

# Total White blood count, absolute Neutrophil count and Neutrophil Lymphocyte ratio and heart failure in patients with STEMI

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## ABSTRACT

**Background:** In Pakistan risk factors for coronary Artery disease are highly prevalent. The cause of 30-40% death in Pakistan is coronary artery disease. Inflammatory markers have a significant role in cardiovascular events: These markers are C - reactive protein, interleukin-6 and high erythrocyte sedimentation rate. Few parameters are proposed to predict the outcome in coronary artery disease that includes WBC count neutrophil count and neutrophil/lymphocyte ratio.

**Methodology:** It was a prospective descriptive study conducted in the Cardiac unit, Ibn-e-Siena Hospital, Multan. Data of 159 patients who met the inclusion criteria was collected. Patient's demographic details were noted. All patients having any of these, cardiogenic shock, pump failure (ejection  $\leq$ 30%) and acute pulmonary edema were taken as having heart failure.

**Results:** In this study main population was from age group 61-70 and 51-60 years age group. White blood count, absolute neutrophil count and neutrophil lymphocyte ratio was compared in patients with heart failure and without heart failure and significant difference was noted among groups.

**Conclusion:** So white blood cell count, absolute neutrophil count and neutrophil lymphocyte ratio are good predictor of heart failure in patients with STEMI. So these parameters can be used to stratify high risk patients and can help in early identification and management of high risk patients

**Keywords:** heart failure, neutrophil lymphocyte ratio, white cell count, ST segment elevation myocardial infarction.

## INTRODUCTION

Among the major causes of death in the world, ischemic heart disease is one of them. Majority of deaths occur in same year in which the people undergo cardiac ischemia including ST segment elevation infarction, unstable angina. In United State 1/5<sup>th</sup> of the deaths occur because of acute coronary heart disease and almost 60,0000 death/year<sup>1,2</sup>. In Pakistan there is risk factors for coronary Artery disease are highly prevalent. This cause 30-40% death in Pakistan is coronary artery disease<sup>2,3</sup>.

Inflammatory markers have a significant role in cardiovascular event. These markers are C - reactive protein, interleukin-6 and high erythrocyte sedimentation rate. Few parameters are proposed to predict the outcome in coronary artery disease that includes WBC count neutrophil count and neutrophil/lymphocyte ratio<sup>4,5,6,7</sup>.

In various studies, a major predictor are of mortality and complications after MI has been identified that is N/L ratio. A study conducted by Ghaffari et al showed a significant relationship between neutrophil lymphocyte ratio and death and complication associated with MI. The death rate was 37% and the rate of complication development after MI was 43.6%. In their study they showed predictors of mortality that included the high age (P 0.04), low ejection fraction (p 0.001) and elevated absolute Neutrophil count (P 0.04). The heart failure and arrhythmias during first day of admission were predicted by elevated WBC count (P-0.03) and neutrophil lymphocyte ratio (P 0.01). They showed that patient at the time of admission having neutrophil count  $>9.61 \times 10^9$  cell/mm<sup>3</sup>, have greater chances of developing VT/VF (13.6%, P <0.001) and pulmonary edema (8.6%, P 0.03) within a day in comparison to those with WBC count less than this<sup>5</sup>.

Another study conducted by He J et al noticed neutrophil lymphocyte ratio at various timings that are; at admission, 24, 72 hours and at time of discharge. In comparison to absolute neutrophil count (P 0.001), the neutrophil lymphocyte ratio more accurately predicted the mortality. They made three groups according to the value of neutrophil lymphocyte ratio. They

described that greater the neutrophil lymphocyte ratio, greater the predictive value for death and complication after myocardial infarction<sup>6</sup>.

Han YC et al observed that during hospital stay 7.1% of cardiac events occurred and at 12 months 11.3% patients developed cardiac events. Cardiac events include MACE (all cause death, nonfatal Myocardial infarction, ischemic stroke). It was observed in neutrophil lymphocyte ratio subgroups that with low neutrophil lymphocyte ratio MACE was 3.7%, with medium neutrophil lymphocyte ratio MACE was 11.1% and with high neutrophil lymphocyte ratio was 19.1% (p value <0.002) at 12 months and in hospital MACE was 2.8%, 5.6% and 12.7% (P 0.001) and mortality rate was 1.9%, 5.6% and 12.7% (P 0.003)<sup>7</sup>.

## METHODOLOGY

It was a prospective descriptive study conducted in the Cardiac unit, Ibn-e-Siena Hospital, Multan after taking approval from ethical committee. Sampling was done by nonprobability consecutive sampling. Patients of both genders presented to emergency department of cardiac unit with acute ST segment elevation myocardial infarction (STEMI) was included and Patients who have any of this were excluded from study: having Active or chronic inflammatory disease, Active malignancy, haematological proliferative disorder, autoimmune disease, acute infection, patients receiving steroid therapy.

Data of 159 patients who met the inclusion criteria was collected. Patient's demographic details were noted. History and informed consent was taken from every patient. All the patients had a complete blood examination at presentation and 24 hours. Patient's outcome i.e., cardiogenic shock, pump failure and acute pulmonary edema were noted and recorded into proforma. All patients having any of these, cardiogenic shock, pump failure (ejection  $\leq$ 30%) and acute pulmonary edema were taken as having heart failure. All the laboratory investigations were acquired from the same laboratory and all the assessments was done by a single consultant to eliminate bias. Confounding variables was controlled by exclusion.

**Data analysis procedure:** All data was entered into SPSS 20. Numerical variables was presented by mean $\pm$ SD. Categorical variables like cardiogenic shock, pump failure and pulmonary

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edema was presented by frequency and percentage. Chi square test was used for categorical data. Student t test was used for numerical data. A p value of <0.05 was considered significant

**RESULTS**

In this study main study population was from age group 61-70 and 51-60 years age group (Fig. 1).

Majority of the population were male and more than 50% of study population were hypertensive, other comorbidities and frequency of different types of myocardial infarction are depicted in the table 1.

In the study patients with cardiogenic shock, acute pulmonary edema and patients with low ejection fraction were grouped as patients having heart failure and frequency of these can be noted from fig 2.

Fig.1: Age groups of study population.

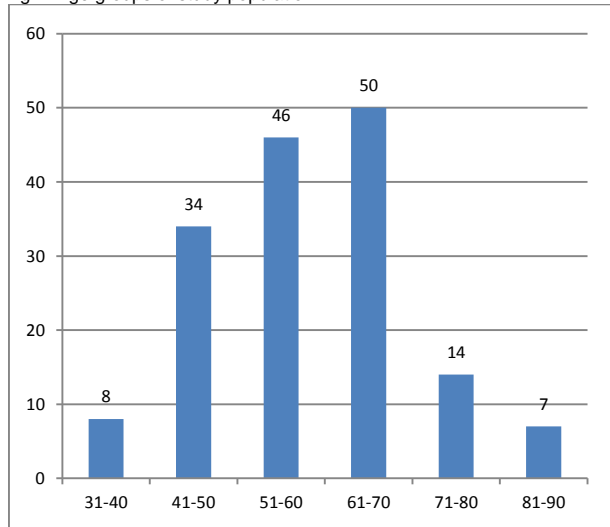
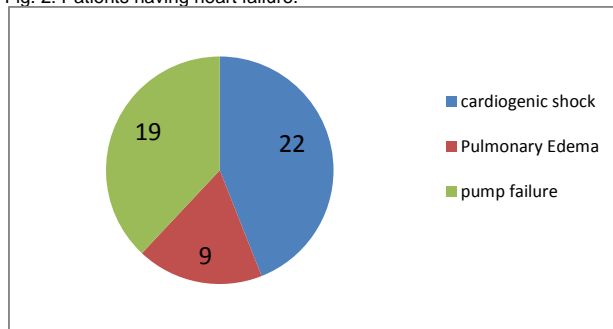


Table 1: Descriptive characteristics and different types of myocardial infarction

Parameter	Numbers	Percentage %
Gender(Male/Female)	129/30	81.13/18.86
Hypertension	88	55.34
Diabetes	69	43.39
Family History of IHD	12	7.54
History Of CABG	2	1.25
Hyperlipidemia	5	3.14
Smoking	67	42.13
Anterior Wall MI	80	50.31
Inferior Wall MI	51	32.07
Posterior Wall MI	10	6.28
Lateral Wall MI	18	11.32

Fig. 2: Patients having heart failure.



White blood count, absolute neutrophil count and neutrophil lymphocyte ratio was compared among patients with heart failure and without heart failure and statistically significant difference was observed between the groups, as shown in the table 2, 3 and 4 respectively.

Table 1: White blood count in study population

Outcome	White blood cell count		Total
	Normal (<11000mm <sup>3</sup> ) n=117	High (>11000mm <sup>3</sup> ) n=42	
Without Heart Failure	104	05	109
With Heart failure	13	37	50

P value 0.000

Table 2: Absolute Neutrophil count comparison between groups

Outcome	Absolute Neutrophil count(ANC)		Total
	Normal(<65mm <sup>3</sup> ) (n=112)	High(>65mm <sup>3</sup> ) (n=47)	
Without Heart Failure	99	10	109
With Heart Failure	13	37	50

P value 0.023

Table 3: Neutrophil lymphocyte ratio in study groups

Outcome	Neutrophil lymphocyte ratio		Total
	Normal (n=108)	High(>4.5) (N=51)	
Without Heart Failure	97	12	109
With Heart Failure	09	41	50

P value 0.014

**DISCUSSION**

In this economically advanced era, changes in the lifestyle has led to increase in the incidence of acute coronary syndrome.<sup>11</sup> Considered as an inflammatory condition, in atherosclerosis formation of atheroma and endothelial damage will lead to formation of clot that will result in myocardial infarction<sup>12</sup>. In this inflammatory process neutrophils play a central and enhance inflammatory process by many mechanisms like arachdonic acid pathway, by generating oxygen free radicals and with the help of hydrolytic enzymes<sup>13,14</sup>. Lymphocytes have the ability to suppress inflammation and decreased lymphocyte count is associated with poor cardiac outcome<sup>15</sup> Stress during myocardial infarction lead to lymphopenia because of catecholamine induced apoptosis and suppression of maturation of lymphocytes<sup>16,17,18</sup>. So white blood cell count, neutrophil count and neutrophil lymphocyte ratio are simple inexpensive, readily available measure that can be used to stratify high risk patients<sup>19,20</sup>. Studies have proved that white blood cell count can predict high risk patient with myocardial infarction. But it is observed that raised neutrophil and decreased lymphocytes are better predictor of both in-hospital and long term mortality compared to white blood cell count<sup>20</sup>.

Raised white blood cell count has been suggested to be associated with higher risk of heart failure. A study by Bekwelem et al noted that the incidence of heart failure is significantly high in patients with high white blood cell count.<sup>21</sup> Another study by Atsuhiko also reported that patients with ≥7700cell/μl white blood cell count had significantly higher rate of heart failure.<sup>22</sup> A study conducted by Copper et al showed that every increment of 10000/mm<sup>3</sup> in white blood cell count is associated with increment in the risk of death due to Left ventricular dysfunction resulting from acute myocardial infarction and white blood cell count >7000 is independent predictor of mortality in patients with Ischemic Left ventricular dysfunction<sup>23</sup>. In the current study, it was also observed that ST segment elevation myocardial infarction patients who developed heart failure had significantly high white blood cell count. So findings of the current study are in agreement with previous studies.

The next parameter which was evaluated was absolute neutrophil count. In the present it was observed that raised neutrophil count was significantly associated with development of

heart failure with p value of 0.023. Durmus et al have shown that patients who developed heart failure had significant relation with absolute neutrophil count<sup>24</sup>. Similar findings have been shown by Jan et al<sup>23</sup>.

Neutrophil lymphocyte ratio is used for the diagnostic purposes in many diseases and suggested to simple easily available parameter and have good predictive value in patients with STEMI<sup>20</sup>. Sedat et al have shown that absolute neutrophil count is positively related with left ventricular ejection fraction in patients with acute coronary syndrome<sup>25</sup>. Another study by El Shafey et al also described left ventricular systolic dysfunction in patients with high Neutrophil lymphocyte ratio<sup>26</sup>. Rajesh Bajari also described similar findings in his study<sup>16</sup>. In current study after myocardial infarction, patients who developed heart failure have significantly high Neutrophil lymphocyte ratio, so these findings are in agreement with previous studies.

So it can be concluded from the study that white blood cell count, absolute neutrophil count and neutrophil lymphocyte ratio are good predictor of heart failure in patients with ST segment elevation myocardial infarction. Though pro-BNP and BNP are more specific markers of heart failure but in country like Pakistan, resources are limited and these are not available in every healthcare setting, so white blood cell count, absolute neutrophil count and neutrophil lymphocyte ratio can be used to stratify high risk patients. These are available almost in every healthcare setting and so can help in early identification and management of high risk patients. This will help reduction in morbidity and mortality in patients with ST segment elevation myocardial infarction.

## CONCLUSION

White blood cell count, absolute neutrophil count and neutrophil lymphocyte ratio are good predictor of heart failure in patients with ST segment elevation myocardial infarction.

**Author contribution:** **ARK:** Study design, data collection, writing the manuscript, formulation of tables reviewed and approved, **NA:** Statistical analysis, result interpretation, manuscript writing and revising it critically for important intellectual content, **AS:** Statistical analysis, interpretation of results, Reviewed and approved the manuscript, **SM:** data collection, writing the manuscript, formulation of tables reviewed and approved, **MA:** result interpretation, manuscript writing and revising it critically for important intellectual content, **AE:** manuscript writing and revising it critically for important intellectual content.

**Limitations of the study:** It was single center study that was conducted at a tertiary care hospital, so it do not represent general population. Sample size was small and other inflammatory markers was not evaluated in the study.

**Conflict of Interest:** None to declare.

**Funding Source:** None to declare.

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