Section: Radio-Diagnosis

Original Research Article

VASCULAR TERRITORY AND LESION CHARACTERIZATION OBJECTIVE ROLE OF CONTRAST-ENHANCED CT AND MRI IN THE ASSESSMENT OF ISCHEMIC STROKE: CORRELATION OF LESION CHARACTERISTICS, VASCULAR TERRITORY INVOLVEMENT, AND INFARCT VOLUME

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ABSTRACT

Background: Acute ischemic stroke is a major cause of mortality and long-term disability worldwide and accounts for the majority of cerebrovascular accidents. Early diagnosis and accurate characterization of ischemic lesions are essential for timely therapeutic intervention, prognostication, and prevention of neurological deterioration. Computed tomography (CT) and magnetic resonance imaging (MRI) are the principal imaging modalities used in the evaluation of ischemic stroke. While CT remains the first-line imaging technique because of its rapid availability and ability to exclude hemorrhage, MRI, particularly diffusion-weighted imaging (DWI), offers superior sensitivity in detecting acute ischemic changes. Correlation of lesion characteristics, vascular territory involvement, infarct severity, and infarct volume using these modalities can improve diagnostic accuracy and guide clinical decision-making.
Aim: To evaluate the role of contrast-enhanced computed tomography (CT) and magnetic resonance imaging (MRI) in the assessment of ischemic stroke and to correlate lesion characteristics, vascular territory involvement, and infarct volume detected by the two imaging modalities. **Objectives:** To compare CT and MRI findings in ischemic stroke, assess lesion characteristics, determine vascular territory involvement, evaluate infarct severity using the Alberta Stroke Program Early CT Score (ASPECTS), measure infarct volume, correlate ASPECTS score with infarct volume, and determine the diagnostic value of combined CT and MRI evaluation.
Materials and Methods: This hospital-based observational cross-sectional study included 132 consecutive patients with imaging-confirmed ischemic stroke who underwent both CT and MRI examinations. Lesion characteristics evaluated included side of involvement, lesion location, number of lesions, hemorrhagic transformation, contrast enhancement, gray-white matter differentiation loss on CT, and diffusion restriction on MRI. Vascular territory involvement was categorized as anterior cerebral artery (ACA), middle cerebral artery (MCA), posterior cerebral artery (PCA), vertebrobasilar, lacunar, or multiple territories. Infarct severity was assessed using ASPECTS, and infarct

volume was measured by manual planimetric analysis and classified as small (<30 mL), moderate (30–70 mL), or large (>70 mL).

Results: Left-sided infarcts were the most common (36.4%), followed by right-sided (32.6%) and bilateral lesions (31.1%). Cortical lesions accounted for 50.8% of cases, and single lesions were observed in 73.5% of patients. Haemorrhagic transformation and contrast enhancement were present in 36.4% and 46.2% of cases, respectively. Gray-white matter differentiation loss on CT was identified in 53.8% of patients, while diffusion restriction on MRI was detected in 66.7%. ACA territory infarction was the most frequent vascular distribution (22.0%), followed by MCA (19.7%) and PCA (18.9%) territories. Severe ASPECTS scores (0–4) were observed in 35.6% of patients, while small infarct volumes predominated (54.5%). A clear inverse relationship was noted between ASPECTS score and infarct volume.

Conclusion: CT and MRI provide complementary information in the evaluation of ischemic stroke. MRI demonstrated greater sensitivity in detecting acute ischemic lesions, whereas CT effectively identified early parenchymal changes and infarct extent. The inverse relationship between ASPECTS score and infarct volume highlights their value as indicators of stroke severity. Combined CT and MRI assessment enhances characterization of lesion morphology, vascular territory involvement, and infarct burden, thereby improving diagnostic accuracy and clinical management.

Keywords: Ischemic stroke, Computed tomography, Magnetic resonance imaging, Diffusion-weighted imaging, ASPECTS score, Infarct volume, Vascular territory, Cerebral infarction.

INTRODUCTION

Ischemic stroke is one of the leading causes of mortality and long-term neurological disability worldwide, accounting for approximately 80–85% of all stroke cases. Despite advances in prevention and acute management, ischemic stroke continues to impose a substantial socioeconomic burden, particularly in low- and middle-income countries where access to advanced neuroimaging and timely intervention remains limited. Early diagnosis and accurate characterization of cerebral ischemia are critical for optimizing treatment strategies and improving functional outcomes. Neuroimaging plays a central role in the evaluation of acute ischemic stroke by facilitating rapid diagnosis, identifying salvageable brain tissue, determining vascular involvement, and estimating infarct burden. [1,2] (PMC)

Computed tomography (CT) remains the most widely available and commonly performed first-line imaging modality in patients presenting with acute stroke symptoms. Non-contrast CT is rapid, cost-effective, and highly effective in excluding intracranial haemorrhage. In addition, early ischemic changes such as loss of gray-white matter differentiation, sulcal effacement, and focal hypodensity may be detected on CT, although sensitivity during the hyperacute stage remains limited. Recent advances in multidetector CT technology and contrast-enhanced imaging techniques have improved the ability of CT to assess infarct extent and vascular pathology in acute ischemic stroke. [3,4] (RSNA Publications Online)

Magnetic resonance imaging (MRI), particularly diffusion-weighted imaging (DWI), has emerged as the most sensitive imaging modality for the detection of acute cerebral ischemia. DWI can identify ischemic injury within minutes of symptom onset by demonstrating restricted water diffusion resulting from cytotoxic oedema. Numerous studies have demonstrated that DWI has superior sensitivity and specificity compared with conventional CT for the detection of acute infarction, especially in small cortical, lacunar, and posterior circulation strokes. Furthermore, MRI provides excellent soft tissue contrast and facilitates comprehensive assessment of lesion characteristics, infarct age, and tissue viability. [5-7] (Frontiers)

Accurate characterization of lesion morphology is essential for understanding stroke severity and predicting clinical outcome. Parameters such as lesion location, side of involvement, number of lesions, haemorrhagic transformation, and enhancement characteristics provide valuable information regarding the extent and pathophysiology of cerebral ischemia. Cortical and subcortical infarctions may differ significantly in clinical presentation and prognosis, while the presence of haemorrhagic transformation has important therapeutic implications. Comparative evaluation of these lesion characteristics using CT and MRI can enhance diagnostic confidence and guide management decisions. [2,8] (j-stroke.org)

The identification of vascular territory involvement represents another important component of ischemic stroke assessment. Infarcts may involve the anterior cerebral artery (ACA), middle cerebral artery (MCA), posterior cerebral artery (PCA), vertebrobasilar circulation, or lacunar territories, each demonstrating distinct clinical and radiological patterns. Determining the affected vascular territory assists in understanding stroke mechanisms, identifying underlying vascular pathology, and predicting neurological deficits. Contemporary neuroimaging techniques have improved visualization of vascular territories and enabled more accurate localization of ischemic lesions.[1,9] (PMC)

Quantification of infarct severity and volume has gained increasing importance in acute stroke imaging. The Alberta Stroke Program Early CT Score (ASPECTS) is a widely accepted semiquantitative tool used to assess the extent of early ischemic changes, particularly in MCA territory infarctions. Lower ASPECTS scores are associated with larger infarct burden, increased risk of hemorrhagic transformation, and poorer clinical outcomes. Recent studies have demonstrated that ASPECTS and infarct core volume serve as complementary imaging biomarkers for evaluating stroke severity and selecting candidates for reperfusion therapies. [10,11] (OUP Academic)

Infarct volume measurement has emerged as an important prognostic marker in acute ischemic stroke. Estimation of infarct core volume using CT or MRI provides valuable information regarding tissue damage and potential functional recovery. Larger infarct volumes have been associated with unfavorable neurological outcomes and increased mortality. Advances in imaging analysis and volumetric assessment techniques have improved the accuracy and reproducibility of infarct volume estimation, thereby enhancing clinical decision-making and prognostic evaluation. [11-13] (OUP Academic)

Although both CT and MRI are routinely employed in stroke evaluation, there remains a need for studies directly correlating lesion characteristics, vascular territory involvement, ASPECTS scoring, and infarct volume between these imaging modalities. Such comparative analyses are particularly relevant in resource-constrained settings where CT often serves as the initial imaging modality and MRI may be used for confirmation and detailed characterization. Therefore, the present study was undertaken to evaluate the role of contrast-enhanced CT and MRI in the assessment of ischemic stroke and to correlate lesion characteristics, vascular territory involvement, and infarct volume in patients presenting with acute cerebral infarction.

MATERIALS AND METHODS

Study Design and Setting

This hospital-based observational cross-sectional study was conducted in the Department of Radiodiagnosis of a tertiary care teaching hospital over a period of 18 months after obtaining approval from the Institutional Ethics Committee. The study included patients clinically suspected to have acute ischemic stroke who underwent both computed tomography (CT) and magnetic resonance imaging (MRI) as part of their diagnostic evaluation.

Study Population

A total of 132 consecutive patients diagnosed with ischemic stroke and who underwent both CT and MRI examinations during the study period were included in the study.

Inclusion Criteria

1. Patients aged 18 years and above.
2. Patients presenting with clinical features suggestive of acute ischemic stroke.
3. Patients who underwent non-contrast CT brain followed by MRI brain including diffusion-weighted imaging (DWI).
4. Patients with imaging findings consistent with cerebral infarction.
5. Patients willing to participate in the study and providing informed consent.

Exclusion Criteria

1. Patients with intracerebral haemorrhage or subarachnoid haemorrhage.
2. Patients with brain tumours, traumatic brain injury, or central nervous system infections.
3. Patients with transient ischemic attacks without imaging evidence of infarction.
4. Patients with contraindications to MRI such as cardiac pacemakers, cochlear implants, or ferromagnetic implants.
5. Patients with incomplete imaging studies or poor-quality images unsuitable for analysis.

Imaging Protocol

Computed Tomography

All patients underwent non-contrast CT (NCCT) of the brain using a multidetector CT scanner. Axial images were obtained from the skull base to the vertex with standard stroke imaging parameters. Contrast-enhanced CT was performed when clinically indicated to evaluate vascular anatomy and lesion enhancement characteristics.

Magnetic Resonance Imaging

MRI examinations were performed on a 1.5-Tesla. The imaging protocol included:

- Axial T1-weighted imaging
- Axial T2-weighted imaging
- Fluid Attenuated Inversion Recovery (FLAIR)
- Diffusion Weighted Imaging (DWI)
- Apparent Diffusion Coefficient (ADC) mapping
- Susceptibility Weighted Imaging (SWI) or Gradient Echo (GRE)
- Post-contrast T1-weighted sequences wherever indicated

DWI was considered the reference standard for identifying and delineating the acute ischemic lesions.

Image Analysis

All CT and MRI examinations were independently reviewed by two experienced radiologists blinded to each other's findings. Any discrepancy was resolved by consensus.

Assessment of Lesion Characteristics

The following lesion characteristics were recorded on both CT and MRI:

- Side of involvement (right, left, bilateral)

- Location (cortical, subcortical, or mixed)
- Number of lesions (single or multiple)
- Presence of hemorrhagic transformation
- Presence of contrast enhancement
- Gray-white matter differentiation loss on CT
- Diffusion restriction on MRI

Assessment of Vascular Territory Involvement

The vascular territory involved was classified into one of the following categories

Grade	Vascular Territory
1	Anterior Cerebral Artery (ACA)
2	Middle Cerebral Artery (MCA)
3	Posterior Cerebral Artery (PCA)
4	Vertebrobasilar Territory
5	Lacunar Infarction
6	Multiple Territories

Vascular territory assignment was performed separately on CT and MRI and subsequently compared for agreement.

ASPECTS Scoring

The Alberta Stroke Program Early CT Score (ASPECTS) was calculated on non-contrast CT images and corresponding DWI-MRI images for infarcts involving the middle cerebral artery territory.

The ASPECTS score ranges from 0 to 10, with lower scores indicating larger infarct burden.

ASPECTS Score	Infarct Severity
8–10	Mild Infarction
5–7	Moderate Infarction
0–4	Severe Infarction

CT-ASPECTS and DWI-ASPECTS scores were recorded and compared.

Infarct Volume Measurement

Infarct volume was calculated on both CT and MRI using manual planimetric measurements. Lesions were measured on each slice showing infarction and multiplied by slice thickness to obtain total infarct volume in milliliters (mL).

Infarct volumes were categorized as

Grade	Infarct Volume
Small	<30 mL
Moderate	30–70 mL
Large	>70 mL

CT-derived infarct volume and MRI-derived infarct volume were compared for correlation.

Outcome Measures

The primary outcome measures were:

1. Correlation between CT-ASPECTS and DWI-ASPECTS scores.
2. Correlation between CT infarct volume and MRI infarct volume.
3. Agreement between CT and MRI in identifying vascular territory involvement.
4. Correlation between infarct volume and ASPECTS score.
5. Relationship between vascular territory involvement and infarct volume.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0.

Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages.

The following statistical tests were employed:

- Pearson or Spearman correlation coefficient for CT-ASPECTS versus DWI-ASPECTS and CT volume versus MRI volume.
- Cohen's Kappa coefficient for agreement between CT and MRI vascular territory classification.
- Chi-square test for comparison of categorical variables.
- One-way Analysis of Variance (ANOVA) for comparison of infarct volume across vascular territories.
- Independent Student's t-test where appropriate.
- A p-value <0.05 was considered statistically significant.

RESULTS

A total of 132 patients with imaging-confirmed ischemic stroke who underwent both CT and MRI examinations were included in the study. Lesion characteristics, vascular territory involvement, ASPECTS score distribution, and infarct volume measurements were analyzed and compared between the two imaging modalities. The findings demonstrated a broad spectrum of lesion distribution and infarct severity among the study population.

Lesion Characteristics

The lesion characteristics observed on CT and MRI are summarized in Table 1. Left-sided cerebral involvement was slightly more common than right-sided involvement, while a substantial proportion of patients demonstrated bilateral lesions. Cortical infarcts constituted the most frequent lesion location, followed by subcortical and mixed cortical-subcortical involvement. Single lesions were observed more frequently than multiple lesions. Hemorrhagic transformation was identified in more than one-third of patients, while contrast enhancement was present in nearly half of the study population. Loss of gray-white matter differentiation was observed on CT in over half of the patients, whereas diffusion restriction on MRI was detected in two-thirds of cases, highlighting the superior sensitivity of MRI in identifying acute ischemic lesions.

Table 1: Distribution of Lesion Characteristics among Study Participants (n = 132)

Variable	**Number**	**Percentage (%)**
Side of Involvement		
Right	43	32.6
Left	48	36.4
Bilateral	41	31.1
Location of Lesion		
Cortical	67	50.8
Subcortical	39	29.5
Mixed	26	19.7
Number of Lesions		
Single	97	73.5
Multiple	35	26.5
Hemorrhagic Transformation Present	48	36.4
Contrast Enhancement Present	61	46.2
Gray-White Matter Differentiation Loss on CT	71	53.8
Diffusion Restriction on MRI	88	66.7

Inference: Cortical, unilateral, and single-lesion infarcts predominated, while MRI demonstrated diffusion restriction in a higher proportion of patients than CT identified gray-white matter loss.

Figure 1. Distribution of Major Lesion Characteristics in Ischemic Stroke

The major lesion characteristics identified on CT and MRI are illustrated in Figure 1. Diffusion restriction on MRI was the most frequently observed imaging finding, followed by gray-white matter differentiation loss on CT and contrast enhancement. Hemorrhagic transformation was observed in approximately one-third of patients.

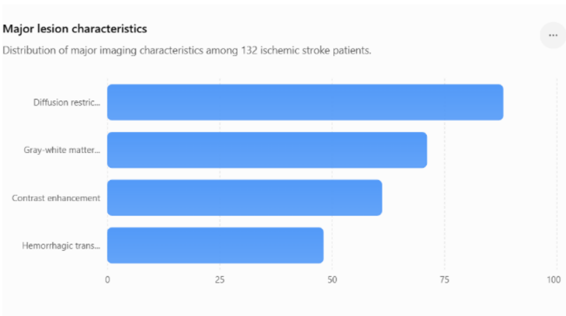


Figure Legend: Distribution of major lesion characteristics detected on CT and MRI among patients with ischemic stroke.

Inference: Diffusion restriction on MRI was the most common imaging feature, highlighting the superior sensitivity of MRI in detecting acute ischemic injury.

Vascular Territory Involvement

The vascular territory distribution of ischemic infarcts is shown in Table 2. Infarcts were distributed across all major cerebral vascular territories, reflecting the heterogeneous nature of ischemic stroke. The anterior cerebral artery territory accounted for the highest proportion of infarcts, closely followed by middle cerebral artery and posterior cerebral artery involvement.

Vertebrobasilar territory infarcts and lacunar infarctions were also frequently encountered. Multiple vascular territory involvement represented the smallest subgroup, suggesting that most ischemic events were confined to a single arterial territory.

Table 2: Distribution of Vascular Territory Involvement (n = 132)

Grade	**Vascular Territory**	**Number**	**Percentage (%)**
1	ACA	29	22.0
2	MCA	26	19.7
3	PCA	25	18.9
4	Vertebrobasilar	23	17.4
5	Lacunar	20	15.2
6	Multiple Territories	9	6.8

Inference: ACA and MCA territories together accounted for over 40% of ischemic infarcts, whereas multiple-territory involvement was relatively uncommon.

Figure 2. Distribution of Vascular Territory Involvement

The vascular territory involvement among study participants is presented in Figure 2. ACA territory infarction constituted the largest subgroup, closely followed by MCA and PCA territory infarctions. Multiple vascular territory involvement represented the smallest category.

Figure Legend: Distribution of ischemic stroke according to vascular territory involvement.

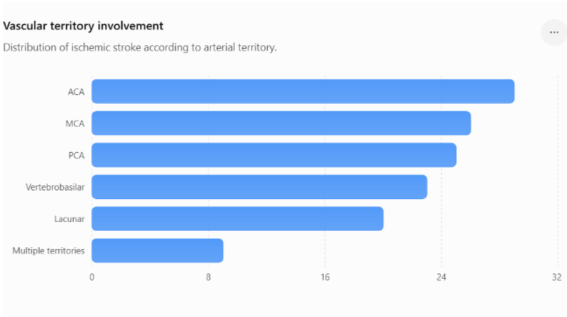


Figure Legend: Distribution of ischemic stroke according to vascular territory involvement.

Inference: ACA and MCA territories were the most commonly involved vascular regions, together accounting for more than 40% of all infarcts.

ASPECTS Score Distribution

The Alberta Stroke Program Early CT Score (ASPECTS) was used to assess infarct severity. The distribution of ASPECTS categories is presented in Table 3. Severe infarction constituted the largest category, followed closely by mild and moderate infarction groups.

The relatively balanced distribution across all three categories allowed meaningful assessment of lesion burden across varying severities. Nearly one-third of patients demonstrated severe infarction, indicating substantial ischemic involvement at presentation.

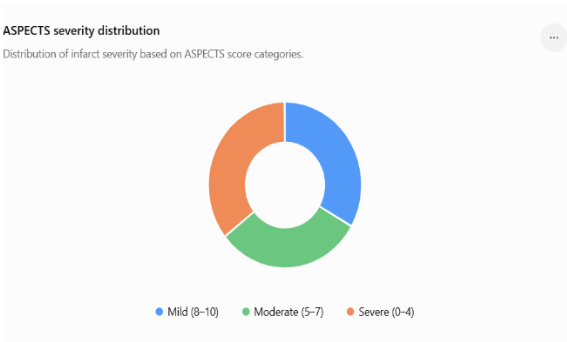
Table 3: Distribution of ASPECTS Scores (n = 132)

ASPECTS Category	Number	Percentage (%)
Mild (8–10)	44	33.3
Moderate (5–7)	41	31.1
Severe (0–4)	47	35.6

Inference: Severe infarction represented the most common ASPECTS category, indicating a considerable burden of advanced ischemic injury among study participants.

Figure 3. Distribution of ASPECTS Severity Categories

The distribution of ASPECTS severity categories is depicted in Figure 3. Severe infarction accounted for the largest proportion of patients, followed closely by mild and moderate infarction. The findings demonstrate a relatively even distribution of infarct severity within the study cohort.



Inference: Severe infarction was the most frequent ASPECTS category, reflecting a substantial burden of advanced ischemic injury at presentation.

Figure Legend: Pie chart showing the distribution of ASPECTS score categories among the study population.

Infarct Volume Distribution

The infarct volume measured on CT and MRI was categorized into small, moderate, and large infarcts. Table 4 presents the distribution of infarct volumes among the study population. Small infarcts accounted for the majority of cases, representing more than half of all patients.

Moderate and large infarcts constituted smaller proportions of the cohort. Despite the high prevalence of small infarcts, a substantial number of patients demonstrated moderate-to-large infarct volumes, emphasizing the varied severity spectrum of ischemic stroke.

Table 4: Distribution of Infarct Volume Categories (n = 132)

Infarct Volume Category	Number	Percentage (%)
Small (<30 mL)	72	54.5
Moderate (30–70 mL)	39	29.5
Large (>70 mL)	21	15.9

Inference: More than half of the patients exhibited small infarct volumes, while approximately one-sixth had large infarcts exceeding 70 mL.

Relationship between ASPECTS Severity and Infarct Volume

A comparison of ASPECTS severity categories with infarct volume grades demonstrated a progressive increase in infarct volume with decreasing ASPECTS scores. Patients with mild ASPECTS scores were predominantly associated with small infarcts, whereas severe ASPECTS scores were more frequently associated with moderate and large infarct volumes.

This inverse relationship supports the utility of ASPECTS as a surrogate marker of infarct burden. The findings indicate that lower ASPECTS scores correspond to larger ischemic lesions and greater tissue involvement.

Table 5: Comparison of ASPECTS Severity with Infarct Volume Category

ASPECTS Category	Small	Moderate	Large	Total
Mild (8–10)	35	7	2	44
Moderate (5–7)	23	13	5	41
Severe (0–4)	14	19	14	47
Total	72	39	21	132

Inference: Lower ASPECTS scores were associated with larger infarct volumes, demonstrating an inverse relationship between ASPECTS and infarct burden.

Summary of Results

Among 132 patients with ischemic stroke, cortical lesions, left-sided involvement, and single infarcts were the most frequent imaging findings. ACA and MCA territories were the most commonly affected vascular regions. Severe ASPECTS scores accounted for the largest subgroup, while small infarct volumes predominated overall. A clear inverse relationship was observed between ASPECTS score and infarct volume, supporting the role of CT and MRI in comprehensive assessment of ischemic stroke severity and extent.

Major lesion characteristics

Distribution of major imaging characteristics among 132 ischemic stroke patients.

characteristic	count
Diffusion restriction	88
Gray-white matter loss	71
Contrast enhancement	61
Hemorrhagic transformation	48

Vascular territory involvement

Distribution of ischemic stroke according to arterial territory.

territory	count
ACA	29
MCA	26
PCA	25
Vertebrobasilar	23
Lacunar	20
Multiple territories	09

ASPECTS severity distribution

Distribution of infarct severity based on ASPECTS score categories.

category	count
Mild (8–10)	44
Moderate (5–7)	41
Severe (0–4)	47

DISCUSSION

The present study evaluated the role of contrast-enhanced CT and MRI in the assessment of ischemic stroke by correlating lesion characteristics, vascular territory involvement, ASPECTS score, and infarct volume in 132 patients. The findings demonstrate that CT and MRI provide complementary diagnostic information, with MRI exhibiting greater sensitivity for acute ischemic lesions and CT remaining valuable for rapid initial assessment. These observations are consistent with contemporary stroke imaging literature emphasizing the combined use of multimodal imaging for accurate diagnosis and prognostication. [1,14]

In the present study, left-sided infarcts (36.4%) were slightly more common than right-sided (32.6%) and bilateral lesions (31.1%). Cortical lesions accounted for 50.8% of cases, while single lesions were identified in 73.5% of patients. Similar findings were reported by Al-Salahat et al. (2025), who observed that cortical infarctions remain the predominant pattern in acute ischemic stroke and that lesion localization significantly influences clinical outcome and therapeutic planning.[18] MRI was particularly useful in delineating cortical involvement and identifying subtle ischemic changes not readily visible on CT.

A major finding of the present study was the higher detection rate of diffusion restriction on MRI (66.7%) compared with gray-white matter differentiation loss on CT (53.8%). Diffusion-weighted imaging is considered the most sensitive technique for identifying acute cerebral ischemia because it detects cytotoxic edema within minutes of arterial occlusion. Contemporary evidence indicates that DWI remains superior to conventional CT for detecting early infarction, particularly in small cortical, lacunar, and posterior circulation strokes.[5,6] Suzuki et al. demonstrated that DWI-based assessment provides a more accurate representation of infarct core volume and correlates better with clinical outcomes than conventional imaging techniques.[14]

Hemorrhagic transformation was observed in 36.4% of patients in the present study. This finding is clinically important because hemorrhagic conversion influences therapeutic decisions, particularly thrombolytic and endovascular interventions. Previous studies have shown that larger infarct cores and lower ASPECTS scores are associated with an increased risk of hemorrhagic transformation. The relatively high prevalence observed in the present cohort may reflect delayed presentation and advanced ischemic injury among many patients at the time of imaging.[10,14]

Analysis of vascular territory involvement demonstrated that ACA territory infarction was most frequent (22.0%), followed by MCA (19.7%) and PCA (18.9%) involvement. Although MCA territory infarctions are traditionally reported as the most common subtype, the distribution observed in the present study may reflect local referral patterns and population characteristics. Accurate identification of vascular territories is essential because it assists in predicting neurological deficits, determining stroke mechanisms, and planning therapeutic interventions. Recent advances in multimodal CT and MRI have substantially improved vascular territory mapping and lesion localization.[1,18]

ASPECTS scoring remains one of the most widely accepted imaging biomarkers for evaluating ischemic stroke severity. In the present study, severe infarction (ASPECTS 0–4) was observed in 35.6% of patients, while mild and moderate infarction accounted for 33.3% and 31.1%, respectively. Similar observations have been reported by Dogariu et al. (2024), who demonstrated that lower ASPECTS scores are associated with larger infarct cores and poorer functional outcomes.[16] The authors emphasized that ASPECTS remains a practical and reproducible method for rapid assessment of infarct burden in acute stroke patients.

The present study further demonstrated that small infarcts (<30 mL) constituted 54.5% of cases, whereas large infarcts (>70 mL) accounted for 15.9%. Infarct volume has emerged as an important prognostic marker because larger infarcts are strongly associated with unfavorable neurological outcomes and increased mortality. Ospel et al. (2024) reported a near-linear relationship between infarct volume and functional outcome, noting that increasing infarct volume progressively reduces the probability of favorable recovery.[17] Their findings support the clinical relevance of volumetric assessment observed in the present study.

An important observation in our study was the inverse relationship between ASPECTS score and infarct volume. Patients with severe ASPECTS scores demonstrated larger infarct volumes, whereas mild ASPECTS scores were predominantly associated with small infarcts. This finding agrees with the observations of Suzuki et al. (2023), who reported a strong correlation between DWI-ASPECTS and infarct core volume.[14] Similarly, Wei et al. demonstrated that ASPECTS and infarct volume function as complementary biomarkers for evaluating stroke severity and predicting outcomes.[10]

Recent developments in artificial intelligence and automated image analysis have further strengthened the utility of CT and MRI in ischemic stroke assessment. Liu et al. (2023) developed an automated ASPECTS reporting system capable of achieving performance comparable to expert neuroradiologists.[15] Likewise, Azzam et al. (2025) demonstrated that AI-based ASPECTS interpretation can reduce observer variability and improve diagnostic consistency.[19] These advances suggest that future stroke imaging workflows may increasingly integrate automated ASPECTS scoring and infarct volume quantification to facilitate rapid clinical decision-making.

Overall, the findings of the present study reinforce the complementary roles of CT and MRI in ischemic stroke evaluation. CT remains indispensable as the first-line imaging modality because of its speed, availability, and ability to exclude hemorrhage, whereas MRI provides superior lesion characterization, diffusion assessment, and infarct volume estimation. The observed relationship between lesion characteristics, vascular territory involvement, ASPECTS score, and infarct volume highlights the importance of multimodal imaging in comprehensive stroke assessment. Integration of CT and MRI findings can improve diagnostic accuracy, facilitate prognostic stratification, and support timely therapeutic interventions in patients with acute ischemic stroke.[1,18,19]

Limitations of the Study

The present study has certain limitations that should be considered while interpreting the findings. First, the study was conducted at a single tertiary care center, which may limit the generalizability of the results to other healthcare settings and populations. Second, the sample size of 132 patients, although adequate for observational analysis, may not fully represent the entire spectrum of ischemic stroke presentations. Third, the cross-sectional design precluded long-term follow-up and assessment of functional outcomes. Fourth, infarct volume measurements were performed using manual planimetric methods, which may be subject to observer variability. Fifth, advanced perfusion imaging and angiographic correlation were not included in all patients. Finally, interobserver agreement between radiologists was not separately quantified, which could have provided additional information regarding diagnostic reproducibility.

CONCLUSION

Author 1 (Ravindranath Reddy K): Conceptualization of the study, study design, image interpretation, data analysis, manuscript drafting, and final approval of the manuscript.

Author 2 (Joji Reddy Onteddu): Supervision of the study, radiological evaluation, methodology development, critical revision of the manuscript, and final approval.

Author 3 (Abdul Gafoor J): Data collection, image analysis, statistical interpretation, literature review, manuscript editing, and final approval.

Author 4: Data acquisition, maintenance of study records, preparation of tables and figures, assistance in statistical analysis, manuscript formatting, and final approval of the manuscript.

Conflict of Interest: The authors declare that there are no conflicts of interest related to this study.

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