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Serum Ferritin in Patients with Acute Myocardial Infarction

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***Abstract**: **Objective**: To determine the difference in serum ferritin level among Acute Myocardial Infarction (AMI) patients and healthy subjects.*
***Methods**: This hospital based case control type of analytic study was conducted between January 2015 to December 2015, evaluating serum ferritin of 50 patients of AMI and 50 healthy control subjects.*
***Results**: Mean serum ferritin was higher in MI patients (202.1±81.2 µg/L) as compared to controls (135.4±90 µg/L), and this difference was statistically significant (p<0.001). ROC curve analysis found that Serum ferritin level more than was145 µg/L was a good predictor of AMI with Sensitivity 74% and specificity 68%.*
***Conclusion:** Body iron (serum ferritin) was found to significantly higher in AMI and was a good predictor of AMI. They can be used as a simple and economical method for predicting an impending acute coronary event.*
***Key words**: Acute Myocardial Infarction, serum ferritin*

I. Introduction

Coronary artery disease (CAD) is one of the most common causes of mortality and morbidity in both developed and developing countries. It is a leading cause of death in India, and its contribution to mortality is rising: the number of deaths due to CAD in 1985 is expected to have doubled by 2015.(1) The conventional risk factors for CAD can be divided into non-modifiable and modifiable risk factors. The former include age, sex and family history, while the latter include diabetes mellitus (DM), smoking, dyslipidemia, hypertension and obesity.(2)

Over the past several years, observational and epidemiological studies have identified a host of new and potential risk factors for atherothrombotic vascular diseases. In this growing list of new and emerging risk factors, the entities like elevated blood levels of homocysteine, fibrinogen, inflammation and infection, atherogenic lipoprotein, elevated triglyceride, and number of genetic polymorphism are of particular interest. Apart from these, there is strong evidence that oxidative free radicals have a role in the development of degenerative diseases including coronary heart disease (CHD).(3,4)
In the early 1980's, Jerome Sullivan hypothesized that iron depletion might provide a protective mechanism in warding off heart disease. (5) He proposed the iron hypothesis based upon three logical reasons; myocardial failure was seen in iron storage diseases, increased stored iron was seen in men as they aged, and also in women after menopause. (6)
In explanation, iron is a mineral, vital to the body (7,8) however, when too much iron is taken into the body or when overload occurs due to another disorder, such as hemochromatosis, transferrin becomes saturated and free iron can be released. (7) The production of free radicals by free iron has been found in some studies to cause oxidative damage to the coronary arteries, and possibly oxidize LDL cholesterol, resulting in even more coronary damage. (8) Thus it is biologically plausible that iron may play a role in the development of a heart disease.
Since serum ferritin concentrations are directly proportional to intracellular ferritin concentration, it is considered to be the best clinical measure of body iron stores and the most feasible to use in epidemiologic studies. (9)
The role of ferritin in pathogenesis of coronary artery diseases (CAD) like acute MI (AMI), has generated considerable interest in recent times. There is a plethora of articles reporting the relationship between serum ferritin and AMI but with conflicting and contradictory results. Several studies have found significant associations between iron storage and atherosclerosis. (10, 11) Some studies are suggestive of a link between iron overload and myocardial infarction. (12,13,14,15,16) whereas many studies have found evidence that does not support the link between iron storage and coronary heart disease (17,18) or atherosclerosis(19, 20).
Limited attention has been paid to iron status in the absence of severe deficiency or overload, hence this study was conducted to evaluate serum ferritin level in AMI.

II. Methodology

This hospital based case control analytic study was done from January 2015 to December 2015, in Dept. of Medicine, SMS Medical College, Jaipur. The study protocol was approved by the Clinical Trial Screening and the Ethics Committee of the hospital, and written informed consent was obtained from all study subjects. Fifty patients of acute myocardial infarction and fifty age, sex and hemoglobin matched controls were taken in study. 25 males and 25 females were taken in both case and control group. All subjects were subjected to detailed history, physical examination and relevant investigations. Cases and controls were investigated for conventional risk factors (BMI, blood sugar, lipid profile). Study subjects were evaluated for serum creatine kinase-MB fraction (CK-MB),Trop-T, serum ferritin along with complete blood counts, renal function , liver function etc.

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III. Statistical Analysis

Data thus collected was entered in MS excel sheet and the data was analyzed using PRIMER and Med Calc.14.2.1.0 software. Quantitative data were summarized in form of mean and Standard Deviation and the difference in means was analyzed by using unpaired student's t test, while qualitative data were summarized in form of proportion. The difference in proportion was analyzed using Chi square test. Statistical significance was kept at $p < 0.05$. Receiver operating characteristic (ROC) curve analysis was performed to determine the predictive value of serum ferritin for AMI

IV. Results

In this study mean age of cases and control was 57.6±11.1 years and 54.8±11.2 years respectively. Age range in this study was 30-87 years. The mean hemoglobin of cases and controls was 14.15±0.81 gm% and 14.30±0.77 gm% respectively. No significant difference was observed between cases and controls in relation to age, sex and hemoglobin level.

Mean serum ferritin was higher in cases (202.1±81.2 µg/L) as compared to controls (135.4±90 µg/L). This difference was statistically significant. In ROC curve of serum ferritin level, the area under curve (AUC) was found to be 0.716 (95% confidence interval l=0.613 to 0.819). The optimal cut off value of serum ferritin level for predicting AMI was 145 µg/L (Sensitivity 74% and specificity 68%).

In present study, most (74%) of the MI cases had ferritin level >200 µg/L, while most (74%) of the control subjects had ferritin level below 200 µg/L. Serum ferritin level (>200 µg/L) was significantly associated with AMI ($P<0.01$). Median serum ferritin level of MI cases (211µg/L) was significantly higher than controls (111µg/L).).

In present study mean cholesterol level (mg/dl) among MI cases and controls was 230± 53.81and 200.48 ±50.96 respectively, and this difference was statistically significant. LDL cholesterol (mg/dl) level was also significantly higher among MI cases (126.44±49.54) as compared to controls (106.38±38.48). VLDL cholesterol (mg/dl) was also significantly higher in MI case (57.74 ± 22.35) as compared to controls (37.42 ±14.36). MI case had significantly higher serum Triglycerides (mg/dl) (173.1 ± 67.27) as compared to controls (112.52 ± 43.17). Serum HDL cholesterol level (mg/dl) was significantly lower among MI cases (36.92 ± 6.96) as compared to controls (44.06 ± 7.10).

V. Discussion & Conclusion

Present study found that mean serum ferritin was significantly higher in patient of AMI as compared to controls which was similar to studies done by Salonen et al[11] , Tuomainen et al.[12] , M.P. Holay et al[13] and Silvia WD et al[14]. This study found that most (74%) of the MI cases had ferritin level >200 µg/L, while most (74%) of the control subjects had ferritin level below 200 µg/L and Serum ferritin level (>200 µg/L) was significantly associated with AMI which was similar to findings of studies done by Holay et al[13], Kerstin Klipstein-Grobusch et al[10] and Salonen et al[11]. In present study median serum ferritin level of cases was significantly higher than controls. Studies done by Holay et al[13] and Kerstin Klipstein-Grobusch et al[10] also show significantly high median ferritin in AMI cases.

In this study along with serum ferritin other risk factors like diabetes mellitus, hypertension, body mass index, smoking, serum cholesterol, serum triglyceride, serum high-density lipoprotein (HDL), serum low-density lipoprotein (LDL) and serum very low density lipoprotein (VLDL) were significantly associated with AMI like in studies conducted by Holay et al[13], Silvia WD et al[14] and Salonen et al[11].

According to "iron hypothesis," iron is believed to be detrimental for the cardiovascular system in promoting atherosclerosis development and progression. Iron, in its catalytically active form, can participate in the generation of reactive oxygen species and induce lipid peroxidation, triggering endothelial activation, smooth

muscle cell proliferation and macrophage activation; all of these processes are considered to be proatherogenic. Patients with higher ferritin level can easily be identified during routine haematological analysis along with other risk factor estimation. Thus, in conclusion, serum ferritin may provide an important, simple, effortless, and cost effective tool, for predicting an impending acute coronary event.

Referances

[1]. Misra A, Nigam P, Hills AP, et al. Consensus physical activity guidelines for Asian Indians. Diabetes Technol Ther 2012;14:83–98
[2]. Reddy KS, Yusuf S Emerging epidemic of cardiovascular disease in developing countries. Circulation 1998;97:596–601
[3]. Aviram M. Modified forms of low density lipoproteins and atherosclerosis. Atherosclerosis 1993;98:1–9.
[4]. Oliver MF. Antioxidant nutrients, atherosclerosis and coronary heart disease. Br Heart J 1995;73:299–301.
[5]. D'Agostino RB, Grundy S, Sullivan LM, Wilson PW. Validation of the Framingham coronary heart disease prediction scores. Results from a multiple ethnic groups investigation. JAMA 2001; 286:180-187
[6]. Gropper SS, Smith JL, Groff JL. Advanced Nutrition and Human Metabolism. 5th ed.California: Wadsworth, Cengage Learning; 2009.
[7]. Corti MC, Gaziano M. Hennekens CH. Iron Status and Risk of Cardiovascular Disease. AEP. 1997; 1: 62-68.
[8]. Sung KC, Kang H, Shin HS. Relationship of Cardiovascular Risk Factors and Serum Ferritin with C-reactive protein. Archives of Medical Research. 2007;38:121-125.
[9]. Danesh J, Appleby P. Coronary Heart Disease and Iron Status. Circulation.1999;99:852-854.
[10]. Kerstin Klipstein-Grobusch, Johan F Koster, Diederick E Grobbee, Jan Lindemans, Heiner Boeing, Albert Hofman and Jacqueline CM Witteman Serum ferritin and risk of myocardial infarction in the elderly: theRotterdam Study Am J Clin Nutr 1999;69:1231–6. Printed in USA. © 1999 American Society for Clinical Nutrition.
[11]. Salonen JT, Nyyssonen K, Korpela H, Tuomilehto J, Seppanen R, Salonen R. High Stored Iron Levels Are Associated With Excess Risk of Myocardial Infarction in EasternFinnish Men. Circulation. 1992;86:803-811.
[12]. Tuomainen TP, Punnonen K, Nyyssonen K, Salonen JT. Association Between Body Iron Stores and the Risk of Acute Myocardial Infarction in Men. Circulation. 1998;97:1461-1466.
[13]. M.P. Holay, A.A. Choudhary, S.D. Suryawanshi Serum ferritin—a novel risk factor in acute myocardial infarction Indian Heart Journal 6402 (2012) 173–177
[14]. Delphine W, Silvia CR, Biswas S, Uthappa S, Shetty P. Ferritin—a potent threat for acute myocardial infarction. J Assoc Physicians (India) 2003; 51:947–50.
[15]. Mehran Haidari,Ebrahim Javadi,Arashmidos Sanati,Mehrdad Hajilooi and Jafar Ghanbili Association of Increased Ferritin with Premature Coronary Stenosis in Men: American Association for Clinical Chemistry 47:9 /1666–1672 (2001)
[16]. Sempos CT, Looker AC, Gillum RF, McGee DL, Vuong CV, Johnson CL. Serum Ferritin and Death from all Causes and Cardiovascular Disease: The NHANES II Mortality Study. Ann Epidemiol. 2000;10:441-448.
[17]. Yunker LM, Parbooshingh JS, Conradson HE, Faris P, Bridge PJ, Buithieu J, Title LM, Charbonneau F, Verma S, Lonn EM, Anderson TJ. The effect of iron status on vascular health. Vascular Medicine. 2006;11:85-91.
[18]. Moore M, Folsom AR, Barnes RW, Eckfeldt JH. No Association between Serum Ferritin and Asymptomatic Carotid Atherosclerosis. The Atherosclerosis Risk in Communities (ARIC) Study. AJE. 1995;141:719-723.
[19]. Sempos CT, Looker AC. Iron Status and the risk of coronary heart disease: an example of the use of nutritional epidemiology in chronic disease research. J Nutr Biochem. 2001;12:170-182.
[20]. Corti MC, Gaziano M, Hennekens CH. Iron Status and Risk of Cardiovascular Disease. Ann Epidemiol. 1997;7:62-68.

Table No-1 Comparison of groups according to mean Serum Ferritin

Group	No	Mean (µg/L)	std. deviation	P Value
Case	50	202.1	81.2	0.000
Control	50	135.4	90	

Table No-2 Comparison of groups according to Serum Ferritin Level

Ferritin	Case	Control	Grand Total	P Value
Normal < 200 µg/L	18	37	55	0.000
Raised ≥200 µg/L	32	13	45	
Grand Total	**50**	**50**	**100**	

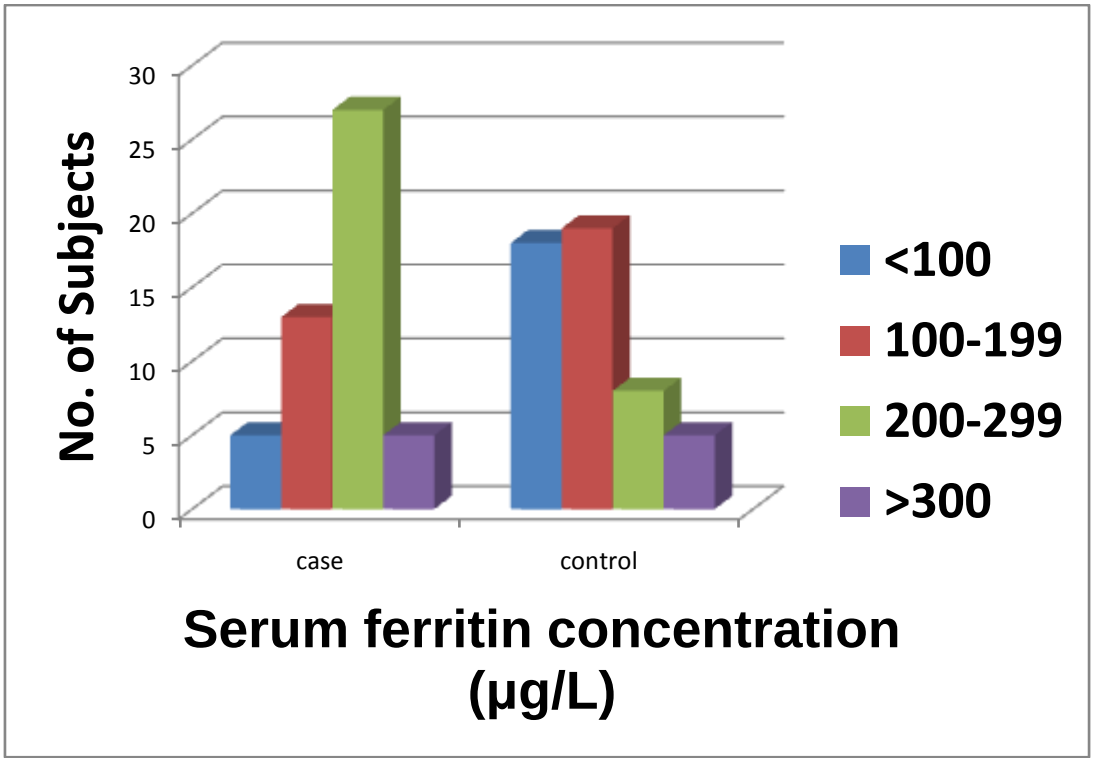
Table-3 distribution of study subjects according to ferritin level

Ferritin level (µg/L)	Case		Control		Grand Total	
	N	%	N	%	N	%
<100	5	10	18	36	23	23
100-199	13	26	19	38	32	32
200-299	27	54	8	16	35	35
≥300	5	10	5	10	10	10
Grand Total	**50**	10	**50**	36	**100**	**100**

Table 4 Comparison of groups according to Mean Parameters

SN	PARAMETER (mean)	CASES	CONTROLS	P-VALUE
1	**Age (years)**	57.6±11.1	54.8±11.2	0.212
2	**Hemoglobin (gm %)**	14.15±0.81	14.30±0.77	0.345
3	**BMI (Kg/m^2)**	26.72±4.34	23.62±3.06	0.000
4	**S. Total Cholesterol (mg/dl)**	230 ± 53.81	200.48 ±50.96	0.006
5	**Serum Triglyceride(mg/dl)**	173.1± 67.27	112.52 ± 43.17	0.000
6	**HDL(mg/dl)**	36.92 ± 6.96	44.06 ± 7.10	0.000
7	**LDL(mg/dl)**	126.44±49.54	106.38±38.48	0.026

8	**VLDL(mg/dl)**	57.74 ± 22.35	37.42 ±14.36	0.000



Distribution of study subjects according to ferritin level