

Estimation of serum ferritin levels in patients of acute coronary syndrome

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Abstract

Objective: The objective of this study was to assess the serum ferritin levels in individuals diagnosed with acute coronary syndrome.

Methodology: This case control study was conducted in hospital. Overall 60 cases of coronary syndrome were admitted in ward while 60 healthy control were recruited after fulfilling the exclusion and inclusion criteria. For the sake of this investigation, a coronary syndrome is defined as a group of clinical symptoms that are typical of acute myocardial ischemia, such as unstable angina, non-ST elevation myocardial infarction (NSTEMI), and ST elevation myocardial infarction (STEMI).

Results: There was a statistically significant difference in the mean serum ferritin levels between the cases and controls. The cases exhibited greater levels of serum ferritin (mean = 369.87 ± 50.22 ng/ml) compared to the controls (mean = 189.34 ± 14.67 ng/ml). Males in the cases group exhibited significantly higher mean serum ferritin levels (445 ± 128.0 ng/ml) compared to females (227.2 ± 121.93 ng/ml).

Conclusion: In conclusion, a statistically significant difference observed in the serum ferritin levels between cases of acute coronary syndrome (ACS) and the control group, as shown by a P value of 0.001. The calculated odds ratio yielded a value of 1.6.

Keywords: Serum ferritin level, Acute coronary syndrome, Case bs control

INTRODUCTION:

India is currently in the forefront of global statistics in terms of the occurrence, prevalence, complications, and mortality rates associated with coronary artery disease. The incidence of this phenomenon has tripled during the past three decades [1]. India and other developing nations account for 80% of global cardiovascular-related mortality [2]. Acute myocardial infarction (AMI) incidence has been linked to a number of risk factors, such as smoking, hypertension, obesity, and dyslipidemia. In addition to the conventional risk factors, fatigue and insufficient sleep have been found to be significant risk factors for acute myocardial infarction (AMI) [3]. The elderly population has a higher prevalence of cardiovascular disease, which can occasionally present as acute coronary syndrome. An individual's susceptibility to cardiovascular disease is significantly influenced by their age [4]. According to certain research, serum ferritin may operate as a standalone predictor of the risk of AMI. An intracellular protein called serum ferritin is essential for keeping the balance of serum iron levels [5].

Particularly in the process of ATP synthesis by oxidative respiration within the mitochondria, the presence of serum iron is essential for promoting oxygen metabolism [6]. Strong evidence exists that oxidative free radicals contribute significantly to the aetiology of degenerative diseases like coronary heart disease (CHD), including coronary artery disease (CAD)[7]. Low-density lipoprotein (LDL) peroxidation increases in the presence of reactive free radicals, which increases the amount of LDL that macrophages absorb. The development of atherosclerosis and the formation of foam cells are both influenced by this intake [8-9].

Iron, an essential component of the diet, acts as a pro-oxidant. Elevated levels of blood ferritin, a marker of iron storage, have been identified as a potential emerging risk factor for coronary heart disease (CHD) [10]. Iron, which functions as a stimulant for the generation of free radicals, has been associated with lipid peroxidation and the development of atherosclerosis, ultimately resulting in myocardial infarction. The most prevalent manifestation of ACS is chest discomfort [11].

Anginal equivalents refer to symptoms that are indicative of myocardial infarction, apart from the typical presentation of angina [12]. The symptoms encompass dyspnea, nausea, epigastric discomfort, and weakness. These conditions are frequently observed in the aged population and individuals diagnosed with diabetes. Elderly individuals commonly have negative consequences as a result of acute coronary syndrome (ACS) owing to delays in identification and the presence of unusual symptoms. The diagnosis of acute myocardial infarction is established by considering the patient's medical history, including the presence of acute chest pain, in conjunction with the analysis of electrocardiogram (ECG) criteria and laboratory test results [13]. The electrocardiogram (ECG) continues to be an essential instrument in the detection and treatment of acute myocardial infarction. Hence, the objective of this study was to assess the serum ferritin levels in

individuals diagnosed with acute coronary syndrome.

METHODOLOGY:

This case control study was conducted in hospital of from December 2022 to June 2023. Overall 60 cases of coronary syndrome were admitted in ward while 60 healthy control were recruited after fulfilling the exclusion and inclusion criteria. The inclusion criteria of cases involved recently diagnosed cases of acute coronary syndrome while all the cases of liver cirrhosis, autoimmune diseases, patients having history of blood transfusion and iron therapy and haemorrhoids, and patients with haemochromatosis were excluded.

For the sake of this investigation, a coronary syndrome is defined as a group of clinical symptoms that are typical of acute myocardial ischemia, such as unstable angina, non-ST elevation myocardial infarction (NSTEMI), and ST elevation myocardial infarction (STEMI).

Unstable angina is defined as angina pectoris or comparable ischemic discomfort that occurs during periods of rest or with little physical activity, typically lasts longer than 10 minutes, becomes noticeably severe within the previous two weeks, and displays a crescendo pattern, manifesting as noticeably more intense, prolonged, or frequent episodes compared to previous episodes.

When a patient displaying the symptoms of unstable angina has myocardial necrosis, as evidenced by elevated levels of cardiac biomarkers, the diagnosis of non-ST segment elevation myocardial infarction (NSTEMI) is confirmed.

The electrocardiogram (ECG) criteria for diagnosing ST elevation myocardial infarction (STEMI) necessitates the observation of ST segment elevation in a minimum of two contiguous leads. This diagnosis is assigned in the absence of left ventricular hypertrophy and left bundle branch block.

Statistical analysis was done by using SPSS version 23.0. Chi square test and student t test was used to compare and interpret the data. Meanwhile, p value less than 0.05 was considered for representing statistical significance.

RESULTS:

A total of 120 people were included in the study, with 60 individuals diagnosed with ACS and the remaining 60 serving as age and sex matched healthy controls.

The investigation involved the examination and comparison of demographic profiles. The majority of patients diagnosed with ACS fell between the age range of 51 to 60 years, with a mean age of 56.21 ± 11.69 years. Among the 60 patients diagnosed with Acute Coronary Syndrome (ACS), a majority of 61.67% were male, while the remaining 38.33% were female. The average haemoglobin levels observed in these cases were 13.98 ± 1.61 g/dl.

The most prevalent risk factor detected was hypertension, closely followed by diabetes mellitus. Additional risk variables were dyslipidemia, tobacco use, and obesity. The average serum cholesterol levels were found to be significantly elevated in the cases group (220.41 ± 59.22 mg/dl) compared to the controls group (169.66 ± 14.64 mg/dl). The cases had significantly lower levels of serum high density lipoprotein (HDL) compared to the controls. The mean HDL level for cases was 39.76 ± 8.74 mg/dl, whereas the mean HDL level for controls was 54.20 ± 3.67 mg/dl.

The patients exhibited elevated serum LDL levels (mean LDL = 139.87 ± 56.7 mg/dl) in comparison to the controls (mean LDL = 96.70 ± 123.03 mg/dl). The average body mass index (BMI) of the patients was found to be higher, with a mean value of 24.93 ± 2.84 kg/m², whereas the controls had an average BMI of 23.24 ± 1.89 kg/m². The user's text is too short to be rewritten academically. The predominant form of acute coronary syndrome observed in the study was ST-segment elevation myocardial infarction (STEMI), accounting for 64.33% of cases. This was followed by non-ST-segment elevation myocardial infarction (NSTEMI) at 15.90%, while 15.0% of patients presented with unstable angina. The left anterior descending artery (LAD) was the vascular most frequently implicated, accounting for 44.9% of cases, followed by the right coronary artery (RCA). The left main coronary artery (LMCA), left anterior descending artery (LAD) in conjunction with the right coronary artery (RCA), and the RCA in conjunction with the left circumflex artery (LCX) were also implicated. A majority of patients diagnosed with ST-segment elevation myocardial infarction (STEMI), specifically 61.08% of them, underwent reperfusion treatment. A total of 32.99% of the patients received thrombolysis, whereas 25.39% got primary percutaneous coronary intervention. A total of 39.02% of cases were subjected to cautious management.

There was a statistically significant difference in the mean serum ferritin levels between the cases and controls. The cases exhibited greater levels of serum ferritin (mean = 369.87 ± 50.22 ng/ml) compared to the controls (mean = 189.34 ± 14.67 ng/ml). Males in the cases group exhibited significantly higher mean serum ferritin levels (445 ± 128.0 ng/ml) compared to females (227.2 ± 121.93 ng/ml).

A considerable proportion of individuals diagnosed with AS exhibited systolic dysfunction (85.0%) and diastolic dysfunction (71.90%). The prevalence of Type II diastolic dysfunction was found to be the highest. Systolic and diastolic dysfunction were identified in all 10 patients who experienced mortality. The statistical analysis revealed a significant association between the kind of diastolic dysfunction and mortality, while no significant association was found between systolic dysfunction and death. Out of the entire cohort of 51 individuals diagnosed with systolic dysfunction, it was observed that 38 patients, accounting for approximately 64.33% of the sample, exhibited elevated levels of serum ferritin. There was no observed correlation between serum ferritin levels and the presence of systolic or diastolic dysfunction. A considerable proportion of patients exhibited heart failure, with 41.66% of the population experiencing this condition. Among these patients, Killip class III was found to be the most prevalent. Among the participants, a substantial proportion (84.00%) exhibited elevated levels of serum ferritin.

A statistically significant correlation was observed between the Killip class of heart failure and serum ferritin levels. The p-value is less than 0.05. The majority of patients diagnosed with Acute Coronary Syndrome (ACS) experienced a hospitalisation period ranging from 5 to 6 days, whereas a significant proportion of these individuals exhibited elevated blood ferritin levels.

Elevated levels of serum ferritin were shown to be correlated with an extended duration of hospitalisation among individuals diagnosed with acute coronary syndrome (ACS). The obtained p-value is less than 0.05. Out of the observed total of 10 mortalities, it was found that 9 patients exhibited elevated levels of serum ferritin. However, the observed difference did not reach statistical significance. There was no observed association between elevated blood ferritin levels and death in patients with acute coronary syndrome (ACS).

Table 1: General characteristics and Serum ferritin levels of participants

	Case N (%)	Controls N (%)
Age		
> 70 years	7 (11.67%)	7 (11.67%)
61 to 70 years	18 (30%)	11 (18.33%)
51 to 60 years	24 (40%)	14 (23.3%)
41 to 50 years	11 (18.3%)	23 (38.33%)
30 to 40 years	0 (0%)	5 (8.33%)
Gender		
Male	37 (61.7%)	28 (46.67%)
Female	23 (38.33%)	32 (53.3%)
Serum ferritin level		
≥ 500	19 (31.67%)	1 (1.67%)
400 to 499	12 (20%)	0 (0%)
300 to 399	10 (16.67%)	4 (6.67%)
200 to 299	10 (16.67%)	18 (30%)
100 to 199	4 (6.67%)	25 (41.67%)
<100	5 (8.33%)	12 (20%)

Table 2: Association of Serum ferritin levels with Killip class of heart failure

Killip class of heart failure	Normal	Low	High
Class 4	1 (4%)	0	6 (24%)
Class 3	0 (0%)	0	11 (44%)
Class 2	1 (4%)	1 (4%)	4 (16%)
Class 1	1 (4%)	0	0

DISCUSSION:

The present investigation enrolled a cohort of 120 patients, consisting of 60 diagnosed cases of acute coronary syndrome and 60 age and sex matched healthy controls. The objective of this study was to investigate the potential association between serum ferritin levels and the risk of acute coronary syndrome.

In the current investigation, a majority of the patients diagnosed with acute coronary syndrome (ACS) fell within the age range of 51 to 60 years, constituting 40% of the total sample. Conversely, among the control group, the highest proportion of individuals belonged to the age range of 41 to 50 years, accounting for 38.33% of the sample. The average age of patients was 56.21 ± 11.69 years, whereas the average age of individuals in the control group was 57.23 ± 10.69 years. Among the

60 patients diagnosed with Acute Coronary Syndrome (ACS), 23 patients (38.33%) were identified as females, while 37 patients (61.67%) were identified as males. In comparison, the control group consisted of 32 females (53.33%) and 28 males (46.67%). The demographic characteristics of our research groups closely resembled those seen in a previous study conducted by Hoque et al [14]. In their investigation, the majority of instances of acute coronary syndrome (ACS) were found to occur within the age range of 50 to 59 years, accounting for 38.5% of the total cases. Out of the total number of cases, 44 individuals (67.7%) were identified as males, while 21 individuals (32.3%) were identified as females.

The average haemoglobin levels in the cases group were 12.71 ± 1.41 g/dl, whereas in the controls group, the average levels were 12.29 ± 1.48 g/dl. The findings presented by Herakall M and Biradar MS [5] align with the aforementioned results, as they reported mean haemoglobin levels of 12.59 g/d and 12.48 g/dl for patients and controls, respectively, which exhibited no statistically significant difference.

Among the traditional risk factors for acute coronary syndrome (ACS), hypertension was the most prevalent risk factor identified in the study group, with a prevalence rate of 70%. Following hypertension, diabetes mellitus was the second most common risk factor, observed in 56.67% of the study population.

Additional risk factors that were identified in the study included dyslipidemia, which was detected in 51.67% of the participants, smoking, which was reported by 35.0% of the individuals, and obesity, which was present in 15.0% of the subjects. The findings of this study exhibited a notable resemblance to the observations made by Hoque AT et al [14] wherein hypertensive individuals accounted for 72.34% of the patient population, whereas diabetics formed 60%. Dyslipidemia, smoking, and obesity were identified as significant risk factors in this study.

A comparison was made between the serum lipid profiles of the patients and controls. The average serum cholesterol levels in the cases group were 217.41 ± 63.22 mg/dl, while in the controls group, they were 167.66 ± 17.74 mg/dl. The average serum cholesterol levels were found to be significantly elevated in the cases group (220.41 ± 59.22 mg/dl) compared to the controls group (169.66 ± 14.64 mg/dl). The cases had significantly lower levels of serum high density lipoprotein (HDL) compared to the controls. The mean HDL level for cases was 39.76 ± 8.74 mg/dl, whereas the mean HDL level for controls was 54.20 ± 3.67 mg/dl. The patients exhibited elevated serum LDL levels (mean LDL = 139.87 ± 56.7 mg/dl) in comparison to the controls (mean LDL = 96.70 ± 123.03 mg/dl). There was a statistically significant difference.

The average body mass index (BMI) of the patients was 24.93 ± 2.84 kg/m, while the average BMI of the controls was 22.24 ± 1.56 kg/m. The presence of statistical significance indicated that obesity is a major risk factor for ACS. In a previous study conducted by Herakall M and Biradar MS [5], the average serum cholesterol levels in the groups of individuals with the condition being studied and those without the condition were found to be 242.8 ± 32.63 mg/dl and 189.4 ± 13.01 mg/dl, respectively. The study observed that the average body mass index (BMI) in patients and controls was 27.1 ± 3.77 kg/m² and 24.9 ± 3.73 kg/m², respectively.

In the present study, it was observed that 41.66% of the patients diagnosed with Acute Coronary Syndrome (ACS) had heart failure. Among these patients, it was shown that the most prevalent category of heart failure was Killip class III. According to a study conducted by Moradi et al [15], approximately 33.42% of patients exhibited indications of left ventricular failure in acute coronary syndrome (ACS). The left anterior descending artery (LAD) was shown to be the most often affected vessel in acute coronary syndrome (ACS), accounting for 45.0% of cases. This was followed by the right coronary artery (RCA), which was involved in 23.33% of cases. The left major coronary artery (LMCA) was found to be affected in 6.67% of the individuals. The left anterior descending artery (LAD) in conjunction with the right coronary artery (RCA) was observed in 5.0% of patients, whereas 8.33% of patients exhibited involvement of the RCA in combination with the left circumflex artery (LCX). The study conducted by Bonaca MP et al [16] reported similar findings, with the left anterior descending (LAD) artery being the vascular most frequently affected, followed by the right coronary artery (RCA) and the left circumflex artery (LCX). In the current investigation, the average serum ferritin levels among the patients were found to be 369.87 ± 50.22 ng/ml, whereas among the controls, the mean values were 181.27 ± 92.23 ng/ml. Among the instances of acute coronary syndrome (ACS), a total of 19 individuals, accounting for 31.67% of the sample, exhibited blood ferritin levels equal to or exceeding 500 ng/ml. Among the control group, a mere 1 patient, accounting for 1.67% of the total, exhibited serum ferritin levels exceeding 500 ng/ml. The observed discrepancy exhibited statistical significance, as indicated by a P value greater than 0.05. The odds ratio was determined to be 1.6. Individuals with elevated serum ferritin levels had a 60% higher likelihood of developing acute coronary syndrome (ACS) in comparison to those with serum ferritin levels within the normal range. The findings of this study exhibited a notable similarity to the research conducted by Herakall et al [5] wherein a considerably greater proportion of patients in the cases group displayed blood ferritin levels exceeding 300 ug/l in comparison to the control group. The cases group exhibited significantly higher mean serum ferritin levels compared to the control group (332.5 vs. 153.8 g/l) ($P < 0.05$).

CONCLUSION:

In conclusion, a statistically significant difference observed in the serum ferritin levels between cases of acute coronary syndrome (ACS) and the control group, as shown by a P value of 0.001. The calculated odds ratio yielded a value of 1.6. Therefore, it may be inferred that those with elevated blood ferritin levels are at a 60.9% higher risk of having acute coronary syndrome (ACS) compared to those with normal serum ferritin levels. Additionally, these patients are more susceptible to developing heart failure and experience longer hospital stays.

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