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Original Research Article

Ferritin at the Crossroads of Inflammation and Risk: Cardiometabolic Correlates in Acute Myocardial Infarction

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Abstract:

Background: Acute myocardial infarction (AMI) commonly occurs in individuals with multiple coexisting cardiovascular risk factors. Serum ferritin, apart from reflecting iron stores, is increasingly recognized as a marker of inflammation and metabolic dysfunction.

Aim: To determine the correlation between serum ferritin levels and risk factors such as hypertension, diabetes mellitus, dyslipidemia, smoking, and obesity in patients with AMI.

Methods: This prospective observational study was conducted in the Department of General Medicine, Great Eastern Medical School and Hospital, Ragolu, Srikakulam, Andhra Pradesh. A total of 107 patients with AMI were included. Clinical details, demographic variables, cardiovascular risk factors, and laboratory investigations including serum ferritin estimation by chemiluminescent immunoassay were recorded. Statistical analysis was performed using descriptive and inferential methods, and associations between ferritin levels and risk factors were assessed.

Results: Hypertension was the most frequent risk factor (64.5%), followed by smoking (63.6%), diabetes mellitus (59.8%), dyslipidemia (59.8%), and obesity (57.9%). Mean serum ferritin levels were significantly higher in patients with hypertension (377.85 vs 284.55 ng/mL, p=0.009), diabetes (392.45 vs 273.67 ng/mL, p=0.001), dyslipidemia (426.37 vs 223.18 ng/mL, p<0.001), obesity (416.29 vs 246.10 ng/mL, p<0.001), and smoking (387.56 vs 270.00 ng/mL, p=0.01).

Conclusion: Serum ferritin was significantly associated with all major cardiovascular risk factors in AMI, suggesting its utility as a marker of cumulative cardiometabolic risk burden.

Keywords: Acute myocardial infarction; Serum ferritin; Cardiovascular risk factors; Dyslipidemia; Obesity.

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Introduction

Acute myocardial infarction (AMI) develops on a background of multiple cardiometabolic and behavioral risk factors, including hypertension, diabetes mellitus, dyslipidemia, smoking, and obesity. Serum ferritin, although traditionally regarded as an indicator of body iron stores, is increasingly recognized as a marker of inflammation, oxidative stress, and metabolic dysfunction that may interact with these established cardiovascular risk factors [1]. Recent studies have shown that higher ferritin levels are associated with adverse metabolic profiles, including increased body mass index, central obesity, dyslipidemia, impaired glucose metabolism, and elevated blood pressure, all of which contribute to atherosclerotic burden and coronary events [2, 3]. In patients with AMI, evaluating the relationship between serum ferritin and conventional risk factors may help clarify whether elevated ferritin reflects only acute inflammation or also the cumulative burden of pre-existing cardiovascular risk. Therefore, the present study aimed to determine the correlation between serum ferritin levels and risk factors such as hypertension, diabetes, dyslipidemia, smoking, and obesity in patients with AMI.

Methods

This prospective observational study was conducted in the department of General Medicine, Great Eastern Medical School and Hospital, Ragolu, Srikakulam, Andhra Pradesh. The study population comprised patients presenting with chest pain to the emergency medicine and General Medicine during the study period. Patients were screened clinically and investigated for AMI. Those fulfilling the eligibility criteria were enrolled after obtaining

written informed consent in a language understandable to them. Inclusion criteria comprised patients with chest pain and at least one of the following diagnostic findings: ST-segment elevation of more than 1 mm in at least two contiguous electrocardiographic leads, new-onset bundle branch block, echocardiographic evidence of regional wall motion abnormality, or elevated Troponin I and/or Troponin T levels in the absence of ST-segment elevation. Patients with previous coronary artery disease, recent blood transfusion, current iron therapy, unstable angina, or conditions known to elevate serum ferritin such as hemochromatosis, liver disease, tuberculosis, and chronic inflammatory disorders were excluded.

After enrollment, a detailed clinical history was obtained and all participants underwent general and systemic physical examination using a predesigned proforma. Demographic variables such as age and sex were recorded, along with conventional cardiovascular risk factors including hypertension, diabetes mellitus, dyslipidemia, smoking, and obesity. The diagnosis of AMI was established on the basis of clinical presentation, electrocardiographic findings, cardiac biomarker elevation, and echocardiographic assessment, as applicable. Laboratory investigations included complete blood picture, serum ferritin, lipid profile, renal function tests, and liver function tests. Electrocardiography was performed in all patients, and echocardiography was used to assess cardiac involvement. For the present analysis, special emphasis was placed on studying the relationship between serum ferritin levels and major cardiovascular risk factors such as hypertension, diabetes, dyslipidemia, smoking, and obesity in patients with confirmed AMI.

Serum ferritin estimation was carried out using the chemiluminescent immunoassay (CLIA) method based on the sandwich-CLIA principle. Chemiluminescence generated in the presence of ferritin-antibody complexes was measured by the immunoassay analyzer as relative light units, and ferritin concentration was derived by comparison with the standard calibration curve. Institutional Ethics Committee approval had been obtained before commencement of the study. Data were entered into Microsoft Excel and analyzed using SPSS version 21. Qualitative variables were expressed as frequency and percentage, while quantitative variables were presented as mean with standard deviation or median with interquartile range depending on normality distribution. The Shapiro-Wilk test was used to assess normality. Chi-square test or Fisher's exact test was used for comparison of proportions wherever appropriate, and the Mann-Whitney U test was applied for comparison of non-normally distributed continuous variables between groups. Spearman correlation analysis was performed to assess the relationship between serum ferritin levels and major risk factors. A p value of ≤ 0.05 was considered statistically significant.

Results

Among the 107 patients with acute myocardial infarction, hypertension emerged as the most common cardiovascular risk factor, being present in 64.5% of cases. This was followed closely by smoking in 63.6% of patients, while diabetes mellitus and dyslipidemia were each noted in 59.8% of the study population. Obesity was also highly prevalent and was observed in 57.9% of patients. Analysis of serum ferritin levels in relation to these risk factors demonstrated a significant positive association across all major variables studied. Patients with diabetes mellitus had substantially higher mean serum ferritin levels than non-diabetic patients (392.45 vs 273.67 ng/mL, p=0.001). Likewise, dyslipidemic patients showed markedly elevated ferritin levels compared to those without dyslipidemia (426.37 vs 223.18 ng/mL, p<0.001). Obese patients also had significantly higher mean ferritin values than non-obese individuals (416.29 vs 246.10 ng/mL, p<0.001). In addition, smokers demonstrated higher serum ferritin concentrations than non-smokers (387.56 vs 270.00 ng/mL, p=0.01). These findings indicate that serum ferritin was significantly associated with all major cardiovascular risk factors assessed, with the strongest associations seen in dyslipidemia and obesity, suggesting that ferritin may serve as a marker of cumulative cardiometabolic and inflammatory burden in patients with AMI.

Table 1: Distribution of cardiovascular risk factors in AMI patients

Risk factor	Present n (%)	Absent n (%)
Hypertension	69 (64.5)	38 (35.5)
Diabetes mellitus	64 (59.8)	43 (40.2)
Dyslipidemia	64 (59.8)	43 (40.2)
Obesity	62 (57.9)	45 (42.1)
Smoking	68 (63.6)	39 (36.4)

Table 2: Association between serum ferritin levels and cardiovascular risk factors				
Risk factor	**Group**	**Mean ferritin (ng/mL)**	**Median**	**p-value**
Hypertension	Yes	377.85	371	0.009
	No	284.55	212.65	
Diabetes mellitus	Yes	392.45	395	0.001
	No	273.67	210.8	
Dyslipidemia	Yes	426.37	419.7	<0.001
	No	223.18	205.9	
Obesity	Yes	416.29	416	<0.001
	No	246.1	202	
Smoking	Yes	387.56	338.1	0.01
	No	270	225	

Discussion

The present study showed that hypertension was the most frequent risk factor among patients with AMI, followed closely by smoking, diabetes mellitus, dyslipidemia, and obesity. This clustering is clinically important because AMI rarely develops in isolation and usually reflects the cumulative effect of multiple cardiometabolic and behavioral exposures. Within this context, serum ferritin may be interpreted not merely as an iron-storage marker, but also as an indicator of inflammation, oxidative stress, and metabolic dysregulation. Recent evidence has strengthened the biological plausibility of this concept. A systematic review in AMI reported that abnormal ferritin levels were linked to adverse short-term outcomes, while a Mendelian randomization study suggested a possible relationship between ferritin biology and myocardial infarction risk [4]. In parallel, a recent clinical study found that elevated ferritin was significantly associated with increased BMI, central obesity, dyslipidemia, and impaired glucose metabolism, supporting the view that ferritin may reflect cumulative cardiometabolic burden rather than isolated iron excess alone [5].

A notable observation in the present study was the significant association between ferritin and hypertension, along with higher ferritin concentrations in smokers than non-smokers. These findings are consistent with published evidence that ferritin correlates with vascular and inflammatory risk. A Korean study on adults found that higher ferritin levels were associated with higher blood pressure and greater odds of hypertension, while another study also demonstrated a significant relationship between ferritin quartiles and hypertension prevalence, especially in higher-risk working groups [6, 7]. Smoking can amplify this association through oxidative stress, endothelial dysfunction, and chronic inflammatory activation. Supporting this, a population-based Korean study showed that former or current smokers had higher ferritin concentrations than never-smokers, with ferritin increasing according to smoking amount. Therefore, the higher ferritin levels seen in hypertensive patients and smokers in the current study may reflect inflammatory iron sequestration and vascular stress superimposed on established cardiovascular risk states [6 – 8].

The association between ferritin and diabetes observed in this study is also biologically plausible and supported by recent literature. Diabetic patients had substantially higher mean ferritin levels than non-diabetics, suggesting a link between iron-related biomarkers and glycometabolic dysregulation. A 2024 study of adult patients with type 2 diabetes reported significantly elevated ferritin in uncontrolled diabetes and found positive correlations with HbA1c and fasting blood sugar [9]. However, the relationship between diabetes and iron indices may be modified by adiposity and underlying metabolic phenotype. In reproductive-aged women from the United States, obesity significantly modified the relationship between diabetes and iron biomarkers, indicating that ferritin should be interpreted within the broader context of body composition and inflammatory milieu [10]. This is relevant to the current study because obesity was also common and strongly associated with ferritin. In addition, national survey data published in 2025 found that higher ferritin levels were positively associated with greater total and trunk fat mass, reinforcing the concept that elevated ferritin may represent combined metabolic and inflammatory loading in AMI patients with diabetes and excess adiposity [11].

Among all risk factors assessed in the present study, the strongest ferritin association was observed with dyslipidemia and obesity. This deserves emphasis because dyslipidemia and obesity are central components of metabolic syndrome and major contributors to plaque vulnerability, endothelial dysfunction, and atherosclerotic progression. A 2024 retrospective cohort study among diabetic patients demonstrated a significant association between ferritin and lipid abnormalities, supporting the current finding that dyslipidemic individuals have markedly higher ferritin levels [12]. Earlier work from China similarly showed that ferritin was independently associated with metabolic syndrome and insulin resistance, and that ferritin rose as the number of metabolic syndrome components

increased [13]. More recent data from the VIKING Health Study suggested that the ferritin-metabolic syndrome relationship may even be non-linear in some populations, although extremes of ferritin remained associated with metabolic risk [14]. Taken together, these studies suggest that the elevated ferritin seen in obese and dyslipidemic AMI patients may capture an integrated signal of adiposity, lipid derangement, low-grade inflammation, and insulin resistance.

Clinically, the present findings suggest that serum ferritin may serve as a practical adjunct marker of cardiometabolic risk burden in AMI rather than simply an isolated biochemical abnormality. Because ferritin estimation is inexpensive and widely available, it may help identify AMI patients in whom traditional risk factors coexist with heightened inflammatory activity. Finally, ferritin is a nonspecific marker and must be interpreted cautiously, particularly because it is influenced by acute-phase responses, liver dysfunction, occult infection, and chronic inflammatory states. It is a hospital-based observational design also limits causal inference; it cannot determine whether higher ferritin directly contributes to atherosclerotic injury or merely reflects the metabolic and inflammatory environment in which AMI develops. Even so, the present findings align with broader evidence linking ferritin to obesity-related iron perturbation, metabolic syndrome, and poor cardiovascular risk profiles. Future studies using multivariable regression and longitudinal follow-up would clarify whether ferritin independently predicts recurrent events or adds incremental prognostic value over conventional AMI risk factors [4, 11, 12].

Conclusion

Serum ferritin levels were significantly higher in AMI patients with conventional cardiovascular risk factors such as hypertension, diabetes mellitus, dyslipidemia, smoking, and obesity. The strongest associations were observed with dyslipidemia and obesity, followed by diabetes, smoking, and hypertension. These findings suggest that elevated ferritin in AMI may reflect not only acute inflammatory activation but also the cumulative burden of underlying cardiometabolic risk. As serum ferritin estimation is simple, inexpensive, and widely available, it may serve as a useful adjunctive biomarker for identifying AMI patients with a high-risk metabolic profile in routine clinical practice, particularly in resource-limited tertiary care settings.

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