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ASSOCIATION OF HEMOGLOBIN LEVELS WITH CLINICAL OUTCOME IN PATIENTS ADMITTED WITH NSTEMI AND STEMI.

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ABSTRACT

INTRODUCTION: Acute myocardial infarction is the leading cause of death and hospital admissions worldwide. In previously conducted studies, levels of hemoglobin was associated with negative outcome in hospitalized patients. Data is limited in our region in this regard, that is why this study aims to determine association between hemoglobin levels among patients admitted with acute myocardial infarction. **MATERIAL AND METHODS:** A clinical prospective study was conducted through a convenient sampling technique. The study site was a tertiary care Isra University Hospital. Hyderabad and data was collected from the patients admitted in the department of cardiology. All the patients admitted with acute myocardial infarction AMI, age between 30 years to 70 years, both male and female were selected in inclusion criteria. Hemoglobin Hb was divided into three categorize, i Normal Hb between 12gm/dl to 16gm/dl both in males and females, ii Anemia Hb <12gm/dl, and polycythemia Hb >16gm/dl. In-hospital outcome complications and mortality was assessed and compared with level of hemoglobin using chi-square and student's *t*-test, where appropriate. A p value of <0.05 was considered as statistically significant. **RESULTS:** A total of 128 patients were enrolled for final analysis. Patients with NSTEMI were more prevalent than STEMI, 88 68.75% and 40 31.25%. Most of the patients with acute myocardial infarction AMI had normal hemoglobin levels n = 90, 70.31% while anemia was observed among 26.56% n = 34 of the patients. Anemia was significantly observed in patients with NSTEMI n = 22, 17.18% as compared to patients with STEMI n = 12, 9.37%, 0.001. Mean difference of hemoglobin levels among anemic NSTEMI vs. STEMI was also observed significant, -0.48±0.3 gm/dl, p 0.02. Overall mortality was observed in 5.46% n = 7. In both groups, higher in-hospital mortality was observed in anemic patients with STEMI n = 3, 7.5% as compared to anemic patients with NSTEMI n = 2, 1.56%. **CONCLUSION:** Our study concludes that patients with STEMI were less anemic than patients admitted with NSTEMI. Rate of complications were observed higher among NSTEMI anemic patients while in-hospital mortality was significantly higher among STEMI anemic patients.

KEYWORDS: Acute myocardial infarction, levels of hemoglobin, anemia, in-hospital outcome

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INTRODUCTION:

Acute coronary syndrome ACS is the main cause of hospitalization in a cardiac emergency department and now becoming global concern due to its high rates of mortality, morbidity, and associated complications [1-4]. Unstable Angina UA, non-ST segment elevation myocardial infarction NSTEMI, and ST-segment elevation myocardial infarction STEMI are collectively termed as Acute coronary syndrome ACS [5]. Recent data suggest that prevalence of ACS in Pakistan was 36.9% [6]. In a previously published study from Pakistan has shown higher prevalence of STEMI than NSTEMI, 50.4% vs. 33.5%, respectively [7]. Prognosis of patients

admitted with acute myocardial infarction is related to multiple factors such as increasing older patients, diabetes mellitus, dyslipidemia, and hypertension [8]. Another study documented hypotension, tachycardia, and winter season were associated with higher rates of in-hospital mortality [9]. A study conducted by JJ González-Ferrer and colleagues [10] have observed that hemoglobin levels at admission compared to hemoglobin levels reduction in subsequent days was associated with increased rates of major adverse cardiovascular events including cardiogenic shock and deaths. Another study has documented higher levels of hemoglobin >16.0gm/dl was also associated with mortality [11]. But, a recent data published in American College of Cardiology did not observed rise in mortality during hospitalization but higher rates of deaths were observed after 1 year in anemic ACS patients as compared to those who had normal hemoglobin levels [12]. Different studies have shown different observations and no conclusive statement can be drawn from available data. Also, no such study has been conducted in our area in which relationship of hemoglobin levels with in-hospital outcome were observed. Considering the fact and need, this study planned to determine the association between levels of hemoglobin with in-hospital outcome in patients admitted with ACS.

MATERIAL AND METHODS:

This study was conducted in the department of Cardiology, Isra University Hospital, Hyderabad. An observational hospital-based prospective study was planned and convenient sampling technique was selected for sampling technique. All the patients admitted with acute myocardial infarction AMI, age between 30 years to 70 years, both male and female were selected in inclusion criteria. Exclusion criteria for this study was, patients known cases of ischemic heart disease IHD and taking anti-platelet therapy, patients who were on anti-coagulation therapy, previous history of coronary artery bypass grafting CABG or percutaneous coronary intervention PCI, patients with valvular heart disease, patients with cardiomyopathy, pregnant women, underlying malignancy, diseases that may affect hemoglobin levels chronic liver, chronic kidney disease, blood disorder, and those who did not consent to participate. Diagnosis of AMI was made based on the recent proposed guidelines by the American Heart Association/American College of Cardiology AHA/ACC 13. A sterile 5cc syringe was used to collect the blood sample of study participants under aseptic measures including hemoglobin levels. Hemoglobin Hb was divided into three categorize, i Normal Hb between 12gm/dl to 16gm/dl both in males and females, ii Anemia Hb <12gm/dl, and polycythemia Hb >16gm/dl.

DATA COLLECTION AND ANALYSIS:

Predesigned structured questionnaire was used to collect the relevant data. All patients who consented to participate were given standard care of treatment during hospitalization. At the time of enrollment all the recruited patients were underwent current and past medical history along with their physical and cardiovascular examination. Baseline and clinical data were collected including age, gender, marital status, area of residence, social class, addiction habits, comorbid conditions hypertension, diabetes mellitus, and dyslipidemia, levels of hemoglobin, and in-hospital outcome improved & discharged, in-hospital complications, and death. Means were calculated for continuous variables such as age and levels of hemoglobin while categorical variables were analysed as frequencies and percentages. Independent *t*-test and *chi*-square tests were applied where appropriate and a p value <0.05 was considered as statistically significant.

RESULTS:

A total of 128 patients were enrolled for final analysis those who fulfilled the inclusion & exclusion criteria. Patients with NSTEMI were more prevalent than STEMI, 88 68.75% and 40 31.25%. Patients with STEMI were younger 58.91±7.21 years, more in body weight 83.78±8.49 – kg, higher levels of cardiac troponins 24.08±6.09 ng/ml, and low levels of hemoglobin 11.99±3.62 gm/dl as compared to patients with NSTEMI, p <0.05. Males were more prevalent among both groups, 52 59.09% in NSTEMI and 24 60.0% in STEMI. Significant proportion of patients with STEMI were smoker 14 35.0% and addicted to chewable tobacco 3 7.50%, p <0.05. Presence of T2DM was significantly observed in patients admitted with STEMI 15 37.5%, p 0.001. Table 1.Most of the patients with acute myocardial infarction AMI had normal hemoglobin levels n = 90, 70.31% while anemia was observed among 26.56% n = 34 of the patients. Anemia was significantly observed in patients with NSTEMI n = 22, 17.18% as compared to patients with STEMI n = 12, 9.37%, 0.001. Mean difference of hemoglobin levels among anemic NSTEMI vs. STEMI was also observed significant, -0.48±0.3 gm/dl, p 0.02. Graph 1, 2 & 3.Table 2 shows association of Hemoglobin levels with outcome among NSTEMI and STEMI. Overall mortality was observed in 5.46% n = 7. In both groups, higher in-hospital mortality was observed in anemic patients with STEMI n = 3, 7.5% as compared to anemic patients with NSTEMI n = 2, 1.56%. Rest of the detailed description shown in table 2.

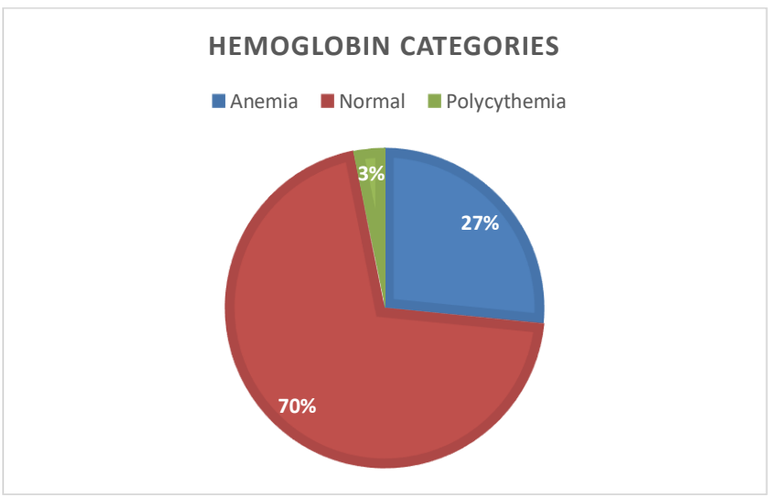
TABLE 01. BASELINE AND CLINICAL CHARACTERISTICS OF PATIENTS ADMITTED WITH MYOCARDIAL INFARCTIONN = 128

P value <0.05 is statistically significant

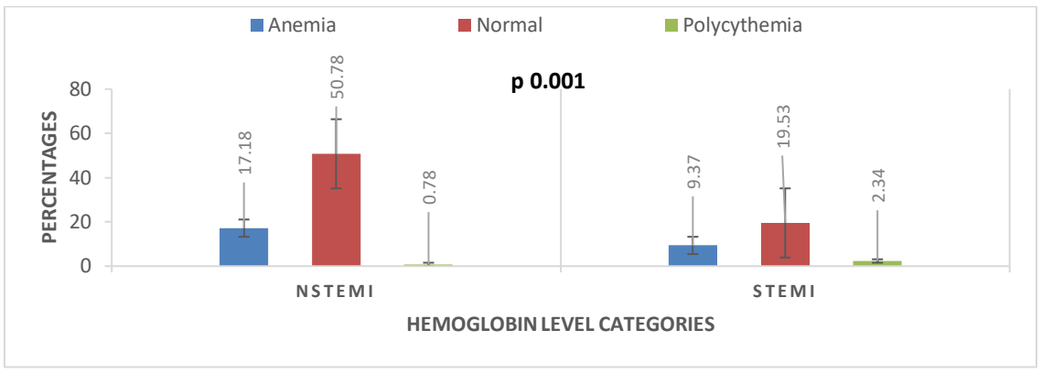
Baseline & clinical parameters	Total	NSTEMI	STEMI	P - Value
	N = 128	N = 88	N = 40	
Age- year	58.16±8.49	61.82±6.18	58.91±7.21	0.001
Weight - kg	78.16±14.54	76.30±18.66	83.78±8.49	0.001
Height - cm	171.15±4.32	172.44±4.27	171.18±4.98	0.08
BMI - kg/m2	26.88±3.51	26.11±3.28	26.32±2.09	0.1
Serum creatinine - mg/dl	1.11±3.01	1.14±2.21	1.02±0.8	0.22
Cardiac troponin I -ng/ml	14.32±8.60	6.42±12.15	24.08±6.09	0.001
Hemoglobin level - gm/dl	13.01±3.45	12.13±3.49	11.99±3.62	0.001
Gender				
Male	76 59.37	52 59.09	24 60	0.98
Female	52 40.62	36 40.90	16 40	
Area of Residence				
Urban	93 72.65	60 68.18	33 82.50	0.51
Rural	35 27.34	28 21.87	7 17.50	
Marital Status				
Single	3 2.34	2 2.27	1 2.5	0.09
Married	123 93.09	85 96.59	38 95.0	
Widowed	2 1.56	1 1.13	1 33.33	
Addiction habits				
Current smoker	22 17.18	8 9.09	14 35.0	0.03
Chewable tobacco	5 3.90	2 2.27	3 7.50	
Comorbids				
Hypertension	35 27.34	21 23.86	14 35.0	0.1
Diabetes Mellitus	22 17.18	7 7.95	15 37.5	0.001
Dyslipidemia	14 10.93	5 5.68	9 22.5	0.05

BMI = Body mass index, NSTEMI = Non-ST segment elevation myocardial infarction, STEMI = ST-Segment elevation myocardial infarction

GRAPH 01: DISTRIBUTION OF PATIENTS ACCORDING TO THEIR HEMOGLOBIN LEVELS N = 128



GRAPH 02: ASSOCIATION OF HEMOGLOBIN LEVELS AMONG NSTEMI AND STEMI PATIENTS N = 128



GRAPH 03: DISTRIBUTION OF ANEMIA AMONG NSTEMI AND STEMI PATIENTS N = 34

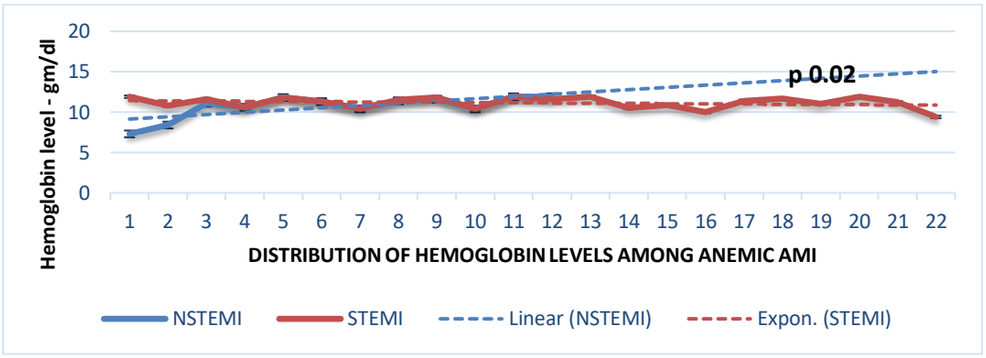


TABLE 02: ASSOCIATION OF HEMOGLOBIN LEVELS WITH OUTCOME AMONG AMI N = 128

Type of AMI	Hemoglobin categories	Outcome			p value
		Improved & discharged	In-hospital complications	In-hospital mortality	
		N %	N %	N %	
	Anemia n = 22	16 18.18	4 4.54	2 1.56	0.001
NSTEMI	Normal n = 65	52 59.09	12 13.63	1 1.13	
N = 88	Polycythemia n = 1	0 0	1 1.13	0 0	
	Total	**68 72.27**	**17 19.31**	**3 3.40**	
STEMI	Anemia n = 12	5 12.5	4 10	3 7.5	0.03
N = 40	Normal n = 25	18 45	6 15	1 2.5	
	Polycythemia n = 3	2 5	1 2.5	0	
	Total	**25 62.5**	**11 2.5**	**4 10**	
P value <0.05 is statistically significant					
NSTEMI = Non-ST segment elevation myocardial infarction, STEMI = ST-Segment elevation myocardial infarction					

DISCUSSION:

Acute myocardial infarction is the main reason of hospitalization in the Cardiac emergency department. Its burden continue on the rise due to increase in the prevalence of its modifiable risk factors such as uncontrolled hypertension, diabetes mellitus, metabolic syndrome, sedentary lifestyle, obesity, dyslipidemia, addiction to drugs, and smoking [14-16]. Besides these conventional risk factors, with the advancement of medical technology & facilities, there are certain other less studied

risk factors that also contribute in the incidence of AMI, its morbidity and mortality [17]. Association of hemoglobin levels among patients admitted with AMI is on lime-light by the researchers. In our study, overall prevalence of anemia among patients admitted with AMI was 26.56%. This is also confirmed by the previously published study from Germany that showed range of anemic patients lye between 12% and 38% [18.] In contrast to our study, higher prevalence of anemia was observed 38% in males and 58.8% among females in a study conducted in Punjab province of Pakistan among patients admitted with ACS 1[9].

Association of hemoglobin levels with in-hospital outcome among patients of AMI was also observed in previously published studies. In a study conducted by Sabatine MS and colleagues have observed that patients with STEMI had higher mortality when hemoglobin falls below 14gm/dl [20]. In another study, authors have observed linear relationship of hemoglobin levels with poor prognosis and higher risk of cardiovascular events [21.] Dutch study evaluated relationship of hemoglobin levels with in-hospital and long-term outcome of patients admitted with acute STEMI and found that anemia due to any cause is associated with increased risk of in-hospital post-myocardial infarction complications and deaths [22]. Our study is also consistent with the previously published studies and observed higher rates of in-hospital complications among NSTEMI patients 19.31% and higher rates of in-hospital mortality among STEMI patients 10%. Unfortunately, no study has been conducted in Pakistan through which our data can be compared. Study from China also explored association of hemoglobin levels in STEMI patients undergoing primary percutaneous coronary intervention pPCI and observed higher prevalence of in-hospital complications including acute kidney injury AKI in whom hemoglobin levels were below normal range [23]. The main reason of higher mortality and complications associated with low hemoglobin levels could be due to poor perfusion, blood stasis, and it exacerbates the preexisting compromised coronary blood supply in patients with MI [24]. Study conducted by Kang SH demonstrated anemia is associated with short and long-term poor outcomes in ACS patients [25].

Attention should be given in patients admitted with AMI and low hemoglobin levels at the time of admission and measures should be taken to correct that low levels as early as possible so that poor outcome associated with anemia would be managed properly.

CONCLUSION:

Our study concludes that patients with STEMI were less anemic than patients admitted with NSTEMI. Rate of complications were observed higher among NSTEMI anemic patients while in-hospital mortality was significantly higher STEMI anemic patients.

ETHICS APPROVAL: The ERC gave ethical review approval.

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin.

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CONFLICT OF INTEREST: No competing interest declared.

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