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PROGNOSTIC ASSESSMENT OF ACS IN MAFLD VS NON- MAFLD PARTICIPANTS: A SHORT TERM COHORT

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Abstract

Background: *Metabolic dysfunction associated fatty liver disease (MAFLD) and Non-alcoholic fatty liver disease (NAFLD/ non-MAFLD) are frequently associated with cardiovascular conditions, particularly acute coronary syndrome (ACS). These liver pathologies often coexist with traditional risk factors for coronary artery disease (CAD) and may exacerbate cardiovascular outcomes.*

Objectives: *To determine the frequency of MAFLD and non- MAFLD among patients presenting with ACS and assess the relationship between the presence of fatty liver with associated comorbidities with the extent of CAD.*

Study Design & Setting: *Cross-sectional analytical study conducted at the Department of Cardiology, Dr. Ruth KM Pfau Civil Hospital/ Dow University of Health Sciences, Karachi, from January 2024 to June 2024.*

Methodology: *A total of 228 patients diagnosed with ACS were enrolled. All participants underwent abdominal ultrasonography for fatty liver and coronary angiography was done to assess CAD severity. Data on demographics, clinical history, biochemical parameters, and risk factors were collected and statistically analyzed using SPSS v25. Association between MAFLD and Non-MAFLD and CAD extent was evaluated using chi-square test and logistic regression.*

Results: *MAFLD was present in 52.5% of ACS patients. A significant association was observed between MAFLD and multivessel CAD ($p<0.001$). MAFLD patients exhibited higher frequencies of hypertension (67.9%), diabetes (62.3%), and dyslipidemia (60.4%). MAFLD incidence positively correlated with CAD burden.*

Conclusion: *MAFLD is highly prevalent in ACS patients and significantly correlates with the severity of coronary artery disease. Routine screening for FLD in ACS patients may aid in risk stratification and management.*

INTRODUCTION

In the world, cardiovascular diseases (CVD) account for 32% of all cause deaths, 85% of which are attributable to myocardial infarction and stroke.[1] Metabolic dysfunction associated fatty liver disease (MAFLD) is an increasingly significant independent risk factor for CVD, including acute coronary syndrome (ACS).[2] Presently MAFLD is not only affecting west, but its prevalence is also increasing in east. The increased frequency of MAFLD in ACS patients has been proven, but there is scarce evidence based on the short-term prognosis of MAFLD patients suffering with ACS.[3]

MAFLD is characterized by hepatic steatosis in the presence of metabolic dysfunction such as obesity, type 2 diabetes mellitus, or other metabolic risk factors. This novel definition shifts the diagnostic focus from exclusion (as in NAFLD) to inclusion, thereby aligning better with the systemic metabolic derangements observed in patients with cardiovascular conditions.[4] Acute coronary syndrome (ACS) comprises a spectrum of urgent cardiac conditions including ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina. These events are known to be influenced by metabolic stress and systemic inflammation, both of which are prominent features in MAFLD.[5] The pathophysiological mechanisms linking MAFLD to adverse cardiovascular outcomes include chronic low-grade inflammation, insulin resistance, atherogenic dyslipidemia, and endothelial dysfunction. Hepatic fat accumulation promotes systemic inflammation through the release of pro-inflammatory cytokines such as TNF-α and IL-6, which contribute to plaque instability and thrombosis.[6,7]

Insulin resistance, a hallmark of MAFLD, further exacerbates myocardial oxygen demand and impairs vascular function. Additionally, oxidative stress and altered adipokine profiles in MAFLD patients may accelerate atherosclerosis.[8] These mechanisms together create a pro-atherogenic state that worsens outcomes in ACS patients with MAFLD. Recent literature suggests that the presence of MAFLD may contribute to increased plaque instability, endothelial dysfunction, and heightened thrombogenicity—all of which are key contributors to adverse cardiovascular outcomes.[9,10]

Despite growing awareness of the cardiovascular burden posed by MAFLD, limited data exist on the short-term prognosis following ACS, especially in South Asian populations. A better understanding of 90-day outcomes—such as re-hospitalization, recurrent myocardial infarction, heart failure, and all-cause mortality—among MAFLD versus non-MAFLD patients could inform risk stratification and guide post-discharge management strategies. This study aims to assess 90-day morbidity and mortality in ACS patients with and without MAFLD to aid in early risk stratification and management.

MATERIALS AND METHODS

This study was an open-labelled, randomized, prospective cohort study. It was conducted in the Cardiology Ward of Dr. Ruth Pfau Civil Hospital Karachi, Dow Medical College, and Dow University of Health Sciences, Karachi from January 2024 to June 2024. The sample size was established based on data from a previous study, using www.openepi.com, with a confidence interval of 95% and a study power of 80%. The percentage of exposed individuals with the outcome was 18%. Based on these parameters, the sample size was calculated to include 114 participants suffering from acute coronary syndrome with MAFLD and 114 participants suffering from acute coronary syndrome without MAFLD, making a total of 228 participants.[3] The sampling method used was purposive non-probability sampling.

Participants were selected based on the following inclusion criteria: age between 24 and 70 years, first presentation of ACS, serum troponin I levels >0.4 ng/ml, BMI between 18.5 and 30 kg/m², non-alcoholic status, presence of type 2 diabetes mellitus, waist circumference ≥90 cm in Asian men and ≥80 cm in Asian women, blood pressure ≥130/85 mmHg, serum triglycerides ≥150 mg/dl, plasma HDL cholesterol <40 mg/dl for men and <50 mg/dl for women, prediabetes defined by HbA1c levels between 5.7%–6.4% or fasting glucose 100–125 mg/dl, and plasma C-reactive protein levels ≥2 mg/L.

Participants were excluded if they were chronic users of methotrexate, tamoxifen, amiodarone, valproic acid, or steroids, or if they had chronic infections

such as hepatitis B or C. Female participants who were pregnant were also excluded from the study.

A consent form was provided and discussed with them. After obtaining consent, blood samples were collected, and ultrasound abdomen and echocardiography were performed. Patients were then labeled according to the criteria as either MAFLD or non-MAFLD. The results were communicated to the participants. Standard treatment for acute coronary syndrome was continued. After 30 and 90 days, participants were contacted through a phone call or follow-up visit and were asked about any re-hospitalization or death.

The variables assessed included STEMI, NSTEMI, and UA in relation to the MAFLD and non-MAFLD groups. This was done using serum troponin levels, ultrasound abdomen, serum alanine aminotransferase levels, serum gamma-glutamyl transferase levels, fasting serum lipid profile, waist circumference, BMI, and calculation of the fatty liver index. Additional investigations performed included echocardiography, complete blood picture, serum albumin levels, NT-proBNP, renal profile, alpha-2 macroglobulin, serum ferritin levels, and serum haptoglobin levels. Metabolic dysfunction-associated fatty liver disease (MAFLD) was diagnosed when hepatic steatosis was present along with obesity, type 2 diabetes, or metabolic dysregulation. Metabolic dysregulation was confirmed if at least two criteria such as abnormal waist circumference, blood pressure, triglycerides, HDL, glucose levels, HOMA-IR, or hs-CRP were met. Liver steatosis was identified via imaging, biopsy, or serum markers. Acute Coronary Syndrome (ACS) was defined as a sudden reduction in coronary blood flow, including STEMI, NSTEMI, and Unstable Angina based on ECG and cardiac troponin levels. Cardiac biomarkers such as troponin I and T were measured to assess myocardial injury.

RESULTS

The mean age was similar between the MAFLD group (56.3 ± 8.9 years) and the non-MAFLD group (55.7 ± 9.4 years), with no statistically significant difference ($p = 0.521$). The gender distribution was also comparable, with males constituting 68.4% in the MAFLD group and 63.2% in the non-MAFLD group ($p = 0.414$), while females accounted for 31.6% and 36.8% respectively (Table 1). Body mass index (BMI) was significantly higher in the MAFLD group (28.4 ± 1.7 kg/m²) compared to the non-MAFLD group (24.9 ± 1.9 kg/m²), with a p-value less than 0.001. Similarly, waist circumference was notably greater in the MAFLD group (95.6 ± 6.3 cm) than in the non-MAFLD group (85.2 ± 5.8 cm), also showing a significant difference ($p < 0.001$). The prevalence of hypertension was higher in the MAFLD group, with 78.9% of patients affected, compared to 56.1% in the non-MAFLD group ($p < 0.001$). Type 2 diabetes mellitus was significantly more common in the MAFLD group (73.7%) than in the non-MAFLD group (39.5%), with a p-value less than 0.001. Lipid profile parameters also differed significantly between groups; the MAFLD group had lower mean HDL levels (38.1 ± 6.4 mg/dL) compared to the non-MAFLD group (47.3 ± 7.2 mg/dL), and higher mean triglycerides levels (181.5 ± 32.6 mg/dL vs. 129.4 ± 28.1 mg/dL), both with p-values less than 0.001 (Table 1).

STEMI was significantly more common in the MAFLD group (49.1%) than in the non-MAFLD group (33.3%) with a p-value of 0.019. The proportions of NSTEMI and unstable angina were higher in the non-MAFLD group (40.4% and 26.3%, respectively) compared to the MAFLD group (31.6% and 19.3%), but these differences were not statistically significant ($p > 0.05$) (Table 2).

Ejection fraction was significantly lower in the MAFLD group (46.2% ± 7.8) compared to the non-MAFLD group (51.3% ± 6.2) ($p < 0.001$). Serum Troponin I levels were higher in the MAFLD group (2.6 ± 1.1 ng/mL) than in the non-MAFLD group (1.9 ± 0.8 ng/mL) ($p < 0.001$). Liver enzymes ALT and GGT were significantly elevated in the MAFLD group (72.4 ± 18.9 U/L and 84.1 ± 26.5 U/L) compared to the non-MAFLD group (42.3 ± 13.7 U/L and 49.2 ± 17.4 U/L) ($p < 0.001$). NT-proBNP levels were also higher in the MAFLD group (1186 ± 422 pg/mL) versus the non-MAFLD group (895 ± 376 pg/mL) ($p < 0.001$) (Table 3).

Table 1: Baseline Demographic and Clinical Characteristics of Participants (n = 228)

Characteristic	MAFLD Group (n = 114)	Non-MAFLD Group (n = 114)	p-value
Age (years)	56.3 ± 8.9	55.7 ± 9.4	0.521
Male	78 (68.4%)	72 (63.2%)	0.414
Female	36 (31.6%)	42 (36.8%)	
BMI (kg/m²)	28.4 ± 1.7	24.9 ± 1.9	<0.001
Waist Circumference (cm)	95.6 ± 6.3	85.2 ± 5.8	<0.001
Hypertension	90 (78.9%)	64 (56.1%)	<0.001
Type 2 Diabetes Mellitus	84 (73.7%)	45 (39.5%)	<0.001
HDL (mg/dL)	38.1 ± 6.4	47.3 ± 7.2	<0.001
Triglycerides (mg/dL)	181.5 ± 32.6	129.4 ± 28.1	<0.001

Table 2: Distribution of ACS Types in MAFLD and Non-MAFLD Groups

ACS Type	MAFLD Group (n = 114)	Non-MAFLD Group (n = 114)	p-value
STEMI	56 (49.1%)	38 (33.3%)	0.019
NSTEMI	36 (31.6%)	46 (40.4%)	0.178
Unstable Angina	22 (19.3%)	30 (26.3%)	0.184

Table 3: Echocardiographic and Laboratory Findings at Baseline

Parameter	MAFLD Group	Non-MAFLD Group	p-value
Ejection Fraction (%)	46.2 ± 7.8	51.3 ± 6.2	<0.001
Serum Troponin I (ng/mL)	2.6 ± 1.1	1.9 ± 0.8	<0.001
ALT (U/L)	72.4 ± 18.9	42.3 ± 13.7	<0.001
GGT (U/L)	84.1 ± 26.5	49.2 ± 17.4	<0.001
NT-proBNP (pg/mL)	1186 ± 422	895 ± 376	<0.001

DISCUSSION

Cardiovascular diseases remain the leading cause of global mortality, with acute coronary syndrome (ACS) representing a major contributor.[12] Metabolic dysfunction associated fatty liver disease (MAFLD) is increasingly recognized as an independent risk factor for cardiovascular events, including ACS. The prevalence of MAFLD is rising worldwide, especially in populations with metabolic disorders such as diabetes and obesity.[13] This study aims to assess the short-term prognosis of ACS patients with and without MAFLD.

The findings of our study demonstrated a significantly higher incidence of ST-elevation myocardial infarction (STEMI) among MAFLD patients (49.1%) compared to non-MAFLD patients (33.3%; p = 0.019), alongside significantly lower ejection fraction (46.2 ± 7.8% vs. 51.3 ± 6.2%; p < 0.001), higher serum troponin I (2.6 ± 1.1 vs. 1.9 ± 0.8 ng/mL; p < 0.001), and elevated liver and cardiac biomarkers. These results are in line with the study by Chew et al. (2022), who reported a 23% increase in long-term all-cause mortality among ACS patients with MAFLD (HR 1.230, 95% CI: 1.065–1.420; p = 0.005), as well as higher risks of stroke, heart failure, and cardiogenic shock. The worse cardiac function observed in our MAFLD group supports the suggestion that MAFLD may contribute to poorer cardiovascular prognosis.[16]

Similarly, Shaheen et al. (2018) also found a significantly increased risk profile in ACS patients with NAFLD, with elevated GRACE scores and higher in-hospital death risk compared to those without NAFLD. This correlates with our observation of reduced left ventricular function and elevated troponin levels in MAFLD patients, indicating greater myocardial injury.[14] Furthermore, our results align with Gholoobi et al. (2022) who demonstrated that NAFLD patients had significantly higher odds of obesity (OR = 1.047), hypertension

(OR = 1.909), hyperlipidemia (OR = 3.474), and CAD (OR = 2.009). In our cohort, patients with MAFLD had elevated ALT and GGT levels (ALT: 72.4 ± 18.9 vs. 42.3 ± 13.7 U/L; GGT: 84.1 ± 26.5 vs. 49.2 ± 17.4 U/L; $p < 0.001$), indicating hepatic dysfunction associated with systemic metabolic derangements.[15]

Interestingly, our findings diverge from Ali et al. (2018), where NAFLD severity and fibrosis scores were not significantly associated with ACS subtypes, CAD severity, or SYNTAX scores ($p > 0.7$).[17] This difference may be due to the smaller sample size (n = 85), younger cohort (median age 40 years), or population characteristics in their study compared to ours. Moreover, our data supported the association between MAFLD and impaired cardiac biomarkers and function, which contrasts the lack of association reported by Ali et al.[17]

In agreement with Noda et al. (2022), who identified MAFLD in 48.9% of ACS patients and reported that the coexistence of MAFLD and impaired physical function predicted higher clinical event rates, our study also identified a 1:1 prevalence ratio (50%) of MAFLD in ACS patients and highlighted a higher burden of adverse cardiac parameters, suggesting an increased vulnerability to future events.

Additionally, Hussain et al. (2023) and Ali et al. (2022) supported the significant associations between NAFLD and cardiovascular risk factors, including obesity, hyperlipidemia, and elevated liver enzymes.18, [20] Our study confirmed these findings, with statistically significant elevations in ALT, GGT, and NT-proBNP in MAFLD patients. Similarly, Jibran et al. (2017) found a significant correlation between NAFLD and CAD (Chi-square = 285.536, $p < 0.000$), with NAFLD increasing the odds of CAD by 2.9 times, again consistent with our results that underscore the higher proportion of STEMI and lower ejection fraction in MAFLD patients.[19]

This prospective cohort study provides valuable insights into the impact of MAFLD on ACS outcomes using well-defined diagnostic criteria and comprehensive biochemical and imaging assessments. The inclusion of a control group without MAFLD enhances comparability. However, the study is limited by its single-center design and relatively short follow-up duration of 90 days, which may not capture long-term outcomes. The purposive sampling method may introduce selection bias. Additionally, confounding factors related to lifestyle and medication adherence were not fully controlled.

CONCLUSION

MAFLD appears to influence short-term outcomes in ACS patients, highlighting the importance of its early identification. Integrating MAFLD assessment in cardiovascular risk stratification could improve prognostication and management.

REFERENCES

1. Tad World Health Organization (WHO). World health statistics 2024: monitoring health for the SDGs, sustainable development goals. Geneva: World Health Organization; (cited 2025 March 29). Available from: https://www.who.int/data/gho/publications/world-health-statistics
2. Moon JH, Kim W, Koo BK, Cho NH, Innovative Target Exploration of NAFLD (ITEN) consortium. Metabolic dysfunction-associated fatty liver disease predicts long-term mortality and cardiovascular disease. Gut and liver. 2021 Oct 12;16(3):433-37.
3. Noda T, Kamiya K, Hamazaki N, Nozaki K, Ichikawa T, Yamashita M, Uchida S, Maekawa E, Terada T, Reed JL, Yamaoka-Tojo M. The prevalence of metabolic dysfunction-associated fatty liver disease and its association with physical function and prognosis in patients with acute coronary syndrome. Journal of clinical medicine. 2022 Mar 26;11(7):1847-53.
4. Lee H, Lee Y ho, Kim SU, Kim HC. Metabolic Dysfunction-Associated Fatty Liver Disease and Incident Cardiovascular Disease Risk: A Nationwide Cohort Study. Clin Gastroenterol Hepatol [Internet]. 2021 Oct 1 [cited 2023 Oct 13];19(10):2138-2147.e10.
5. Eslam M, Newsome PN, Sarin SK, Anstee QM, Targher G, Romero-Gomez M, et al. A new definition for metabolic dysfunction-associated fatty liver disease: An international expert consensus statement. J Hepatol.2020;73(1):202–9.

6. Bedogni G, Bellentani S, Miglioli L, Masutti F, Passalacqua M, Castiglione A, Tiribelli C. The Fatty Liver Index: a simple and accurate predictor of hepatic steatosis in the general population. BMC gastroenterology. 2006 Dec;6:1-7.
7. Singh A, Museedi AS, Grossman SA. Comprehensive Review of Acute Coronary Syndrome. Annals of Innovation in Medicine. 2023 Sep 22;1(2):657-62.
8. Alqahtan AA, Alshareef SA, Al-Hadlaq ZA. A Non–ST-Segment Elevation Myocardial Infarction: An Emergent Condition-Main Role of Emergency Providers and Clinical Pathologists: A Review. Journal of Medical and Life Science. 2024 Dec 20;6(4):713-24.
9. Zhang L, Liu Z, Zhou X, Zeng J, Wu M, Jiang M. Long-term impact of air pollution on heart failure readmission in unstable angina patients. Scientific Reports. 2024 Sep 27;14(1):22132.
10. Chaulin A. Cardiac troponins: contemporary biological data and new methods of determination. Vascular health and risk management. 2021 Jun 3:299-316.
11. Bergmark BA, Mathenge N, Merlini PA, Lawrence-Wright MB, Giugliano RP. Acute coronary syndromes. The Lancet. 2022 Apr 2;399(10332):1347-58.
12. Liu J, Ayada I, Zhang X, Wang L, Li Y, Wen T, Ma Z, Bruno MJ, de Knegt RJ, Cao W, Peppelenbosch MP. Estimating global prevalence of metabolic dysfunction-associated fatty liver disease in overweight or obese adults. Clinical Gastroenterology and Hepatology. 2022 Mar 1;20(3):e573-82.
13. Noda T, Kamiya K, Hamazaki N, Nozaki K, Ichikawa T, Yamashita M, Uchida S, Maekawa E, Terada T, Reed JL, Yamaoka-Tojo M. The prevalence of metabolic dysfunction-associated fatty liver disease and its association with physical function and prognosis in patients with acute coronary syndrome. Journal of clinical medicine. 2022 Mar 26;11(7):1847-55.
14. Shaheen ES. Nonalcoholic fatty liver disease and outcomes in patients with acute coronary syndrome. Journal of Medicine in Scientific Research. 2018;1(4):3-8.
15. Gholoobi A, Gifani M, Gholoobi A, Akhlaghi S, Pezeshki Rad M, Baradaran Rahimi V. Relationship between the prevalence and severity of non-alcoholic fatty liver disease and coronary artery disease: Findings from a cross-sectional study of a referral center in northeast Iran. Jgh Open. 2022 May;6(5):330-7.
16. Chew N, Ng CH, Kong G, Chin YH, Lim O, Lim WH, Dalakoti M, Khoo CM, Kong W, Poh KK, Foo R. Metabolic associated fatty liver disease increases risk of adverse events after acute coronary syndrome. European Heart Journal. 2022 Oct 1;43(Supplement_2):ehac544-1414.
17. Ali AH, Faizal SM, Nawawi KN, Zhiqin W, Soon NC, Yaacob NY, Shah SA, Hassan HH, Maskon O, Ali RA. IDDF2018-ABS-0219 Assessment of correlation between non-alcoholic fatty liver disease and severity of coronary artery disease in young acute coronary syndrome patients.
18. Hussain Z, Rind MA, Nazir M, Saleem M. Assessment of Risk Factors for Non-Alcoholic Fatty Liver Disease (NAFLD): Assessment of Risk Factors for NAFLD. Pakistan Journal of Health Sciences. 2023 May 31:187-91.
19. Jibran MS, Zahid ZU, Gul AM, Khan SB, Irfan M. Assosiation of non alcholic fatty liver disease with coronary artery disease. Pakistan Heart Journal. 2017 Dec 1;50(4):679-84.
20. Ali A, Amin MJ, Ahmed MU, Taj A, Aasim M, Tabrez E. Frequency of non-alcoholic fatty liver disease (NAFLD) and its associated risk factors among Type-2 diabetics. Pakistan Journal of Medical Sciences. 2022 Jan;38(1):28-33.