

## Original Research Article

# Estradiol and lipid levels in men with acute myocardial infarction

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### ABSTRACT

**Background:** The incidence of myocardial infarction (MI) is more common in men when compared with women and women after menopause are at high risk of MI. This gender difference in CVD risk might be because of the difference in the circulating estrogen levels in men and women. Dyslipidemia is also one of the major causes of MI. The present study was aimed to estimate the levels of serum estradiol and serum lipids in newly diagnosed male MI cases and to find out any correlation between these two.

**Methods:** The study was conducted on 50 newly diagnosed MI admitted in Cardiology department Narayana general hospital and Medical College, Nellore. Only males were included in the study. Fifty age and sex-matched healthy individuals were selected as controls. Lipid levels are estimated by endpoint colorimetric assay (HUMANSTAR kit) and estradiol was estimated by Chemiluminescence immune assay (CLIA).

**Results:** Significantly raised levels of estradiol (p-value <0.0001) and low HDL cholesterol (p-value =0.0085) levels were noticed among the cases compared to controls. No significant correlation was observed between estradiol and lipoproteins (HDL and LDL).

**Conclusions:** The results of the present study in acute MI compared to controls show hyper estrogenemia in Male MI cases, which may be the underlying cause for thrombosis in acute MI. Decreased levels of HDL cholesterol are observed in the MI cases which are known to increase the risk of Atherosclerosis. No significant correlation were noticed between Estradiol and HDL cholesterol in men with acute MI.

**Keywords:** Cardiovascular disease, Estradiol, High density lipoprotein, Myocardial infarction

### INTRODUCTION

Ischemic heart disease and stroke are the main causes of mortality in India and more than 80% of cardiovascular deaths are caused by ischemic heart disease.<sup>1</sup> Sudden ischemic death of myocardial tissue is called myocardial infarction (MI).

Usually, MI is caused by thrombotic occlusion of the coronary vessel caused by the rupture of a vulnerable plaque.<sup>2</sup> The incidence of MI is more common in men when compared with women and women after menopause are at high risk of MI. This gender differences

in cardiovascular disease risk might be related to the difference in the circulating levels of estrogen between men and women.<sup>3</sup>

The protective effect of the female gender has mainly been attributed to an estrogen-mediated decrease in the incidence of atherosclerosis.<sup>4</sup> In women, estrogen acts as vasodilators in the peripheral and coronary circulations. Physiological levels of estrogen increase acetyl choline induced vaso-relaxation in the forearm and coronary vascular beds in postmenopausal women.<sup>5</sup> Thus estradiol performs a cardioprotective role in females. In healthy elderly men also when estrogen therapy was given

showed reduced homocysteine, fibrinogen and PAI-1 concentrations. Serum lipoprotein levels are also influenced favorably without increasing the concentrations of thrombotic risk factors. Animal experiments have also proved the administration of Estradiol decreasing the levels of homocysteine.<sup>6</sup>

In healthy male volunteers, a single dose of estradiol valerate significantly decreased p-selectin levels, this shows the antiatherogenic mechanism of estradiol importance in normal men.<sup>6</sup> Estradiol may also play a role in the control of the membrane protein p-selectin which tie up leukocytes to endothelial cells and activated platelets and thus play a role in atherosclerosis. Administration of synthetic estrogen mestranol in healthy men appears to lead to a significant decrease in plasma platelet activating factor (PAF) acetylhydrolase activity.<sup>7</sup>

The pathogenesis of acute myocardial infarction is multifactorial. However several studies have observed impaired lipid metabolism as one of the crucial causes for atherosclerosis. Excessive accumulation of lipids (mostly cholesterol esters) in macrophages and smooth muscle cells, resulting in the formation of foam cells is the main cause of atherosclerosis. High levels of Total cholesterol and LDL cholesterol and low levels of HDL cholesterol have conclusively linked with CHD incidence and mortality.

Bagatell CJ et al stated that physiological levels of estrogen have been reported to play a role in altering plasma lipoprotein concentration and thus exerts cardioprotective effects mainly against atherosclerotic plaque formation. One of the most favorable functions of estrogen is its effect on lipoprotein results in decreased LDL cholesterol and increase HDL levels.<sup>8</sup>

Estrogen deficiency-induced men have shown decreased plasma HDL and apolipoprotein, a levels.<sup>9</sup> So the present study was aimed to estimate serum estradiol and lipid levels in newly diagnosed myocardial infarction male subjects and to find out the correlation if any.

## METHODS

The present study was carried out on fifty newly diagnosed Myocardial Infarction (MI) patients admitted in cardiology department, Narayana Medical College, Nellore, Andhra Pradesh, India.

### Inclusion criteria

- Only male subjects ageing between 35 to 65 years.
- Healthy people of the same age and sex were selected as controls.

### Exclusion criteria

- Individuals with diabetes
- Renal or liver failure

- Patients with infectious diseases
- Chronic use of inflammatory drugs also smokers and alcoholics

The study was carried out for over a period of 6 months (2017 June to 2017 December). Fasting blood samples were collected from the subjects and controls. Lipid levels were estimated on the day of sample collection, Serum separated was stored at -30°C for estradiol estimation maximum for 3 months.

Serum total cholesterol, LDL, HDL, and TGL were estimated by commercially available kits. Serum estradiol was estimated by the chemiluminescence immunoassay (CLIA) technique.

### Principle and method of the procedure used for examinations

The access estradiol assay is a competitive binding immunoenzymatic assay. A sample is added to a reaction vessel with paramagnetic particles coated with goat anti-rabbit: rabbit anti-estradiol and a TRIS-buffered protein solution. After 20 minutes, estradiol alkaline phosphatase conjugate is added. Estradiol in the sample competes with the estradiol-alkaline phosphatase conjugate for binding sites on a limited amount of specific anti-estradiol antibody. Resulting antigen:antibody complexes are bound to the capture antibody on the solid-phase. After incubation in a reaction vessel, materials bound to the solid phase are held in a magnetic field while unbound materials are washed away. Then, the chemiluminescent substrate Lumi-Phos\* 530 is added to the vessel and light generated by the reaction is measured with a luminometer. The light production is inverse! proportional to the concentration of estradiol in the sample. The amount of analyte in the sample is determined from a stored, multi-point calibration curve.

## RESULTS

The statistical analysis was done using the SPSS 25 software. All the Biochemical parameters are expressed as mean±SD. Pearson correlation coefficient test was done to see the correlation between estradiol and lipids (HDL and LDL). P value of <0.05 was considered as significant.

Serum estradiol levels are elevated significantly in MI cases compared with the controls HDL cholesterol levels in cases are significantly decreased when compared with the controls.

Serum estradiol, total cholesterol and LDL cholesterol are elevated in cases than controls but statistically significant only for estradiol. HDL cholesterol levels in cases are significantly decreased when compared with the controls.

A negative correlation between HDL cholesterol and estradiol was observed ( $r = -0.1778$ ) and it is statistically

not significant. LDL levels are not significantly correlated with serum estradiol levels.

**Table 1: Comparison of estradiol and lipids between cases and controls.**

Parameter	Cases Mean±SD	Controls Mean±SD	p value (<0.005) significant
Estradiol	37.0±8.8	19.9±3.12	(p <0.0001)
HDL	39.4 ± 6.6	43.38 ± 8.11	(p = 0.0085)
Total cholesterol	179 ± 35.0	153 ±20.7	(p >0.05)
LDL	100.8± 16.7	100.76±19.02	(p >0.05 )

Correlation was done by using Pearson correlation test and the 'r' values for estradiol and HDL is 0.1778, estradiol and LDL is 0.01.

## DISCUSSION

The results of the present study show hyper estrogenemia in diagnosed acute MI in men. MI usually the result of two main processes, CAD and thrombosis. Estrogen administration to men has been reported to provoke thrombosis.<sup>10</sup> Hyper estrogenemia reported in men may be related to the thrombosis of MI. Studies have shown that patients with high estradiol levels at the time of MI might be liable to a higher risk of ventricular fibrillation and sudden death.<sup>11</sup> Estradiol might provoke thrombosis through a different mechanism of interest. Hyper estrogenemia has also been implicated in coronary spasm and ventricular arrhythmias that may accompany coronary thrombus formation.<sup>12</sup> Kaltua AA, et al observed that estradiol increases the synthesis and synaptic activities of adrenergic neurotransmitters. Adrenergic stimulation plays an important role in different cardiac disease.<sup>13</sup> Blocking of adrenergic receptors shown to decrease the incidence of ventricular arrhythmias, rate of reinfarction and sudden death in the survivors of AMI.<sup>14</sup>

Greengrass PM, et al stated that high levels of estradiol in the acute phase of MI may because of enhanced conversion of testosterone into estradiol.<sup>15</sup> High serum levels of HDL are associated with reduced risk for the development of the atherosclerotic disease and also HDL particles are believed to be antiathero-genic, secondary to their capacity to drive reverse cholesterol transport and antagonize pathways of inflammation, thrombosis, and oxidation.<sup>16,17</sup> In the present study decreased HDL levels were observed which are non-significantly negatively correlated with estradiol this finding was similar with the other studies.<sup>18</sup>

## CONCLUSION

The study concluded that hyper estrogenemia is the cause of MI. In the present study, negative correlation between

estradiol and HDL was observed which was not statistically significant and LDL cholesterol was nonsignificantly positively correlated with estradiol.

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