

# Frequency of Metabolic Dysfunction Associated Steatotic Liver Disease (MASLD) in Patients Presenting with Ischemic Stroke at Tertiary Care Hospital

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## ABSTRACT

**Objective:** To determine the frequency of MASLD in patients presenting with ischemic stroke at Tertiary Care Hospital.

**Study Design:** Descriptive cross-sectional study.

**Place and Duration of the Study:** Neurology Department, Pak Emirates Military Hospital Rawalpindi, from 23-10-2025 to 23-01-2026.

**Methodology:** This study was conducted after taking ethical approval from IRB. A total of 92 patients presenting with ischemic stroke were included in the study after taking written informed consent. MASLD was assessed by abdominal ultrasound and measurement of ALT and AST levels. Data were collected on predesigned proforma. Data analysis was done using SPSS v26, and p-value  $\leq 0.05$  was considered statistically significant.

**Results:** A total of 92 patients with ischemic stroke were included (mean age  $51.3 \pm 5.9$  years; 63% male), MASLD was found in 24% patients. MASLD was observed in 17.2% males and 35.3% females ( $p = 0.05$ ). MASLD prevalence was higher in patients with dyslipidemia (39.5% vs 13.0%,  $p = 0.003$ ), hypertension (37.1% vs 15.8%,  $p = 0.020$ ), diabetes (34.1% vs 14.6%,  $p = 0.028$ ), and BMI  $>25 \text{ kg/m}^2$  (70.0% vs 11.1%,  $p < 0.001$ ). No significant association was found with age ( $p = 0.528$ ).

**Conclusion:** The results of study suggest that, MASLD is common among patients with ischemic stroke and is strongly associated with metabolic risk factors, and female gender. These findings highlight the significance of early identification, monitoring, and management of MASLD to potentially reduce the burden of stroke.

**Keywords:** MASLD, Ischemic stroke, Tertiary Care Hospital

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**Conflict of interest:** None

## INTRODUCTION

MASLD, currently affecting 46% population, worldwide.<sup>(1)</sup> Among them 40% patients, present with advanced liver fibrosis, and 10–15% have established cirrhosis at diagnosis.<sup>(2)</sup> In Pakistan its prevalence (2024) noted was 29.82%.<sup>(3)</sup> Key risk factors includes visceral obesity, dyslipidemia, hypertension, and type 2 diabetes.<sup>(4)</sup> Research indicates that it is autonomous CVD risk factor, even after adjusting for traditional risk factors, and may work synergistically with diabetes to promote cardiovascular events.<sup>(5, 6)</sup>

Meta-analyses have found that MASLD patients have 1.1 to 2.5 time's higher risk of stroke. However, data on how NAFLD affects stroke severity and outcomes remain limited.<sup>(7)</sup> <sup>(8)</sup> The cause of death in patients with MASLD is reported to be MI and stroke, making it major global public health concern. Multiple studies have identified plasma lipids as key mediators linking MASLD to elevated stroke and CVD risk.<sup>(9)</sup> Increased liver fat has been correlated with thicker carotid intima-media. Additionally, individuals with MASLD exhibit higher burden of coronary atherosclerosis, highlighting the need for effective management of MASLD to lower the risk of future cerebrovascular events.<sup>(10)</sup>

Despite several international studies demonstrating link between MASLD and increased stroke risk, there remains lack of localized data, where both MASLD and stroke burden are high. Understanding the frequency of MASLD in ischemic stroke patients is essential to identify at-risk individuals and incorporate liver health assessment into stroke risk profiling. This study aimed to fill the existing gap by determining the frequency of MASLD among patients presenting with ischemic stroke in tertiary care setting.

## METHODOLOGY

This descriptive cross-sectional study was conducted at the Department of Neurology, Pak Emirates Military Hospital, Rawalpindi,

over three months [23-10-2025 to 23-01-2026] following synopsis approval from CPSP. Permission was obtained from the hospital ethical committee [A/28/ERC/98/2025 Dated 18-08-2025] prior to data collection. Sample size of 92 cases was estimated using 95% confidence level, 10% margin of error, and expected frequency of MASLD among ischemic stroke patients taken as 39.5%.<sup>(11)</sup> Eligible participants were adults between 20 and 60 years of age of either gender, diagnosed with ischemic stroke (neurological deficit confirmed on CT or MRI showing infarction in corresponding vascular territory, with symptoms lasting more than 24 hours and hemorrhagic stroke excluded radiologically). Patients presenting within 7 days of onset of symptoms were included. Patients with chronic liver disease due to any etiology including chronic hepatitis B and C, hemochromatosis, Wilson's, autoimmune hepatitis, those using hepatotoxic medications, prior stroke, pregnant or lactating females, and alcoholics were excluded from the study.

After obtaining informed consent, patients fulfilling the selection criteria were enrolled using non-probability consecutive sampling. Demographic data including age, gender, and BMI were recorded. Detailed clinical history was taken to assess risk factors including diabetes mellitus (fasting blood sugar >126 mg/dl or use of hypoglycemic medication), hypertension (>130/90 mmHg or use of antihypertensive medication), smoking status, and family history of stroke.

All patients received routine stroke management as per hospital protocol. MASLD was assessed using abdominal ultrasound performed by an experienced radiologist to detect hepatic steatosis. Additionally, 5 cc venous blood sample was taken under aseptic conditions for measurement of liver enzymes including ALT and AST. MASLD was diagnosed on presence of hepatic steatosis on ultrasound along with ALT and AST >40 IU.

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Data were recorded on a predesigned proforma.

Statistical analysis was conducted using SPSS version 26. Continuous variables including age, BMI, ALT and AST levels were expressed as mean  $\pm$  standard deviation. Categorical variables including gender, MASLD presence and comorbidities were expressed as frequencies and percentages. Data were stratified based on age, gender, BMI, diabetes, hypertension, and smoking status. Post-stratification, MASLD frequency was compared within each stratum using chi-square test. P-value  $\leq 0.05$  was considered statistically significant.

### RESULTS

A total of 92 patients with ischemic stroke were included in the study. As shown in table 1; mean age of patients was  $51.34 \pm 5.94$  years, majority were male 58 (63%), vs 34 (37%) females. The mean BMI of study participants was  $24.01 \pm 2.00$  kg/m<sup>2</sup>. Mean serum albumin level was  $3.87 \pm 0.17$  g/dl. Mean ALT and AST levels were  $45.65 \pm 16.27$  IU/L and  $42.08 \pm 13.79$  IU/L, respectively and AST/ALT ratio was  $0.85 \pm 0.04$ . Diabetes was present in 44 (47.8%), hypertension in 35 (38%), dyslipidemia in 38 (41.3%) patients, family history of stroke in 24 (26%) patients. Mean HbA1c level among study participants was  $6.14 \pm 1.23\%$ . Fatty liver on ultrasound was present in 22 (24%) patients.

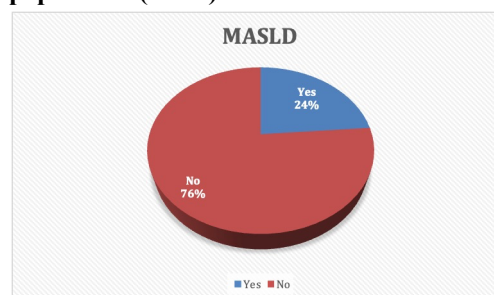
**Table 1: Summary of study variables (N=92)**

<b>Age (years)</b>	<b>Mean <math>\pm</math> SD</b>	$51.337 \pm 5.939$
	<b>Minimum</b>	38
	<b>Maximum</b>	59
<b>Gender frequency (%)</b>	<b>Male</b>	58 (63%)
	<b>Female</b>	34 (37%)
<b>BMI (kg/m<sup>2</sup>)</b>		$24.010 \pm 2.00$
<b>Serum Albumin (g/dl)</b>		$3.868 \pm 0.165$
<b>ALT (IU/L)</b>		$45.650 \pm 16.266$
<b>AST (IU/L)</b>		$42.08 \pm 13.789$

<b>AST/ALT</b>	$0.848 \pm 0.040$
<b>HbA1c (%)</b>	$6.137 \pm 1.227$
<b>Fatty liver on USG frequency (%)</b>	22 (24%)
<b>Diabetes frequency (%)</b>	44 (47.8%)
<b>Hypertension frequency (%)</b>	35 (38%)
<b>Dyslipidemias frequency (%)</b>	38 (41.3%)
<b>Family history of stroke frequency (%)</b>	24 (26%)

As shown in figure 1, MASLD was found in 22 (24%) patients out of total 92 study participants.

**Figure 1: Frequency of MASLD in study population (N=92)**



As shown in figure 3, on stratification with respect to gender, MASLD was present in 10 (17.2%) males and 12 (35.3%) females. However, difference was not significant ( $p = 0.05$ ). Regarding age groups, MASLD was observed in 2 (16.7%) patients aged  $\leq 45$  years and 20 (25.0%) patients aged  $>45$  years, showing no significant association ( $p = 0.528$ ). MASLD was present in more in 15 (39.5%) patients with dyslipidemia compared to 7 (13.0%) patients without dyslipidemia ( $p = 0.003$ ), in 13 (37.1%) hypertensive patients compared to 9 (15.8%) non-hypertensive patients ( $p = 0.020$ ), in 15 (34.1%) diabetic patients vs 7 (14.6%) non-diabetic patients ( $p = 0.028$ ), and in 14 (70.0%) patients with BMI  $>25$  kg/m<sup>2</sup> compared to 8 (11.1%) patients with BMI  $\leq 25$  kg/m<sup>2</sup> ( $p < 0.001$ ).

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**Table 2: Data stratification with respect to effect modifiers**

Effect Modifier	Category	MASLD Yes n (%)	MASLD No n (%)	p-value
Gender	Male	10 (17.2%)	48 (82.8%)	0.05
	Female	12 (35.3%)	22 (64.7%)	
Age Groups	Upto 45 years	2 (16.7%)	10 (83.3%)	0.528
	>45 years	20 (25.0%)	60 (75.0%)	
Dyslipidemia	Yes	15 (39.5%)	23 (60.5%)	0.003*
	No	7 (13.0%)	47 (87.0%)	
Hypertension	Yes	13 (37.1%)	22 (62.9%)	0.020*
	No	9 (15.8%)	48 (84.2%)	
Diabetes	Yes	15 (34.1%)	29 (65.9%)	0.028*
	No	7 (14.6%)	41 (85.4%)	
BMI Groups	Upto 25 kg/m <sup>2</sup>	8 (11.1%)	64 (88.9%)	<0.001*
	>25 kg/m <sup>2</sup>	14 (70.0%)	6 (30.0%)	

\*significant at  $p \leq 0.05$

## DISCUSSION

Ischemic stroke in individuals with MASLD may result from resistance, chronic inflammation, atherogenic lipid abnormalities, endothelial dysfunction, and pro-thrombotic state, all of which contribute to an elevated risk of cerebrovascular events.<sup>(12)</sup> In current study, MASLD was found in 24% patients presented with ischemic stroke. In contrast, frequency of MASLD among ischemic stroke patients found by Huang et al, was higher (39.5%).<sup>(11)</sup> Raharinalalana and colleagues reported that 77.9% individuals with ischemic stroke had metabolic syndrome, suggesting substantial risk of MASLD within this group.<sup>(13)</sup> This difference may be attributed to their larger sample size, prolonged study duration, and possible ethnic variations. Han (2025) demonstrates that individuals with persistent MASLD face an increased risk of ischemic stroke (HR: 1.14).<sup>(14)</sup>

Li et al, found that MASLD was also linked to 34% higher risk of stroke in participants with CKD.<sup>(15)</sup> Sun et al, highlight that recognizing MASLD as stroke risk factor underscores the importance of its early screening and intervention.<sup>(16)</sup> Reported incidence of stroke found by Zhou et al and Fan et al, among those having MASLD found was 1.3% to 9.3%.<sup>(17, 18)</sup> Xiao et al, found significant positive associations with MASLD in the overall population and by sex. After full adjustment, associations remained significant only among females (OR: 2.19) and individuals without metabolic risk factors (OR: 1.67), whereas no significant associations were found in male subgroups.<sup>(19)</sup> Similarly, in current study dyslipidemia, hypertension, diabetes, female sex, and higher BMI were significantly associated with MASLD ( $p < 0.05$ ), while age showed no significant association in this study population ( $p > 0.05$ ). Peng et al, also found that MASLD was positively associated with the risk of hypertension, increased risk of T2DM and hyperlipidemia.<sup>(20)</sup> Overall, our findings indicate that MASLD is prevalent among patients with ischemic stroke and is

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strongly associated with metabolic risk factors. These results underscore the importance of early detection and management of MASLD to potentially reduce cerebrovascular risk.

This study was cross-sectional in nature, and only at single time point. We did not follow patients longitudinally to assess who might develop MASLD later, nor could we determine causality between MASLD and stroke outcomes.

**CONCLUSION:** The results of study suggest that, MASLD is common among patients with ischemic stroke and is strongly associated with metabolic risk factors, and female gender. These findings highlight the significance of early identification, monitoring, and management of MASLD to potentially reduce the burden of stroke.

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