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General Medicine

SERUM FERRITIN LEVELS IN ACUTE MYOCARDIAL INFARCTION: AN EXAMINATION OF PROGNOSTIC SIGNIFICANCE

Dr Ramakrishna M.R.	Professor, Department of General Medicine
Dr Vaibhav N. Kshirsagar*	Junior Resident – 3rd Year *Corresponding Author
Dr Mohammed Naveed	Junior Resident – 3rd Year

ABSTRACT **Background:** While elevated serum ferritin levels have been linked to acute myocardial infarction (AMI), their prognostic value remains uncertain. This investigation examined serum ferritin concentrations in AMI patients and evaluated their clinical significance for prognosis. **Methods:** The study enrolled patients with confirmed AMI admitted to Navodaya Medical College Hospital and Research Centre, Raichur, alongside age and gender-matched control subjects. Serum ferritin measurements were obtained at hospital presentation and during 4-week follow-up visits. Researchers documented clinical characteristics, existing comorbidities, lifestyle habits, and echocardiographic parameters for comprehensive analysis. **Results:** AMI patients demonstrated significantly higher serum ferritin levels both at initial presentation (mean: 319.38 ± 94.75) and at 4-week follow-up (mean: 327.99 ± 105.81) compared to control groups ($p < 0.0001$). The elevated ferritin levels showed remarkable persistence throughout the follow-up period. However, serum ferritin concentrations did not vary significantly across different left ventricular ejection fraction categories ($p = 0.762103$). Additionally, common comorbidities including hypertension and diabetes mellitus, along with lifestyle factors such as smoking and alcohol consumption, showed no significant association with serum ferritin levels in the study population. **Conclusion:** This research demonstrates that serum ferritin levels are substantially elevated in AMI patients, with these elevations persisting at 4-week follow-up assessments. Despite these consistent elevations, ferritin levels showed no correlation with left ventricular ejection fraction measurements or common cardiovascular risk factors and comorbidities. The findings suggest that while ferritin elevation is a consistent feature of AMI, its relationship to cardiac function and traditional risk factors requires further investigation. Additional research is necessary to better understand these complex relationships and determine the potential prognostic utility of serum ferritin as a biomarker in AMI management and patient outcome prediction

KEYWORDS : Serum Ferritin, Acute Myocardial Infarction, Prognosis, Co-morbidities, Habits, Left Ventricular Ejection Fraction

INTRODUCTION

Cardiovascular diseases are the leading global cause of mortality, accounting for approximately 45% of deaths in industrialized nations with significant morbidity and rehospitalization rates [1]. Myocardial infarction (MI) is defined as myocardial cell death from prolonged ischemia due to inadequate oxygen supply [2]. Thrombotic cascades following atherosclerotic plaque rupture cause coronary occlusion, leading to myocardial necrosis and heart failure. Early intervention through fibrinolysis, bypass grafting, or percutaneous coronary intervention is critical [3].

Despite improved hospital care, acute MI remains life-threatening worldwide, requiring prompt primary intervention [4]. Patients present with persistent chest pain, nausea, and sweating, though 20-25% are silent. Troponin I and T are highly specific cardiac biomarkers for diagnosis [5].

Recent studies identified novel atherothrombotic risk factors including homocysteine, fibrinogen, inflammation, and oxidative free radicals [6]. Iron metabolism disturbances cause deficiency states independently associated with heart failure mortality [7]. Iron-induced oxidative stress contributes to coronary artery disease pathogenesis, particularly in South Asian populations [8]. Free iron catalyzes radical production, accelerating atherosclerosis and myocardial injury, with serum ferritin indicating carotid artery disease progression [9]. This study investigates serum ferritin levels in acute MI patients and explores its prognostic significance.

AIMS AND OBJECTIVES

Aim: "The aim of our study was to study the levels of serum ferritin in acute myocardial infarction and its prognostic importance"

Objectives:

1) To determine the levels of serum ferritin in acute myocardial infarction
2) To determine the prognostic importance of serum ferritin in acute myocardial infarction
3) To compare the relationship of serum ferritin with risk factors of acute myocardial infarction

MATERIALS AND METHODS

Myocardial infarction requires immediate treatment to prevent mortality. This study determined the prognostic importance of serum ferritin in acute myocardial infarction and compared its relationship with conventional risk factors.

Source of Data: Cases comprised patients admitted to general medicine wards at Navodaya Medical College Hospital and Research Centre, Raichur, with acute myocardial infarction. Controls included outpatient department attendees or admitted patients with no present or past myocardial infarction history.

Study Design: Hospital-based case-control study.

Study Duration: 18 months (1st January 2024 to 31st July 2025) at Navodaya Medical College Hospital and Research Centre, Raichur, Department of General Medicine.

Sample Size and Sampling Method

The sample size was calculated based on the formula used for sample size calculation for case-control studies:

$n = 2 \times [(Z_{\alpha/2} + Z_{1-\beta})^2 \times (\sigma)^2 / (m_1 - m_2)^2]$

Where:

$Z_{\alpha/2} = 1.96$ (confidence interval at 95%)

$Z_{1-\beta} = 0.84$ (power at 80%)

$\sigma = 34.88$ (standard deviation between cases and controls)

$m_1 = 170.21$ (Serum ferritin mean among cases)

$m_2 = 149.42$ (Serum ferritin mean among controls)

$m_1 - m_2 = 20.79$ (mean difference)

With a design effect of 2 and by substituting the values in the above formula, the sample size obtained was 88, which was rounded off to 100.

So, finally the sample size was estimated to be 100 cases and 100 controls and they were selected based on simple random sampling technique.

Sampling Procedure: Patients admitted to the medicine ward fulfilling inclusion/exclusion criteria were selected after obtaining informed written consent. Cases were recruited following clinical examination, ECG, and troponin I assessment. Age and gender-

matched controls were randomly selected from OPD attendees for minor ailments, routine check-ups, patient companions, or institutional staff, regardless of risk factors like hypertension, diabetes, or smoking history. Controls had no evidence of past or present acute myocardial infarction or coronary heart disease based on clinical examination and ECG findings.

Following recruitment and detailed study explanation, investigations included: 1) Complete blood count 2) ECG 3) Troponin I 4) Serum ferritin 5) Random blood sugar 6) HbA1c. Detailed history documented comorbidities (diabetes, hypertension, dyslipidemia) and habits (smoking, alcohol consumption). Serum ferritin levels were assessed at admission and after 4 weeks.

Inclusion Criteria

1. All diagnosed acute myocardial infarction cases which fulfils any of the following two criteria: Chest pain of duration less than 12 hours ST elevation in the ECG of more than 1 mm in at least two consecutive leads Elevated value of troponin I Presumably new onset bundle-branch block
2. Age of the cases and controls more than 18 years

Exclusion Criteria

1) Cases with high ferritin levels like haemochromatosis, liver diseases. Tuberculosis, chronic inflammatory diseases and those patients on iron therapy.
2) Control group patients with past or present history of acute myocardial infarction or any coronary heart diseases.

Ethical Clearance: Ethical clearance was obtained from institutional ethics committee, Navodaya Medical College Hospital and Research Centre, Raichur.

Data Analysis Plan: Data were coded and entered into MS Excel. Results were presented as rates, ratios, proportions using pie charts, bar diagrams, and line diagrams. Associations between variables were analyzed using chi-square test, t-test, and ANOVA. Statistical significance was set at $p<0.05$. EPI info software was used for analysis.

RESULTS

A total of 100 cases and 100 controls were included in this study. The demographic and clinical characteristics revealed important patterns across both groups. Age distribution showed that the highest concentration of participants was in the 41-50 years category, comprising 38 cases (38%) and 26 controls (26%). The 51-60 years group included 35 cases (35%) and 31 controls (31%), while participants >71 years represented 8 cases (8%) and 4 controls (4%). Gender distribution showed males constituting 78 cases (78%) and 71 controls (71%), while females comprised 22 cases (22%) and 29 controls (29%). The age and gender distribution between cases and controls was not statistically significant ($p = 0.169$ for age, $p = 0.632$ for gender), indicating appropriate matching between groups.

Regarding comorbidities, hypertension was present in 65 cases (65%) compared to 35 controls (35%) with p-value of 0.239. Diabetes mellitus was observed in 67 cases (67%) versus 33% in controls. Among lifestyle factors, smoking history was reported in 55 cases (55%) compared to 45 controls (45%), while alcohol consumption was noted in 57 cases (57%) versus 43 controls (43%), with p-value of 0.146 for habits.

Table 1: Demographic and Clinical Characteristics of Cases and Controls

Characteristic	Cases (n=100)		Controls (n=100)		p-value
	Number	Percentage	Number	Percentage	
Age					0.169
≤40 years	7	7%	10	10%	
41 to 50 years	38	38%	26	26%	
51 to 60 years	35	35%	31	31%	
61 to 70 years	12	12%	21	21%	
>71 years	8	8%	4	4%	
Sex					0.632
Male	78	78%	71	71%	
Female	22	22%	29	29%	

Vital signs analysis revealed significant differences between cases and controls. Systolic blood pressure showed 20 cases (20%) with readings <120 mmHg compared to 100 controls (100%). Blood pressure ranges of 121-140 mmHg were found in 15 cases (15%) versus 0 controls, while 35 cases (35%) had readings >141 mmHg compared to 0 controls ($p < 0.001$).

Table 2: Vital Signs Comparison Between Cases and Controls

Parameter	Cases (n=100)		Controls (n=100)		p-value
	Number	Percentage	Number	Percentage	
Pulse rate					<0.001
<60 bpm	0	0%	100	100%	
61 to 100 bpm	6	6%	0	0%	
101 to 120 bpm	94	94%	0	0%	
Systolic BP					<0.001
<120 mmHg	20	20%	100	100%	
121 to 140 mmHg	15	15%	0	0%	
>141 mmHg	35	35%	0	0%	
Hemoglobin					<0.001
<11 gm%	8	8%	0	0%	
>11 gm%	82	82%	100	100%	

The most significant finding was the substantial elevation in serum ferritin levels among cases compared to controls. At presentation, cases demonstrated a mean serum ferritin level of 319.38 ng/mL (SD ± 94.75) compared to controls with a mean of 183.78 ng/mL (SD ± 44.71), representing a highly statistically significant difference with t-value of 12.597 ($p < 0.0001$). At 4-week follow-up, cases maintained significantly elevated levels at 327.99 ng/mL (SD ± 105.81) compared to controls at 186.14 ng/mL (SD ± 41.94), with continued statistical significance showing t-value of 12.546 ($p < 0.0001$).

Table 3: Comparison of Serum Ferritin Levels between Cases and Controls

Time Point	Cases (n=100)		Controls (n=100)		t-test results
	Mean	SD	Mean	SD	(p-value)
At presentation	319.38	94.75	183.78	44.71	12.597 (<0.0001)*
At 4-week follow-up	327.99	105.81	186.14	41.94	12.546 (<0.0001)*

These results demonstrate significantly elevated and persistent serum ferritin levels in acute myocardial infarction patients, with marked differences in vital signs reflecting the acute pathophysiological state compared to healthy controls.

DISCUSSION

This study investigated serum ferritin levels in acute myocardial infarction patients. Results showed significantly elevated ferritin levels at presentation and 4-week follow-up compared to controls ($p < 0.0001$). No significant differences were found across left ventricular ejection fraction categories or with comorbidities like hypertension, diabetes, smoking, or alcoholism.

These findings align with previous research linking elevated ferritin to AMI risk, but uniquely demonstrate persistent elevation at follow-up. Unlike some studies, we found no correlation between ferritin and LVEF, possibly due to population differences.

Study limitations include small sample size and lack of assessment for dietary, lifestyle, or genetic factors.

CONCLUSION

Serum ferritin levels are significantly elevated in AMI patients with persistence at 4-week follow-up, suggesting potential utility as an AMI marker. However, prognostic significance remains uncertain, requiring larger studies with comprehensive assessment of confounding factors.

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