

SERUM FERRITIN – ROLE AND PROGNOSTIC IMPORTANCE IN ACUTE MYOCARDIAL INFARCTION

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ABSTRACT

Background: Cardiovascular diseases are leading cause of mortality globally, responsible for almost 45% of all deaths. Early treatment of myocardial ischemia is required to prevent necrosis, to have better improved outcome, still MI is a life-threatening disease worldwide. The cardiac biomarkers like troponin I and T are specific for myocardial injury, creatinine kinase is another important biomarker. Free iron is considered a catalyst of production of free radicals implicated in ischemia of myocardial damage. **Materials and Methods:** Patients attending the OPD or admitted in the department of General Medicine with history of acute myocardial infarction were enrolled. We chose 50 MI cases 50 control group after adequate matching. Controls did not have any present or past history/symptom of myocardial infarction. Serum ferritin levels and other important investigations were conducted and compared between cases and controls. Appropriate statistical tests were used to find the possible associations. **Result:** The mean age of our MI patients were 55.72 ± 8.63 years and mean age of control group was 52.73 ± 11.67 years with 63% males in MI group and 69% males in control group. Signs and symptoms of MI cases were ECG abnormality (92%), Troponin Positive (100%). Chest pain history (78%), Uneasiness history (55%), Sweating (32%), breathlessness history (24%). Mean systolic blood pressure of MI cases recorded was 143.56 ± 22.36 mmHg and mean diastolic blood pressure recorded was 88.32 ± 13.46 mmHg. **Conclusion:** Among MI cases, TLC, HbA1c, RBS, LDL, triglycerides and total cholesterol levels were significantly higher compared to control group. Serum ferritin levels were found to be very significantly higher among MI cases compared to control group, indicating importance of serum ferritin in cases of Myocardial Infarction.

INTRODUCTION

As per World Health Organization (WHO), Cardiovascular diseases are leading cause of mortality globally in the industrialized countries, responsible for almost 45% of all deaths, associated with high morbidity, mortality and high rate of rehospitalization.^[1] Myocardial infarction (MI) is defined pathologically as death of myocardial cell due to prolonged myocardial ischemia which is due to inadequate oxygen supply to myocardial cells.^[2] It has become clear over the past 50 years that a cascade of thrombotic events following the atherosclerotic plaque rupture results in occlusion of coronary artery which in turn interrupts the blood supply and oxygen to myocardium resulting in infarction, which further leads to necrosis of myocardium ultimately leading to heart failure. Hence early treatment of myocardial ischemia is required to prevent necrosis which involves fibrinolysis, coronary artery bypass

grafting, percutaneous coronary intervention, etc., to have a better improved outcome.^[3]

The rate of in-hospital mortality among patients with MI has decreased with the improved hospital care, but still acute myocardial infarction is a life-threatening disease worldwide and hence prompt revascularization with primary coronary intervention is critical.^[4] Patients with acute MI present with intense chest pain which is more persistent and often accompanied by nausea, sweating, while 20-25% of the MI's are silent. The cardiac bio-markers like troponin I and T are highly specific for myocardial injury and is the preferred biochemical marker for diagnosis of acute myocardial infarction. Creatinine kinase is another biomarker widely used.^[5] Over the past several years, many observational and epidemiological studies have identified new and potential factors for atherothrombotic vascular diseases. Levels of homocysteine, fibrinogen, infection and inflammation, atherogenic lipoprotein, elevated triglyceride and there is strong evidence

about oxidative free radicals. Iron is a dietary constituent and a pre-oxidant and a high concentration of blood ferritin is considered as a potential novel risk factor for coronary heart disease (CHD).^[6]

Metabolism of iron is important in order to maintain biological function and its disturbance leads to iron deficiency and iron deficiency is a prevalent comorbidity in heart failure and is independently associated with mortality and reduced functional capacity.^[7] The ability of iron to induce oxidative stress has been considered to be contributing to pathogenesis of coronary artery disease (CAD) and coronary heart disease is the leading cause of death in South Asian sub-continent. Dyslipidemia, physical inactivity, hyper-homocysteinemia, genetic, environmental and nutritional factors are associated with increased mortality.^[8]

Free iron is considered a catalyst of production of free radicals which has been implicated in ischemia of myocardial damage and peroxidation of lipid and free iron may accelerate progression of atherosclerosis and contribute to myocardial injury. Direct evidence of high stored concentration of iron increases the incidence of ischemic heart disease. Furthermore, serum ferritin was also observed to be one of the strongest indicators of presence and progression of carotid artery disease.^[9] In order to understand the importance of serum ferritin levels among patients presenting with acute myocardial infarction, we undertook this study to find out the levels of serum ferritin among patients with acute MI.

MATERIALS AND METHODS

Patients attending the OPD or admitted in the department of General Medicine at Chikkamagalur Institute of Medical Sciences with history of acute myocardial infarction were enrolled. We chose 50 MI cases 50 control group after adequate matching. Controls did not have any present or past history/symptom of myocardial infarction. MI cases were recruited once they were assessed by clinical examination, ECG and troponin I investigation. A detailed history was taken from the patients related to their co-morbidities like diabetes, hypertension, dyslipidaemia, also their history of smoking, alcohol consumption. Serum ferritin levels and other important investigations were conducted and compared between MI cases and control group. Appropriate statistical tests were used to find the possible associations.

RESULTS

The mean age of our MI patients were 55.72 ± 8.63 years and mean age of control group was 52.73 ± 11.67 years with 63% males in MI group and 69% males in control group. Signs and symptoms of MI cases were ECG abnormality (92%), Troponin Positive (100%). Chest pain history (78%), Uneasiness history (55%), Sweating (32%), breathlessness history (24%). Mean systolic blood pressure of MI cases recorded was 143.56 ± 22.36 mmHg and mean diastolic blood pressure recorded was 88.32 ± 13.46 mmHg. Lipid parameters were deranged among MI cases [Table 1]. The comparison of serum ferritin levels showed higher levels of serum ferritin among MI cases [Figure 1].

Table 1: Lipid parameters comparison between MI cases and control group

Sl. No	Lipid parameters	MI cases	Control group	p value
01	Total Cholesterol	228.56 ± 113.34	156.76 ± 67.43	<0.0001 *
02	Triglycerides	218.56 ± 96.32	132.44 ± 67.83	<0.0001 *
03	LDL	173.25 ± 65.22	121.56 ± 67.33	<0.0001 *
04	HDL	33.45 ± 5.28	32.88 ± 4.32	0.865 (NS)

(t test: NS is not significant, * is significant, at p value <0.05)

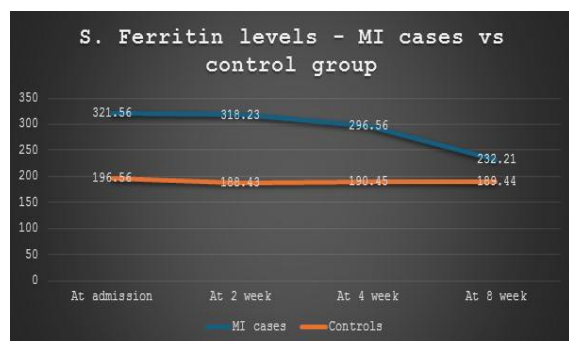


Figure 1: Serum ferritin levels

DISCUSSION

Iron accelerates oxidation of polyunsaturated fatty acids in LDL and high ferritin levels was observed among smokers and also among diabetic individuals. Hence there was a strong and independent relationship was established between high serum ferritin and acute myocardial infarction.^[6] Iqbal M P, et al., in their case control study which was matched for age and gender showed that high body iron status was associated with increased risk of premature incidence of acute myocardial infarction among Pakistani population.^[8]

Amar Z, et al., conducted a study to compare the profile of iron among patients with and without coronary heart disease and they revealed that patients

with coronary artery disease had higher levels of serum ferritin suggesting a potential role of ferritin which increases the risk of cardiovascular disease. Atherosclerosis is one of the causes of development of heart-related diseases and hence patients with raised levels of serum ferritin should consult physician to control their serum ferritin levels as they were at a greater risk of cardiac disorders.^[10] Ramesh G, et al., conducted a study in Telangana on finding the association between metabolic syndromes, level of hs-CRP and serum ferritin among young Asian patients aged less than 45 years presenting with acute myocardial infarction and they concluded that they found a significant association of risk factors namely MetS (syndrome X and insulin resistance syndrome) and levels of highly specific C reactive protein with acute MI and young individuals had higher prevalence of developing cardiovascular diseases. But in their opinion serum ferritin levels had a controversial association with acute myocardial infarction.^[11]

Khalili A, et al., in their study on association between serum ferritin and circulating oxidized LDL levels among patients with coronary artery disease concluded that serum ferritin levels among patients with coronary artery disease were substantially increased and posed as an additional risk factor for formation of atheromatic plaques and subsequent development of coronary artery disease.^[12] A meta-analysis on association of serum ferritin levels with acute myocardial infarction demonstrated that the serum ferritin levels in patients with acute myocardial infarction was higher compared to that of healthy controls, but the drawback was that there were no availability follow-up values of serum ferritin to compare post incidence of myocardial infarction.^[13]

Wolff et al., assessed intima-media thickness and plaque prevalence in the carotid arteries by high-resolution ultrasound among 2443 participants in a population-based study in Northeast Germany and on multivariate analysis it was seen that serum ferritin levels were not independently associated with carotid intima-media thickness among women or men and in contrast, the relationship between serum ferritin levels and carotid plaque prevalence was significant among men but not among women. However, a dose-response relation between serum ferritin levels and carotid plaque prevalence was seen where carotid plaque prevalence became greater with increasing serum ferritin levels, similar for women and men.^[14]

Morrison et al., assessed the relation of serum iron, dietary iron and use of iron supplements to the risk of incidence of fatal acute myocardial infarction among both men and women in a cohort study with 9920 participants, which revealed that both men and women in the highest serum iron category (≥ 175 $\mu\text{g/dL}$) experienced increased risk for fatal acute MI, whereas the authors found no important association between either dietary iron consumption or taking iron supplements and risk of fatal Acute MI.^[15]

Magnusson et al., investigated the association between iron and myocardial infarction in a randomly

selected group of Finnish men and women aged 25 to 74 years since 1983 in a follow up for 8.5 years and it was seen that 81 subjects experienced acute myocardial infarction out of which 63 were men and.^[18] women. Contrastingly they found that the total iron binding capacity was found to be a strong independent negative risk factor among men whereas ferritin and MI were not associated.^[16] Salonen et al., tested the hypothesis that the donation of blood might theoretically reduce the risk by lowering body iron stores by conducting a cohort study by following 2862 men aged 42 to 60 years for an average of almost nine years and it was found out that the blood donors had an 88% reduced risk of acute myocardial infarction compared with non-blood donors.^[17]

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CONCLUSION

Among MI cases, TLC, HbA1c, RBS, LDL, triglycerides and total cholesterol levels were significantly higher compared to control group. History of smoking and alcohol consumption, history of diabetes and hypertension, presence of Echo abnormalities did not make a significant difference in serum ferritin levels. Serum ferritin levels were found to be very significantly higher among MI cases compared to control group, indicating importance of serum ferritin in cases of Myocardial Infarction. Serum ferritin levels were significantly higher among MI cases during first visit and also at 4-week follow-up compared to control group.

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