Original Article

Association of Leucocytosis And Development of Early Left Ventricular Systolic Dysfunction in Patients With Acute Myocardial Infarction

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Objective: To assess the association between leucocytosis and development of early left ventricular systolic dysfunction in patients presenting with first episode of acute myocardial infarction.

Methods: 100 patients presenting with AMI were included in this case control study, conducted at Coronary Care Unit of Services Hospital Lahore from March, 2015 to September, 2015. Blood samples obtained in the first 24 hours after the onset of pain were analyzed for cardiac enzyme levels and cell count. Echocardiography was performed on days 3-5. Patients with LVEF < 40% were assigned to the left ventricular systolic dysfunction group (n = 50) and those with LVEF ≥ 60% were taken as controls (n = 50).

Results: The mean age in the sampled population was 57.36 ± 7.344 years. 22(44%) of the patients who developed LVSD had Leucocytosis, while only 07 (14%) patients in the control group had leucocytosis. The association between leucocytosis and LVSD in patients with AMI was statistically significant (Odds ratio = 4.827 95% CI 1.821 12.791, p = 0.001). There was no effect of gender, diabetes mellitus, hypertension and Hyperlipidemia on the association.

Conclusions: It is concluded that there is a strong association between Leucocytosis and development of early LVSD in patients presenting with AMI.

Keywords: Leukocytosis, Left ventricular systolic dysfunction, acute myocardial infarction.

Introduction

Acute myocardial infarction (AMI) is a major public health problem in the industrial as well as developing world. AMI has become one of the leading causes of morbidity and mortality in Pakistan. One of the major complications of AMI is heart failure (HF). Despite substantial progresses in the diagnosis and treatment of AMI, about 22% of men and 46% of women suffering from an AMI will be disabled with HF within six years. Left Ventricular Systolic Dysfunction (LVSD) is the single most common cause of heart failure after myocardial infarction. The underlying cause is myocardial necrosis leading to the inability of the left ventricle to pump sufficient blood into the circulation. It is classically defined as an ejection fraction of less than 40%. About 40% of patients with an AMI develop LVSD with or without signs of HF, which adversely influences quality of life, hospitalization rates, and mortality.[3]

Patients with LVSD early after AMI are at a greatly increased risk of major cardiac adverse events such as re-infarction, HF, cardiogenic shock, sudden death and increased short and long term mortality.[3] thus necessitating earlier diagnosis and initiation of appropriate therapy.

According to literature, AMI is usually accompanied with peripheral leucocytosis. There is intense systemic activation of leucocytes in patients with acute coronary syndrome, resulting in release of a variety of proteolytic enzymes including elastase and myeloperoxidase , with potential for tissue destruction.[5] Elevated leucocyte count is associated with higher rates of mortality and adverse events in patients with acute coronary syndrome.[6] Various studies have shown that leucocytosis in the acute phase of MI is associated with the development of HF.

This study assessed the association between high Total Leucocyte Count and development of early Left ventricular systolic dysfunction in patients with Acute Myocardial Infarction, both STEMI and NSTEMI. As early bedside echo is generally not available in public hospital, a complete blood examination is a cheap, quick and widely available test to identify patients at higher risk for early left ventricular systolic dysfunction requiring earlier diagnostic and therapeutic interventions, thus preventing short and long term morbidity and mortality due to LVSD after AMI.

Methods

Hospital Lahore, were enrolled in the study. Informed consent was obtained from all patients. ECG was done. Echocardiography was performed on all patients, after stabilization on 3rd post admission day. The first 50 patients having Left Ventricular Ejection Fraction ≤ 40% i.e. having Left ventricular systolic dysfunction, were assigned to the "Case" group and 50 patients having Left Ventricular Ejection Fraction ≥ 60% were assigned to the "Control" group. Blood samples for CBC and cardiac Enzymes were taken within 6 to 24 hours of presentation. Leucocyte count was analyzed by an automated hematology analyzer. Data collected was entered and analyzed in the SPSS version 17. Mean with standard deviation was calculated for quantitative variables e.g. Age, leucocyte count, and frequencies and percentages in case of categorical variables e.g. Gender, Leucocytosis. Odds ratio was calculated to seek significant association between leucocytosis and development of left ventricular systolic dysfunction in patients with acute myocardial infarction. Chi square test and Fisher's exact test were used to assess statistical significance. A p value <0.05 was taken as significant. Odds ratio ≥ 1 was considered significant. Data was stratified for Age, Gender, type of MI, history of Diabetes Mellitus, Hypertension and Hyperlipidemia, to deal with effect modifiers. Post stratification Odds ratio was also calculated.

Results

100 patients, with and without development of LVSD following an Acute MI, were included in the study.

They were divided into two equal groups i.e. 50 patients with LVSD were included in the "Case" group and 50 patients without LVSD were assigned to the "Control" group. There were 32 (64%) males in case group compared to 33 (66%) in Controls and 18 (36%) vs. 17 (34%) females in Case and Control group respectively (p = 0.834)Table I.

Patients from the case and control group were also compared with regard to major cardiac risk factors such as Diabetes mellitus (62% vs. 58%; p = 0.683) [Table II], Hypertension (58% vs. 56%; p = 0.840) [Table III],and Hyperlipidemia (62% vs. 58%; p = 0.683) respectively [Table IV].

When we compared leucocytosis with the development of LVSD in patients with Acute MI, 22(44%) of patients who developed LVSD had Leucocytosis, while only 07 (14%) patients in the control group had leucocytosis. The association was statistically significant. (Odds ratio = 4.827 95% CI 1.821 12.791, p = 0.001)[Table V].

Table-1: Cross tabulation between Gender and Left Ventricular Systolic Dysfunction.

		Left Ventricular Systolic Dysfunction		
		No	Yes	Total
Gender	Female	17	18	35
	Male	33	32	65
	Total	50	50	100

Using chi square test, p value= 0.834 (non-significant)

Table-2: Cross tabulation between Left Ventricular Systolic Dysfunction and Diabetes Mellitus.

		Left Ventricular Systolic Dysfunction		
		No	Yes	Total
Diabetes Mellitus	No	21	19	40
	Yes	29	31	60
	Total	50	50	100

Using chi square test, p value= 0.683 (non-significant)

Table-3: Cross tabulation between Left Ventricular Systolic Dysfunction and Hypertension.

		Left Ventricular Systolic Dysfunction		
		No	Yes	Total
Hypertension	No	22	21	43
	Yes	28	29	57
	Total	50	50	100

Using chi square test, p value = 0.840 (non-significant)

Table-4: Cross tabulation between Left Ventricular Systolic Dysfunction and Hyperlipidemia.

		Left Ventricular Systolic Dysfunction		
		No	Yes	Total
Hyperlipidemia	No	21	19	40
	Yes	29	33	60
	Total	50	50	100

Using chi square test, p value = 0.683 (non-significant)

Table-5: Cross tabulation between leucocytosis and left ventricular systolic dysfunction.

		Left Ventricular Systolic Dysfunction		
		No	Yes	Total
Leucocytosis	No	43	28	71
	Yes	07	22	29
	Total	50	50	100

Using chi square test, p value = 0.001, (statistically significant), odds ratio=4.827

Discussion

In this study, we sought to assess the association between leucocytosis and development of early Left Ventricular Systolic Dysfunction in patients who presented for the first time with an Acute MI. We found that the finding of Leucocytosis in the initial blood sample of patients presenting with an AMI was significantly associated with development of early LVSD in these patients as assessed by Echocardiography showing an ejection fraction of less than 40 %.

Other studies have also shown similar results, further supporting our findings. Eskandarian R. and colleagues, in their case control study, showed that Leucocytosis and neutrophilia in the acute phase of MI are important predictive factors for the development of LVSD. Leucocytosis was higher in patients with systolic dysfunction (47.8%) when compared with the controls (20.3%), and was significantly associated with the development of LVSD (p = 0.001). They proposed that Leucocytosis can be used for risk stratification of such patients.[9]

In a cross sectional study by Jan A et. al carried out at the National institute of Cardiovascular Diseases (NICVD), Karachi from June to August 2010, in which 200 patients with diagnosis of STEMI were included. Out of 91 patients who developedCHF 61(67%) had high TLC (>11000 mm3), while 30 (33%) had normal (<11000 mm3) TLC.Significant association (P<0.008) of high TLC with development of CHF was observed.[5]

Menon et al. in their large observational study consisting of 3,796 men and 2,734 women of all ages, also found that the peripheral total leukocyte count is strongly associated with the development of heart failure, cardiogenic shock, and death during hospitalization for AMI, with the patients in the upper most quintiles of WBC count at an increased risk for heart failure (odds ratio [OR] 2.77, 95% confidence interval [CI] 2.33 to 3.31).

Nunez et al. and Barron et al. also reported similar association between high total leucocyte count and heart failure after acute myocardial infarction.

We found in our study that the association of leucocytosis with LVSD in patients with AMI was significant in both genders and in patients with and without the major risk factors for coronary artery disease i.e. Diabetes, hypertension and Hyperlipidemia.Our study had several limitations, including a smaller sample size along with non-representative sample from a tertiary care hospital. Leucocyte count was measured once, and this point (although within 24 hours of symptom onset) was not consistent in all patients studied. Serial Leucocyte counts may be more helpful in identifying high-risk individuals early. Further studies in this regard should be encouraged.

Conclusion

It is concluded that there is a strong association between leucocytosis and development of early left ventricular systolic dysfunction in patients presenting with an Acute Myocardial Infarction. CBC is an easily available, cheap and quick laboratory test and we propose that it can be used for early stratification of patients presenting with AMI into groups at higher risk of developing LVSD which may help in earlier intervention and decrease in morbidity and mortality.

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Answer Picture Quiz

The two A1: An incinerator

A2: Incineration is one of the most effective methods available for biomedical waste treatment. It reduces the volumes of the waste 85-95% and infectious potential up to 99% at standard operational level. This helps in reducing the requirement of space for landfill, less transportation and handling costs and more importantly avoiding the illegal and unsafe practices of scavenging, reusing and recycling of the waste items. These practices are increasingly associating with increasing incidence of viral diseases like Hep. B, C and HIV.

A3: One of the measurable disadvantages is operational cost among other being adverse environmental health effects of toxic emissions (gases and ashes). Though, that level of consciousness is mainly the issue of the developed world up till now.

A4: The Environmental Protection Council Punjab (PEPC) has approved the operational standards and acceptable limits of emissions via Notification No.SO(G)/EPD/7-26/2013 published in and as extra ordinary issue of The Punjab Gazette August 15, 2016. Being a recommended method of biomedical waste management by Environmental Protection Department (EPD) Punjab, an agreement between both administrative prongs of health (P&SH and SHC&ME) urging all the segregated biomedical waste be incinerated by using the incineration facilities under the operational control of both, interchangeably, where requires.

A5: The following hospitals working under SHC&ME department have incinerators installed:

1. Bahawal Victoria Hospital Bahawalpur
2. Sheikh Zayed Hospital Rahim Yar Khan
3. DG Khan Teaching Hospital DG Khan
4. DHQ Hospital Faisalabad
5. Ghulam Muhammad Abad Hospital Faisalabad
6. Allied Hospital Faisalabad
7. Allama Iqbal Memorial Hospital Sialkot
8. Nishter Hospital Multan
9. Holy Family Hospital Rawalpindi
10. DHQ Teaching Hospital Sargodha
11. DHQ Hospital Sahiwal
12. Sheikh Zayed Hospital Lahore
13. Children Hospital Lahore

Picture downloaded from URL: http://www.china-incinerator.com/double-chamber-incinerator/

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