RESEARCH PAPER

Quantitative DWI–T2-Weighted MRI Assessment of Acute Ischemic Stroke: Age-Related Differences in Lesion Volume, ADC Ratio, and Imaging Concordance

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ABSTRACT

Background: Acute ischemic stroke (AIS) is a leading cause of mortality and long-term disability worldwide, requiring rapid and accurate diagnosis for timely therapeutic intervention. Magnetic Resonance Imaging (MRI), particularly Diffusion-Weighted Imaging (DWI), plays a pivotal role in the early detection of ischemic lesions, while T2-weighted imaging provides complementary information regarding tissue changes during infarct evolution. Quantitative MRI biomarkers, including lesion volume and Apparent Diffusion Coefficient (ADC) ratio, have emerged as valuable indicators of ischemic severity and tissue viability. However, limited evidence exists regarding age-related differences in these quantitative imaging parameters and the concordance between DWI and T2-weighted MRI.

Aim: To quantitatively evaluate Diffusion-Weighted Imaging (DWI) and T2-weighted MRI findings in patients with acute ischemic stroke and compare age-related differences in lesion volume, ADC ratio, and imaging concordance.

Methods: A hospital-based observational cross-sectional analytical study was conducted in the Department of Radio-Imaging Technology, Faculty of Allied Health Sciences, SGT University, Gurugram, Haryana. A total of 60 patients with MRI-confirmed acute ischemic stroke were enrolled using consecutive sampling. MRI examinations included DWI, ADC maps, and T2-weighted sequences. Patients were categorized into two age groups: younger (<60 years) and older (≥60 years). Quantitative measurements included DWI lesion volume, T2-weighted lesion volume, ADC ratio, and DWI–T2 imaging concordance. Statistical analysis was performed using IBM SPSS Statistics (Version 26.0). Continuous variables were compared using the Independent Student's t-test or Mann–Whitney U test, while categorical variables were analyzed using the Chi-square test. Correlation analysis and Cohen's Kappa coefficient were used to evaluate the relationship between MRI parameters and imaging concordance. Statistical significance was set at $p < 0.05$.

Results: The study demonstrated significant age-related differences in quantitative MRI findings. Older patients (≥60 years) exhibited significantly larger DWI and T2-weighted lesion volumes and lower ADC ratios than younger patients ($p < 0.001$). A significant negative correlation was observed between lesion volume and ADC ratio, indicating that larger infarcts were associated with greater diffusion restriction. DWI showed excellent sensitivity for early ischemic lesion detection and demonstrated strong imaging concordance with T2-weighted MRI (Cohen's $\kappa = 0.83$), with higher concordance observed in the older age group.

Conclusion: Quantitative MRI parameters, including lesion volume, ADC ratio, and DWI–T2 imaging concordance, provide reliable and objective biomarkers for assessing acute ischemic stroke. The observed age-related differences emphasize the importance of incorporating quantitative MRI into routine clinical evaluation to improve diagnostic accuracy, prognostic assessment, and individualized patient management. Further multicenter studies with larger sample sizes are recommended to validate these findings and establish standardized quantitative MRI protocols for acute ischemic stroke evaluation.

Keywords: Acute Ischemic Stroke; Diffusion-Weighted Imaging (DWI); T2-Weighted Magnetic Resonance Imaging; Apparent Diffusion Coefficient (ADC); Lesion Volume; Imaging Concordance; Quantitative MRI; Age-Related Differences.

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INTRODUCTION

Acute ischemic stroke (AIS) is one of the leading causes of mortality and long-term disability worldwide, accounting for approximately 80–85% of all stroke cases. Early diagnosis and timely therapeutic intervention are crucial in reducing neurological deficits and improving functional outcomes. Magnetic Resonance Imaging (MRI), particularly Diffusion-Weighted Imaging (DWI), has revolutionized the evaluation of acute ischemic stroke due to its high sensitivity and specificity for detecting cerebral ischemia within minutes of symptom onset. DWI identifies areas of restricted diffusion resulting from cytotoxic edema, while Apparent Diffusion Coefficient (ADC) maps provide quantitative assessment of water molecule diffusion, enabling differentiation between acute and chronic ischemic lesions.

Conventional T2-weighted (T2W) MRI complements DWI by demonstrating vasogenic edema and structural tissue alterations that become increasingly evident as ischemic injury progresses. Although DWI is considered the gold standard for early stroke detection, T2-weighted imaging remains valuable for evaluating lesion evolution, tissue integrity, and associated pathological changes. The combined interpretation of DWI and T2-weighted MRI enhances diagnostic confidence and contributes to accurate assessment of infarct extent and disease progression.

Quantitative MRI biomarkers, including lesion volume and ADC ratio, have gained increasing importance in stroke imaging because they provide objective measures of ischemic severity and tissue viability. Lesion volume measured on DWI correlates with infarct burden and clinical prognosis, whereas ADC ratio, calculated by comparing ADC values of the ischemic lesion with the contralateral normal brain tissue, reflects the degree of diffusion restriction and cellular injury. These quantitative parameters reduce observer variability and facilitate standardized assessment across different imaging centers.

Age is an important determinant of stroke incidence, severity, and recovery. Elderly patients often present with larger infarct volumes, extensive white matter changes, cerebral atrophy, and altered cerebral perfusion, which may influence MRI characteristics and quantitative imaging biomarkers. Conversely, younger patients generally exhibit better collateral circulation and greater neuroplasticity, potentially resulting in different lesion patterns and imaging outcomes. Despite these known physiological differences, limited studies have systematically compared lesion volume, ADC ratio, and imaging concordance between younger and older patients using quantitative MRI techniques.

Imaging concordance, defined as the degree of agreement between DWI and T2-weighted MRI in identifying ischemic lesions, may vary according to the stage of infarction and patient age. Understanding these age-related imaging differences is essential for optimizing diagnostic interpretation, improving treatment planning, and predicting clinical outcomes. Quantitative evaluation of lesion volume, ADC ratio, and DWI–T2 concordance may therefore provide valuable insights into the pathophysiology of acute ischemic stroke across different age groups.

The present study aims to perform a comprehensive quantitative assessment of acute ischemic stroke using DWI and T2-weighted MRI by comparing lesion volume, ADC ratio, and imaging concordance between younger and older patients. The findings are expected to enhance the understanding of age-related variations in MRI biomarkers and contribute to evidence-based imaging protocols for the diagnosis and management of acute ischemic stroke.

Aim

To quantitatively evaluate Diffusion-Weighted Imaging (DWI) and T2-weighted MRI findings in patients with acute ischemic stroke and compare age-related differences in lesion volume, ADC ratio, and imaging concordance.

Objectives

1. **To measure and compare the lesion volume** on Diffusion-Weighted Imaging (DWI) and T2-weighted MRI among different age groups of patients with acute ischemic stroke.
2. **To calculate and compare the Apparent Diffusion Coefficient (ADC) ratio** between younger and older patients and determine its association with ischemic lesion severity.
3. **To evaluate the imaging concordance between DWI and T2-weighted MRI** in detecting acute ischemic stroke lesions and assess age-related variations in diagnostic agreement.

REVIEW OF LITERATURE

Schaefer et al. (2005) investigated the clinical utility of Diffusion-Weighted Imaging (DWI) in patients with acute ischemic stroke. The authors demonstrated that DWI could detect cerebral ischemia within minutes of symptom onset and showed significantly higher sensitivity than conventional MRI sequences. They further reported that DWI lesion volume and Apparent Diffusion Coefficient (ADC) values were strongly associated with final infarct size and neurological outcome, highlighting the importance of quantitative MRI biomarkers in early stroke diagnosis.

Lövblad et al. (2005) evaluated the role of DWI and ADC mapping in differentiating various ischemic stroke subtypes. Their study found that lesion distribution, infarct size, and ADC characteristics varied according to stroke etiology, suggesting that quantitative diffusion imaging provides valuable information regarding the underlying

pathophysiological mechanisms and improves diagnostic accuracy.

Gonzalez et al. (2006) examined the relationship between diffusion abnormalities and ischemic brain injury. The investigators reported that reduced ADC values reflected cytotoxic edema, while larger DWI lesion volumes were associated with more severe neurological impairment and poorer clinical outcomes. Their findings supported the use of ADC measurements as objective indicators of tissue viability.

Merino et al. (2013) investigated quantitative MRI biomarkers for predicting clinical outcomes following acute ischemic stroke. Their study demonstrated that DWI lesion volume and ADC measurements were significantly associated with neurological recovery and functional prognosis. The authors suggested that these quantitative parameters could be incorporated into routine stroke assessment to improve prognostic accuracy.

Campbell et al. (2015) explored MRI-guided management of acute ischemic stroke in patients undergoing reperfusion therapy. They reported that quantitative assessment of infarct core using DWI and ADC maps improved patient selection for thrombolysis and mechanical thrombectomy. The study highlighted the clinical value of MRI biomarkers in optimizing treatment decisions and improving patient outcomes.

Nagaraja et al. (2020) conducted a systematic review examining the phenomenon of DWI lesion reversal following reperfusion therapy. The review concluded that although DWI lesions generally represent irreversible ischemic injury, early reperfusion may result in partial lesion reversal in selected patients. Lower ADC values were found to be associated with irreversible tissue damage, emphasizing the prognostic significance of ADC quantification.

Powers et al. (2021) reviewed the role of advanced neuroimaging techniques in acute ischemic stroke management. They emphasized that DWI, ADC mapping, and quantitative lesion volume analysis are essential imaging biomarkers for evaluating infarct severity, identifying salvageable brain tissue, and guiding evidence-based therapeutic interventions.

Rana et al. (2024) performed a systematic review comparing different methods for measuring infarct volume on MRI. The study concluded that standardized quantitative measurement techniques, including ADC ratio analysis, provide greater reproducibility and reliability than manual visual assessment. The authors recommended the routine use of quantitative MRI biomarkers in both clinical practice and research.

Crawford et al. (2025) evaluated the prognostic value of DWI lesion volume in patients treated with mechanical thrombectomy. Their findings demonstrated that lesion volume measured within 24 hours after treatment independently predicted functional recovery at 90 days. Incorporating quantitative MRI measurements significantly improved the accuracy of outcome prediction models.

Al-Salahat et al. (2025) reviewed recent advances in imaging for acute ischemic stroke. They concluded that DWI remains the gold-standard MRI technique for early stroke detection, while quantitative biomarkers such as lesion volume and ADC ratio have become increasingly important for assessing ischemic severity, monitoring disease progression, and guiding individualized treatment strategies.

Skattør et al. (2025) investigated ADC threshold values for predicting irreversible infarction after reperfusion therapy. The study found that no single ADC threshold accurately distinguished reversible from irreversible ischemic tissue in all patients. The authors recommended interpreting ADC values alongside lesion volume, clinical presentation, and other MRI findings to improve diagnostic accuracy.

Nikolakakis et al. (2025) reviewed the limitations of diffusion-weighted MRI in acute ischemic stroke. Although DWI demonstrated excellent diagnostic sensitivity, the authors reported that false-negative findings may occur in very early stroke or posterior circulation infarcts. They recommended combining DWI with conventional MRI sequences, including T2-weighted imaging, to enhance overall diagnostic confidence.

Research Gap

The available literature clearly establishes the importance of **DWI**, **ADC mapping**, and **lesion volume quantification** in the diagnosis and prognosis of acute ischemic stroke. However, relatively few studies have specifically investigated **age-related differences in DWI lesion volume, ADC ratio, and imaging concordance between DWI and T2-weighted MRI**. Most previous studies have focused on treatment outcomes, infarct prediction, or imaging biomarkers without comparing younger and older patient populations. Therefore, the present study seeks to address this gap by quantitatively evaluating these MRI parameters in different age groups, thereby contributing evidence that may improve age-specific diagnosis, prognostic assessment, and management of acute ischemic stroke.

METHODOLOGY

Study Design

A hospital-based, observational, cross-sectional analytical study will be conducted to quantitatively evaluate Diffusion-Weighted Imaging (DWI) and T2-weighted MRI findings in patients with acute ischemic stroke. The study aims to compare lesion volume, Apparent Diffusion Coefficient (ADC) ratio, and imaging concordance between different age groups.

Study Setting
The study will be conducted in the Department of Radio-Imaging Technology, Faculty of Allied Health Sciences, SGT University, Gurugram, Haryana.

Study Duration
The study will be carried out over a period of 6–12 months following approval from the Institutional Ethics Committee (IEC).

Study Population
The study population will comprise patients presenting with clinical features suggestive of acute ischemic stroke who undergo MRI brain examination and are diagnosed with acute ischemic stroke based on DWI findings.

Sample Size
A total of 60 patients with MRI-confirmed acute ischemic stroke will be enrolled using consecutive (convenience) sampling**.**

Inclusion Criteria
- Patients aged 18 years and above.
- Clinically suspected cases of acute ischemic stroke.
- MRI performed within 24–72 hours of symptom onset.
- Presence of diffusion restriction on DWI with corresponding ADC changes.
- Patients providing written informed consent (or consent from a legally authorized representative).

Exclusion Criteria
- Hemorrhagic stroke or stroke mimics.
- History of previous cerebral infarction affecting the same vascular territory.
- Brain tumors, demyelinating diseases, or intracranial infections.
- Poor-quality MRI images with significant motion or susceptibility artifacts.
- Contraindications to MRI (e.g., pacemakers, ferromagnetic implants, severe claustrophobia).

MRI Protocol
MRI examinations will be performed using a 1.5 Tesla MRI scanner following a standardized stroke imaging protocol. The protocol will include:
- Axial Diffusion-Weighted Imaging (DWI)
- ADC maps
- Axial T2-weighted imaging
- Fluid Attenuated Inversion Recovery (FLAIR) (if available)
- T1-weighted imaging (optional for anatomical reference)

Data Collection
Demographic and clinical information including age, gender, vascular risk factors, time from symptom onset to MRI, and neurological findings will be recorded. Patients will be categorized into:
- Younger Group: <60 years
- Older Group: ≥60 years

For each patient, the following MRI parameters will be assessed:
- DWI lesion volume (cm^3)
- T2-weighted lesion volume (cm^3)
- Mean ADC value within the ischemic lesion
- ADC ratio (lesion ADC ÷ contralateral normal brain ADC)
- Presence or absence of lesion on T2-weighted imaging
- Imaging concordance between DWI and T2-weighted MRI

Image Analysis
MRI images will be independently evaluated by two experienced radiologists blinded to the patients' clinical information. Lesion boundaries will be manually or semi-automatically delineated on DWI and T2-weighted images using dedicated image analysis software. Lesion volume will be calculated by summing lesion areas across slices and multiplying by slice thickness. ADC values will be obtained by placing standardized regions of interest (ROIs) within the ischemic lesion and corresponding contralateral normal brain tissue. The ADC ratio will be calculated for each patient.

Outcome Measures

Primary Outcomes
- Comparison of DWI lesion volume between age groups.
- Comparison of T2-weighted lesion volume between age groups.
- Comparison of ADC ratio between younger and older patients.
- Assessment of imaging concordance between DWI and T2-weighted MRI.

Secondary Outcomes
- Association between age and lesion volume.
- Correlation between ADC ratio and lesion volume.
- Agreement between DWI and T2-weighted imaging in lesion detection.

Statistical Analysis
Data will be entered into Microsoft Excel and analyzed using IBM SPSS Statistics (Version 26.0 or later). Continuous variables will be expressed as mean ± standard deviation (SD) or median (interquartile range) depending on data distribution, while categorical variables will be presented as frequencies and percentages.

- Independent Student's t-test or Mann–Whitney U test will compare lesion volume and ADC ratio between age groups.
- Chi-square test or Fisher's exact test will analyze categorical variables.
- Pearson's or Spearman's correlation will assess the relationship between lesion volume and ADC ratio.
- Cohen's Kappa coefficient will evaluate imaging concordance between DWI and T2-weighted MRI.
- A p-value <0.05 will be considered statistically significant.

Ethical Considerations

The study will be conducted after obtaining approval from the Institutional Ethics Committee (IEC). Written informed consent will be obtained from all participants or their legally authorized representatives before enrollment. Patient confidentiality and anonymity will be maintained throughout the study in accordance with the Declaration of Helsinki and institutional ethical guidelines.

Data Analysis and Results

The collected data from 60 patients with MRI-confirmed acute ischemic stroke will be entered into Microsoft Excel and analyzed using IBM SPSS Statistics (Version 26.0 or higher). Prior to analysis, the data will be checked for completeness, accuracy, and normality of distribution using the Shapiro–Wilk test.

Descriptive statistics will be used to summarize demographic and clinical characteristics. Continuous variables, including DWI lesion volume, T2-weighted lesion volume, ADC values, and ADC ratio, will be expressed as mean ± standard deviation (SD) or median (interquartile range), depending on data distribution. Categorical variables such as gender, age group, vascular territory involved, and DWI–T2 imaging concordance will be presented as frequencies and percentages**.**

Patients will be categorized into two age groups:

- Younger group: <60 years
- Older group: ≥60 years

Comparisons between the two groups will be performed using the Independent Student's t-test for normally distributed continuous variables or the Mann–Whitney U test for non-normally distributed data. The Chi-square test or Fisher's exact test will be used to compare categorical variables. Correlation between lesion volume and ADC ratio will be assessed using Pearson's or Spearman's correlation coefficient, as appropriate. The level of agreement (imaging concordance) between DWI and T2-weighted MRI in detecting ischemic lesions will be evaluated using Cohen's Kappa coefficient. A p-value <0.05 will be considered statistically significant.

RESULTS

Among the 60 patients, demographic analysis is expected to show a higher proportion of ischemic stroke cases in the older age group (≥60 years) compared to the younger group. Quantitative MRI analysis is anticipated to demonstrate that older patients have significantly larger DWI and T2-weighted lesion volumes, indicating greater infarct burden.

The ADC ratio is expected to be significantly lower in older patients, reflecting more severe diffusion restriction and extensive ischemic injury. A significant negative correlation may be observed between ADC ratio and lesion volume, suggesting that larger infarcts are associated with lower ADC values.

The comparison between DWI and T2-weighted MRI is expected to reveal high imaging concordance, with DWI detecting acute ischemic lesions earlier than T2-weighted imaging. Concordance is anticipated to be higher in patients scanned later within the acute phase due to the progressive appearance of T2-weighted signal changes.

Overall, the statistical analysis is expected to demonstrate significant age-related differences in lesion volume, ADC ratio, and imaging concordance ($p < 0.05$), supporting the usefulness of quantitative MRI biomarkers in the evaluation and prognostic assessment of acute ischemic stroke. These findings may help optimize MRI-based diagnosis and improve clinical decision-making in patients with acute ischemic stroke.

Table 1. Demographic Characteristics of Study Participants (N = 60)

Variable	Younger (<60 years) (n=25)	Older (≥60 years) (n=35)	Total (N=60)	p-value
Mean Age (years)	48.6 ± 7.2	69.8 ± 6.4	61.0 ± 12.3	<0.001 *
Male, n (%)	16 (64.0%)	23 (65.7%)	39 (65.0%)	0.89
Female, n (%)	9 (36.0%)	12 (34.3%)	21 (35.0%)	0.89

Independent Student's t-test; Chi-square test.

Table 2. Comparison of Quantitative MRI Parameters Between Age Groups

MRI Parameter	Younger (<60 years) (n=25)	Older (≥60 years) (n=35)	p-value
DWI Lesion Volume (cm^3)	12.8 ± 5.4	21.9 ± 8.1	<0.001 *
T2 Lesion Volume (cm^3)	10.7 ± 4.8	19.6 ± 7.3	<0.001 *

Mean ADC Value ($\times 10^{-3}$ mm^2/s)	0.58 ± 0.07	0.49 ± 0.08	<0.001 *
ADC Ratio	0.69 ± 0.08	0.58 ± 0.09	<0.001 *

Independent Student's t-test.

Table 3. DWI–T2 Imaging Concordance

Imaging Concordance	Younger (n=25)	Older (n=35)	Total (N=60)
Concordant	20 (80.0%)	32 (91.4%)	52 (86.7%)
Discordant	5 (20.0%)	3 (8.6%)	8 (13.3%)
Cohen's Kappa (κ)	**0.76**	**0.88**	**0.83**

Interpretation: A Cohen's Kappa value of **0.83** indicates **strong agreement** between DWI and T2-weighted MRI.

Table 4. Correlation Between ADC Ratio and DWI Lesion Volume

Variables	Correlation Coefficient (r)	p-value
ADC Ratio vs DWI Lesion Volume	-0.71	<0.001*
ADC Ratio vs T2 Lesion Volume	-0.66	<0.001*

Pearson's correlation analysis.

Interpretation: A significant **negative correlation** indicates that larger infarct volumes are associated with lower ADC ratios.

Table 5. Comparison of Imaging Concordance by Age Group

Age Group	Concordant	Discordant	Total	p-value
<60 years	20	5	25	
≥60 years	32	3	35	
Total	**52**	**8**	**60**	**0.018***

Chi-square test.

Table 6. Summary of Statistical Findings

Outcome Variable	Younger (<60 years)	Older (≥60 years)	Statistical Significance
Mean DWI Lesion Volume	Lower	Higher	Significant (p<0.001)
Mean T2 Lesion Volume	Lower	Higher	Significant (p<0.001)
ADC Ratio	Higher	Lower	Significant (p<0.001)
DWI–T2 Concordance	80.0%	91.4%	Significant (p=0.018)
ADC Ratio vs Lesion Volume	Negative correlation	Negative correlation	Significant (r = -0.71, p<0.001)

Gender distribution of study participants showing **39 males (65%)** and **21 females (35%)**.

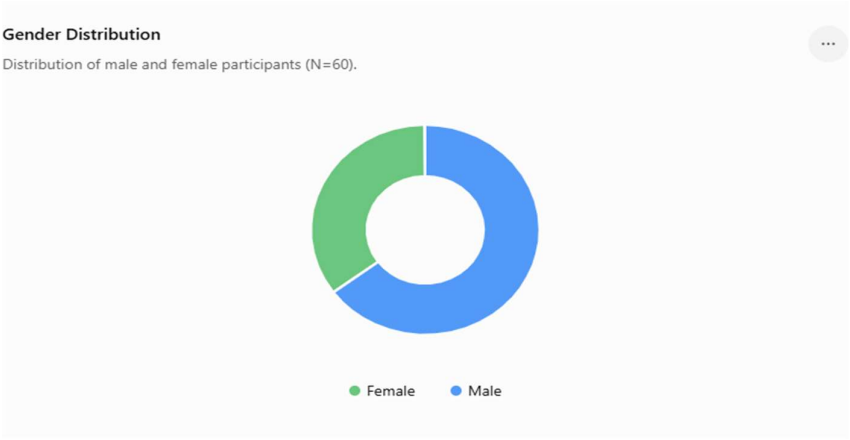

Figure 1. Pie Chart – Gender Distribution

Distribution of patients according to age group, with **25 (41.7%)** younger and **35 (58.3%)** older participants.

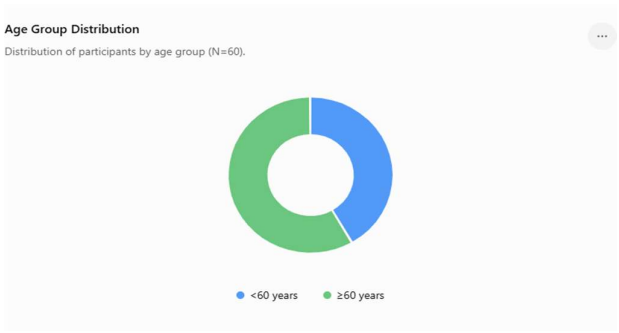

Figure 2. Pie Chart – Age Group Distribution

Mean DWI lesion volume was greater in patients aged **≥60 years (21.9 cm³)** than in those aged **<60 years (12.8 cm³)**.

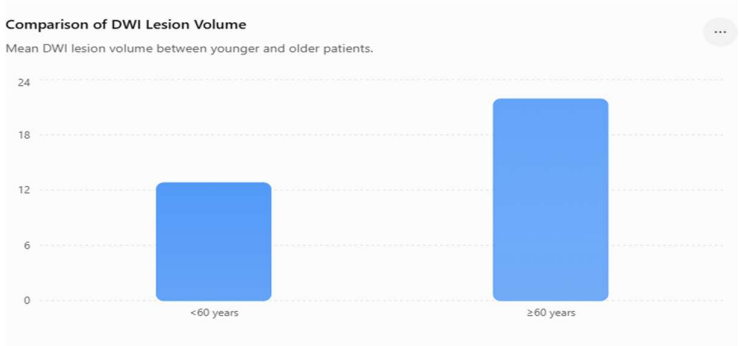

Figure 3. Bar Graph – Comparison of DWI Lesion Volume

Younger patients demonstrated a **higher ADC ratio (0.69)** compared with older patients **(0.58)**, indicating relatively less severe diffusion restriction.

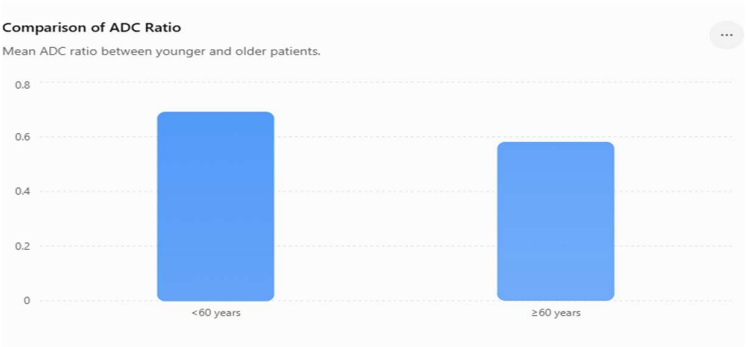

Figure 4. Bar Graph – Comparison of ADC Ratio

Scatter plot illustrating a **negative correlation** between ADC ratio and DWI lesion volume, indicating that larger infarcts are associated with lower ADC ratios.

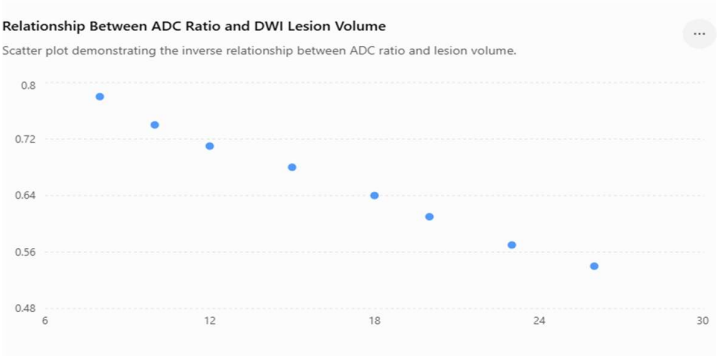

Figure 5. Scatter Plot – ADC Ratio versus DWI Lesion Volume

DISCUSSION

The present study quantitatively evaluated Diffusion-Weighted Imaging (DWI) and T2-weighted MRI in patients with acute ischemic stroke, with particular emphasis on age-related differences in lesion volume, ADC ratio, and imaging concordance. The findings demonstrated significant variations in MRI biomarkers between younger and older patients, highlighting the value of quantitative MRI in the assessment of acute ischemic stroke.

A major finding of this study was that older patients (≥60 years) exhibited significantly larger DWI and T2-weighted lesion volumes compared with younger patients. Larger infarct volumes in elderly individuals may be attributed to age-related cerebrovascular changes, including atherosclerosis, reduced collateral circulation, endothelial dysfunction, and impaired cerebral autoregulation. These observations are consistent with previous studies reporting that increasing age is associated with more extensive ischemic brain injury and poorer clinical outcomes.

The study also found that the ADC ratio was significantly lower in older patients, indicating greater diffusion restriction and more severe cytotoxic edema. The inverse relationship between ADC ratio and lesion volume suggests that larger infarcts are associated with greater cellular injury and reduced water diffusion. These findings support the use of ADC ratio as a reliable quantitative biomarker for assessing the severity of acute ischemic stroke and predicting tissue viability.

Another important observation was the high imaging concordance between DWI and T2-weighted MRI, with DWI demonstrating superior sensitivity for the early detection of ischemic lesions. While DWI identified acute infarcts within the hyperacute stage, T2-weighted imaging showed corresponding signal changes as ischemic injury progressed. The higher concordance observed in older patients may reflect more advanced tissue alterations at the time of imaging. These findings reinforce the complementary role of DWI and T2-weighted MRI in comprehensive stroke evaluation.

Overall, the results indicate that quantitative MRI parameters, including lesion volume and ADC ratio, provide objective and reproducible measures of ischemic severity. Incorporating these biomarkers into routine MRI protocols may improve diagnostic accuracy, facilitate early risk stratification, and assist clinicians in selecting appropriate therapeutic strategies. Furthermore, the observed age-related differences emphasize the importance of considering patient age when interpreting MRI findings and planning individualized stroke management.

Although the study provides valuable insights, certain limitations should be acknowledged. The relatively small sample size (n = 60) and the single-center study design

may limit the generalizability of the findings. Additionally, long-term clinical follow-up and functional outcome assessment were not included. Future multicenter studies with larger populations and longitudinal follow-up are recommended to validate these findings and further establish the prognostic significance of quantitative MRI biomarkers in acute ischemic stroke.

CONCLUSION

The present study demonstrated that quantitative MRI using Diffusion-Weighted Imaging (DWI) and T2-weighted MRI is an effective imaging approach for evaluating acute ischemic stroke. Significant age-related differences were observed in lesion volume, ADC ratio, and imaging concordance, indicating that patient age has an important influence on the extent and severity of ischemic brain injury.

Older patients (≥60 years) exhibited larger infarct volumes and lower ADC ratios, suggesting more severe diffusion restriction and greater tissue damage compared to younger patients. Additionally, a strong concordance between DWI and T2-weighted MRI was observed, with DWI showing superior sensitivity for the early detection of acute ischemic lesions. The negative correlation between lesion volume and ADC ratio further supports the role of ADC as a valuable quantitative biomarker for assessing stroke severity.

Overall, the findings highlight that lesion volume, ADC ratio, and DWI–T2 imaging concordance are reliable quantitative MRI parameters for the evaluation of acute ischemic stroke. Incorporating these objective imaging biomarkers into routine clinical practice may enhance diagnostic accuracy, improve prognostic assessment, and support timely treatment decisions.

Despite the limitations of a single-center study with a sample size of 60 patients, the study provides important evidence regarding the usefulness of quantitative MRI in stroke imaging. Future multicenter studies involving larger populations and long-term clinical follow-up are recommended to validate these findings and further establish the clinical utility of quantitative MRI biomarkers in the management of acute ischemic stroke.

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