>.

According to estimates by the WHO, stroke accounted for 5.7 million deaths and 16 million first-time events in 2005 and these numbers may reach 7.8 million and 23 million by 2030, respectively. Stroke is the second greatest cause of preventable death worldwide and the fourth leading cause of lost productivity<sup>2</sup>.

TIA, the chance of an ischemic stroke is between 3%–10% at two days, 5% at seven days, and 9%–17% at ninety days. Additionally, 15–25% of stroke patients report having had a TIA beforehand. Since last decades the definition of TIA has been revised many times and one such definition published by National Institute of Neurological Disorders and Stroke, in 1990 states that TIA is a temporary loss of brain function lasting less than 24 hours that was considered to be caused by ischemia and can be limited to a part of the brain supplied by a single vascular system<sup>3</sup>.

Neurological symptoms lasting less than 24 hours are not related with cerebral ischemia, multiple studies have shown that up to 30% of TIA patients had a cerebral infarction on CT scans performed days to months following the incident. The rate of cerebral infarctions is considerably higher - up to 67% - in TIA patients who underwent MRI<sup>4</sup>.

MRI of the head is less commonly utilized for evaluating patients with TIA than CT due to its higher cost, time-consuming nature, and limited availability. However, MRI offers several advantages. Because of its higher contrast resolution and lack of bone-related distortions, MRI is more suited for detecting acute and tiny infarctions, particularly those involving the cerebral cortex. The general population has a high prevalence of white matter hyperintense lesions on MRI, which increases with age and the presence of stroke risk factors<sup>5</sup>.

Hence present study is taken to study diagnostic utility of CT and MRI in patients of TIA as a presentation of cerebrovascular accident.

## MATERIALS AND METHOD

Total of 60 Transient Ischemic Attack patients were studied which was diagnosed according to criteria in which all symptoms of cerebrovascular accident resolve within 24 hr. Clearance was obtained from ethical committee for the study.

## Inclusion Criteria

1. All patients >18 years of age.
2. Patients with history of CVA
3. Patient admitted within 24 hours after onset of symptoms.
4. Patient willing to give consent

## Exclusion Criteria

1. Patients with history of epilepsy, migraine and head injury
2. Ischemic or haemorrhage on CT brain due to infection, connective tissue disorders and tumours.

For Patients with Cortical Venous Thrombosis,

A thorough clinical examination was performed with emphasis on the Central Nervous System. At admission, CT-brain was performed to confirm cerebrovascular involvement and to rule out haemorrhage.

CT was performed with Brivo CT385(GE Medical system Beijing) with a slice thickness set to 4 and 5 mm contiguous transverse sections, 140 kVp, 340 mAs, and 1-second scanning time. Interpretations of scans were made after review of hard-copy images at standard window and level settings.

MRI was performed on a 1.5-T MR system (Magnetom Sonata; Siemens Medical Systems). A standardized protocol was used in all patients:

- (1) Transverse, coronal and sagittal localizing sequences followed by transverse oblique contiguous images aligned with the inferior borders of the corpus callosum (applied on sequences 2–6);
- (2) T1-weighted images;
- (3) T2-weighted images;
- (4) diffusion-weighted images;

Lesions on MRI were further analyzed: localization of acute ischemic lesions on DWI was classified in anterior, middle and posterior cerebral artery territory, border zone, brainstem and cerebellum. Acute ischemic lesion size was measured on DWI by manually delineated regions of interest (ROI), summation of these areas in square centimetres on each section, and multiplication by the interslice spacing to determine the volume in cubic centimetres.

## Statistical Analysis

The nominal data parameters were presented in percentage distribution form. Mean and standard deviation of Numerical

parameters was presented. Percentage distribution of the parameters was compared using non-parametric test i.e. Pearson's chi square test. Unpaired t test was used to test the equality of the means variance of the data within the groups was compared using ANOVA (Analysis of variance of means). The significance level of the comparative test was set to 95%, p value of less than 0.05 was considered significant, p < 0.01 as highly significant. Data was analysed using Statistical Product and service solution (SPSS version 21.0) software

**RESULTS**

In present study, out of 60 patients with TIA,

- Negative CT Findings: 78.4% of the patients have negative CT scans, indicating that the majority of TIA patients show no abnormalities on CT imaging.
- Positive CT Findings: 21.6% of the patients have positive CT scans, meaning that a smaller portion of TIA patients exhibit abnormalities on CT.

**Table 1: CT Scan Finding in TIA**

CT	Frequency	Percent
Negative	47	78.4
Positive	13	21.6
Total	60	100.0

In present study, out of 60 patients with TIA,

1. Positive MRI Findings: 53.3% of the patients have positive MRI findings, indicating that more than half of the TIA patients exhibit abnormalities on MRI scans.
2. Negative MRI Findings: 46.7% of the patients show no abnormalities on MRI, meaning that nearly half of the TIA patients have normal MRI results.

**Table 2: MRI Finding in TIA Patient**

MRI	Frequency	Percent
Negative	28	46.7
Positive	32	53.3
Total	60	100.0

There is a significant correlation between CT and MRI findings in TIA patients. Specifically, those with CT-negative results are more likely to have MRI-negative results, and those with CT-positive results are more likely to have MRI-positive results.

This correlation indicates that CT and MRI findings are consistent with each other in TIA patients. The significant p-value (< 0.05) confirms that this correlation is statistically significant and unlikely due to chance.

1. In this study of TIA out of 60 patients there were 28 patients (46%) are such patients which shows both CT and MRI negative.
2. 19 patients are such patients (32%) in which CT scan were negative, but MRI shows positive findings.
3. While 13 patients (22%) were showing both CT and MRI positive.
4. Total CT positive were 13 patients (22%) and MRI positive are 32 patients (53%).

**Table 3: CT and MRI Correlation of TIA Patients**

CT	MRI		Total	P Value
	Negative	Positive		
Negative	28	19	47	< 0.05
Positive	0	13	13	
Total	28	32	60	

**DISCUSSION**

In present study, out of 60 patients with TIA, 22% of the patients have positive CT scans, meaning that a smaller portion of TIA patients exhibit abnormalities on CT. 78% of the patients have negative CT scans, indicating that the majority of TIA patients show no abnormalities on CT imaging. According to Ladurner et al 1979 In the investigations of 235 patients with a definite type of ischaemic attack, 18% of the patients showed a hypodense lesion which was concordant with our study<sup>7</sup> Lo et al 2016 describe a head CT scan was performed as part of the initial diagnostic examination for 1,533 individuals with suspected TIA in a multi-center Class II trial from Germany. 47 individuals (3.1%) had an acute cerebrovascular accident identified on the initial head CT scan, even though all patients were diagnosed with TIA clinically due to the recovery of neurologic deficits in less than 24 hours which was consistent to this study<sup>7</sup>.

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findings, indicating that more than half of the TIA patients exhibit abnormalities on MRI scans.

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Which was consistent to Oppenheim et al who demonstrated that 76% of 59 DWI findings positive for brain ischemia lesions identified in patients with clinical TIAs indicated regions of cerebral infarction<sup>8</sup>.

In this study of TIA out of 60 patients there were 27 patients (45%) are such patients which shows both CT and MRI negative. 19 patients are such patients (32%) in which CT scan were negative, but MRI shows positive findings. While 13 patients (21%) were showing both CT and MRI positive. Total CT positive were 13 patients (21%) and MRI positive are 32 patients (53%). Which was consistent to Totaro et al. 2010 the non-diagnostic CT scans were normal CTs in 123 (57%) cases, incongruous CTs in 66 (31%) cases and leukoaraiotic CTs in 25 (12%) cases. DWI was abnormal in 125 of 214 (58.4%) non-diagnostic CTs. It showed signs of recent brain ischemia in 64 of 123 (52%) patients with a normal CT, in 41 of 66 (62%) patients with an incongruous CT, and in 20 of 25 (80%) patients with leukoaraiosis, in this study on a series of 214 patients with a non-diagnostic CT scan performed within 30 h of the onset of brain ischemia, DWI detected a recent lesion in almost 60% of the cases<sup>9</sup>.

**CONCLUSION**

In the present study of 60 TIA patients, CT scan results show 13(23.3%) patients had positive findings while 46(76.7%) patients had negative findings. 32 patients (53.3%) had positive MRI findings while 28 patients (46.7%) had negative MRI findings. CT negative and MRI positive patients is 18(31%). Both CT and MRI positive are 14(23%) patients, both CT and MRI scans were negative in 28(46%) of patients. Thus, from this study we conclude that CT and/or MRI can be used in TIA patients for understanding of TIA etio-patho-physiology which will act as guideline for therapeutic decision making.

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