Research Article

Association between Raised Neutrophil Count and Congestive Heart Failure in Patients with Acute Myocardial Infarction

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Abstract

Background: Myocardial infarction (MI) is usually accompanied with raised neutrophil count (NC) that results in higher rates of short-term post-MI adverse outcomes and chronic heart failure (CHF).

Objective: The objective of this study is to assess neutrophil count as predictor of CHF development in patients presenting with acute myocardial infarction (AMI).

Methods: This cross sectional study was conducted at Department of Medicine, Mayo Hospital, Lahore for six months. After ethical approval, 180 cases of ages 30-80 years with either gender diagnosed with acute myocardial infarction presenting within 12 hours of onset, without any evidence of heart failure were enrolled by non-probability purposive sampling technique. All patients' neutrophil count was checked & was followed up for next four days for signs and symptoms of Heart Failure according to Framingham criteria. Data was analyzed through SPSS-20 & Chi-Sq. test was used to compare the frequency of CHF in patients with Raised NC and Normal NC.

Results: Mean age of the patients was 57.5$\pm$9.83 years. There were 53.89% (n=97) males and 46.11% (n=83) females. 76.11% patients (n=137) had raised neutrophil count and 23.89% (n=43) had normal neutrophil count. Among patients with raised NC, 53.89% (n=97) developed CHF.

Conclusion: Raised neutrophil count is a good predictor of CHF in patients of acute MI.

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Introduction:

Acute Myocardial Infarction (AMI) is the most important cause of mortality and morbidity worldwide.[1] Coronary atherosclerosis is the leading cause of almost all myocardial infarctions.[2, 3] The mortality & morbidity in these patients is attributed to certain cardiovascular complication like CHF, arrhythmias & cardiogenic shock. The risk of these complications can be predicted by certain raised inflamematory markers. These include troponin, B type natriuretic peptide, C - reactive protein (CRP), interleukin 6 and leukocyte count especially neutrophils. Leukocyte count is part of routinely performed complete blood count & is available everywhere.[4]

Leukocytosis occurs as a result of systemic inflamematory response in infarcted myocardium.[5] Neutrophils are the first leukocytes to invade involved myocardium.[6] These liberate a number of proteolytic enzymes including elastase and myeloperoxidase leading to myocardial destruction.[7] The inflammatory cascade stimulates release of cytokine which discourage adhesion of Neutrophils to the damaged vessels and accelerates bone marrow to release more neutrophils in blood.[8] A study, conducted on 150

AMI patients reported that in patients with acute myocardial infarctions 91 (60.60%) had raised neutronphil count (> 65% of total leukocyte count) and in those patients 58 (63.74%) developed congestive heart failure (CHF), whereas 33 (36.26%) did not develop CHF. In that study 59 (39.33%) patients had normal NC & out of those only 4 (6.78%) developed CHF and 55 (93.22%) did not develop CHF.[9] So there was large number of patients with raised NC who developed CHF than those with normal NC. This indicates that raised NC is a very good predictor of CHF in AMI patients.

Another study conducted on 200 AMI patients reported that 163 (81.5%) patients had raised NC, out of these 81 (49.69%) developed CHF, 72 (44.17%) did not develop CHF, and 10 (6.13%) expired. Whereas 37 (18.5%) AMI patients had normal NC, but 10 (27.03%) developed CHF, 26 (70.27%) remained free of CHF, and 1 (2.70%) expired.[10] This study concluded that CHF was higher in AMI patients with raised NC as well as those with normal NC. This study gave an impression that frequency of post – MI CHF was high in patients with raised neutrophil count hence it predicted the risk of CHF very well.

There is not much work done on association between raised neutrophil count & CHF. That is why we conducted this study to find out clearly the predictive value of raised NC in AMI patients for the development of heart failure, to identify high risk patients on earlier basis for aggressive management.

Methods:

This was a Cross-Sectional study done at Department of Medicine, KEMU, Mayo Hospital, Lahore for 6 months from 1st July 2016 to 30th December 2016. After ethical approval, 180 diagnosed cases of AMI (WHO criteria: Clinical history of more than 20 minutes typical chest pain with ECG changes of ST-segment elevation of ≥ 1mm in two or more contiguous limb leads or ≥ 2mm in precordial leads or new onset left bundle branch block and raised serum cardiac biomarkers) aged 30-80 years with either gender presenting within 12 hours onset, without any evidence of heart failure[11] were recruited using 95% confidence level, 6% margin of error taking an expected percentage of raised NC as 81% in case of AMI by Non-Probability, Purposive sampling technique. All patients after 12 hours of onset of AMI or with CHF, uncontrolled diabetes mellitus or hypertension at presentation or any prior history of MI, infection, active malignancy or ongoing chemotherapy, gastrointestinal hemorrhage, statin therapy or deranged LFTs or RFTs were excluded. After Informed consent, demographic details (name, age, sex, contact) were taken. Venous blood samples were drawn for analysis of neutrophil count & sent to college laboratory (raised neutrophil count was taken as > 65% of total leukocyte count). Patients were admitted and followed up in the ward/ICU for next four days, where evaluation for signs and symptoms of Heart Failure according to Framingham criteria was done. All this information was noted on predesigned proforma. Data was analyzed through SPSS-20. Quantitative variables like age and neutrophil count were calculated as mean and standard deviation. Qualitative variables like gender, Neutrophil count level (raised / normal) and CHF was calculated as frequency and percentage. Chi-Sq. test was used to compare the frequency of CHF in patients with Raised NC and Normal NC. After stratification for age and gender, Chi-Square test was applied taking P-value ≤ 0.05 as significant.

Results:

The mean age of the patients was 57.5 ± 9.83 years. There were 26.67 % (n = 48) patients between 30-50 years while 73.33% (n = 132) were between 51-80 years of age. There were 53.89% (n = 97) males and 46.11% (n = 83) were females. Mean neutrophil count was in our study was 8930.428 ± 2906.04. (Table No. 1)

Out of 180 patients of acute myocardial infarction 76.11% (n = 137) had raised neutrophil count and 23.89 % (n = 43) had normal neutrophil count. (Figure No. 1)

Out of these 53.89% (n = 97) developed CHF and 46.11% (n = 83) had no findings of CHF. Among 97 (53.89%) CHF patients 95.86% (n = 93) had raised NC while 4.12% (n = 4) had normal NC. (Table No. 2)

Table 1: *Demographics of patients (n=180)*

Age	Frequency	Percentage
30-50	48	26.67
51-80	132	73.33
Mean age	57.5 ± 9.83	
Gender		
Male	97 (53.89%)	
Female	83 (46.11%)	
Mean NC level	8930.428 ± 2906.004	

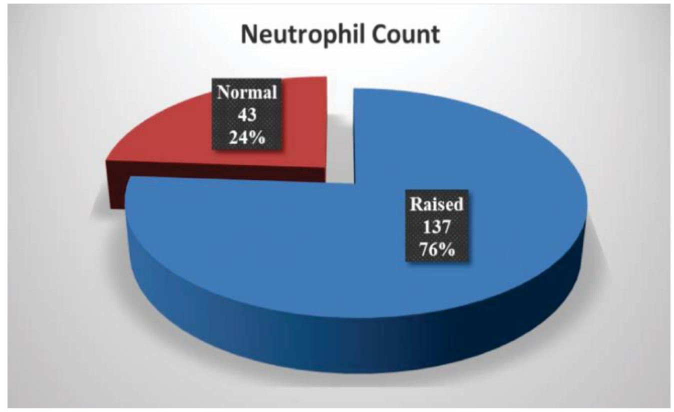

Figure 1: *Frequency of Raised & Normal Neutrophil count (n = 180)*

Table 2: *Comparison of CHF in normal and raised NC groups*

CHF	Raised NC	Normal NC	P value	Relative risk (95% CI)
Yes	93	4	< 0.0000001	1.809
No	44	39		(1.471, 2.224)

Discussion:

Our results showed that the frequency of CHF in patients with raised NC after AMI is higher as compared to the patients with normal NC. Neutrophils are constituent part of White blood cells that invade necrosed myocardium as a result of AMI & hence associated with complication like CHF & death. Several researchers have studied association between raised neutrophil count & AMI complications like CHF. Some reports showed increased frequency of CHF with raised NC, while others did not, rather they showed that frequency of CHF was high in both types of AMI patients that is with normal NC and raised NC. However, this study was planned to update local guidelines for management of such patients better than earlier and to plan better management of these patients.

In our study, 76.11% had raised neutrophil count and CHF was 53.89% in patients with raised NC. Khatri D and others[9] studied AMI patients who developed CHF & its association with neutrophil count. They recorded that in patients with acute myocardial infarctions 91 (60.60%) had raised neutrophil count (> 65% of total leukocyte count) and in those patients 58 (63.74%) developed congestive heart failure (CHF), whereas 33 (36.26%) did not develop CHF. In that study 59 (39.33%) patients had normal NC & out of those only 4 (6.78%) developed CHF and 55 (93.22%) did not develop CHF. So the number of patients with raised NC who developed CHF was significantly higher than those with normal NC. This indicates that a significant association exists between raised NC and CHF, these findings confirm the results of our study.

Another study conducted on 200 AMI patients reported that 163 (81.5%) patients had raised NC, out of those 81 (49.69%) developed CHF, 72 (44.17%) did not develop CHF, and 10 (6.13%) expired. Whereas 37 (18.5%) AMI patients had normal NC, but 10 (27.03%) developed CHF, 26 (70.27%) remained free of CHF, and 1 (2.70%) expired.[10] This study showed higher CHF frequency in AMI patients with raised NC as compared to those with normal NC. The study done on 200 patients gave an impression that frequency of post – MI , frequency of CHF was higher with raised NC as compared to normal NC as seen in our study.

Ghaffari and colleagues[12] in a recent study examined that the frequency of ventricular tachy-arrhythmias including ventricular tachycardia & fibrillation at the first day was directly proportional to higher neutronphil count and higher Neutrophil Lymphocyte Ratio.

They concluded that a simple Complete Blood Count (CBC) showing neutrophil count can be helpful in identifying high risk MI patients who can develop heart failure, and death hence these findings validate our results and showing the association between raised NC and CHF.

Kyne L and co-workers[13] evaluated the relationship between raised neutrophil count & CHF in hospitalized patients of AMI. They concluded CHF in 43% of the cases of AMI & 92.5% of the patients had relative raised neutrophils on multivariable analysis that is also in favor of our results.

Conclusion:

It was concluded that raised neutrophil count was highly associated with the development of CHF in patients of acute myocardial infarction. Hence it is a good predictor of CHF in AMI patients & will help physicians & cardiologists to identify high risk AMI patients who can develop CHF by simply advising a CBC.

Ethical Approval: Given
Conflict of Interest: The authors declare no conflict of interest
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