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Internal Medicine Section

Prevalence of Conventional Risk Factors and Evaluation of Baseline Indices Among Young and Elderly Patients with Coronary Artery Disease

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ABSTRACT

Introduction: Coronary Artery Disease (CAD) is a leading cause of morbidity and mortality worldwide, manifesting in a variety of clinical spectrums such as an asymptomatic disease or acute coronary syndrome. It has become highly prevalent in Southeast Asia, including Pakistan. There has been little work done on the prevalence of traditional risk factors in different age groups and genders and there is a dire need to gauge the importance of baseline indices in CAD patients.

Aim: To determine the prevalence of conventional risk factors and evaluate the variations in lipid profiles, electrolyte levels and haematological indices among patients with CAD in different age groups and gender.

Materials and Methods: This cross-sectional study was carried out in a Tertiary Care Hospital in Karachi, Sindh, Pakistan from January to June 2016, among patients with CAD. We recorded the presence of conventional risk factors and baseline indices within the first 24 hours of admission. Continuous variables were compared using Independent t-test or Mann-Whitney test and categorical variables were compared using chi-square or Fisher's exact test.

Results: The most frequent risk factor was dyslipidemia (91.2%), followed by hypertension (70.4%), diabetes (51.2%), family history of CAD (40.0%) and smoking (29.2%). Total of 98.4% of patients had at least one risk factor. Diabetes and hypertension were found to be common in females; whereas, smoking was predominantly present in males. Diabetes and dyslipidemia were mostly encountered in elderly patients. The most frequent lipid alteration was low levels of High Density Lipoprotein (HDL). Cholesterol and HDL levels were found to be higher in females than males. Elderly patients had lower levels of HDL and higher levels of Cholesterol. The levels of haematological indices were found to be higher in males and younger patients. The median levels of serum sodium and potassium were found to be higher in elderly patients.

Conclusion: Our study findings corroborate with the findings from previous studies regarding the significance of risk factors in causing cardiovascular pathology. Medical interventions and dietary control to improve body's lipid status would be indispensable in the prevention of CAD. Deranged electrolyte levels necessitate correction of body electrolyte parameters as an adjunct in prevention strategies.

Keywords: Acute coronary syndrome, Dyslipidemia, Electrolytes, Hypertension

INTRODUCTION

CAD is a common multifactorial atherosclerotic pathology characterised by an insufficient supply of oxygen rich blood to the myocardium due to narrowing or blocking of a coronary artery [1]. It comprises a spectrum of clinical manifestations ranging from asymptomatic atherosclerotic disease to Acute Coronary Syndrome (ACS), which includes ST-Elevation Myocardial Infarction (STEMI), Non-ST-Elevation Myocardial Infarction (NSTEMI) and Unstable Angina (UA). By 2020, CAD is likely to be the major cause of global morbidity and mortality. Pakistan, being a part of Southern Asia has high rates of CAD, manifesting at quite an earlier age [2]. This calls for effective preventive strategies.

The study conducted in Pakistan reported that 91% of individuals had at least one of four conventional risk factors [3]. However, these risk factors differ according to age group as well as gender [4]. There is hardly any data which examined age and gender differences in the prevalence of conventional risk factors. Therefore, our study will contribute to a better understanding of gender and age differences that exist in our patients with CAD.

Dyslipidemia is a well known risk factor for the development of CAD. Variations in lipid profiles are prevalent in ACS patients, with differing levels of cholesterol, [Low Density Lipoprotein (LDL), HDL] and triglycerides after an episode of acute cardiac injury [5]. However, there is a paucity of data on studies evaluating the variations of lipid profiles in Pakistani patients with CAD. Initiation of lipid-lowering therapy can only be strictly followed once we have accurate data regarding the variations in lipid profile. This knowledge would also help us to stress on the importance of lipid lowering therapy and hence, indirectly aid in increasing patient compliance and adherence [6].

In addition, imbalances in electrolyte levels may occur within the first few hours of ACS, giving rise to life threatening arrhythmias [7]. Therefore, a thorough comparison of standard electrolyte levels like sodium (Na), potassium (K) and magnesium (Mg) among our patients may help prevent such fatalities.

The White Blood Cell (WBC) count has been proved to be a strong independent predictor of mortality in ACS patients and is linked to the presence of conventional risk factors [8]. Moreover, Platelet Distribution Width (PDW) and Red Cell Distribution Width (RDW) have also recently been found to influence outcomes in ACS patients [9]. A better understanding of more parameters like Hemoglobin (Hb), Red Blood Cell (RBC) count, Haematocrit (Hct) and platelet count may help establish a better prognosis and approach towards treatment.

The aim of this study was to determine the prevalence of conventional

risk factors and to evaluate the variations in lipid profiles, electrolyte levels and haematological indices among patients with CAD in different age groups and gender.

MATERIALS AND METHODS

This cross-sectional study was conducted at a Tertiary Care Hospital in Karachi, Sindh, Pakistan. The study duration was six months from January to June 2016. The study was approved by the local Ethical Committee and patients' informed consent was taken. All the patients visiting Cardiology Emergency Ward were evaluated, selected via convenience sampling and only those with confirmed diagnosis of ACS and CAD were included in the study. A total of 300 patients were selected; however, 50 patients refused to become part of the study. This yields a final sample size of 250.

ACS patients were diagnosed and categorised using the criteria defined by American Heart Association [10]. CAD was diagnosed after a patient underwent coronary angiography. Only those patients with > 50% stenosis of any of the coronary arteries were included.

Patients were excluded if they had received anticoagulant therapy or immunosuppressants, received statins or any other lipid decreasing agents, had conditions which put them at high risk of serious bleeding, were diagnosed with cancer, active infectious diseases or inflammatory diseases or severe liver disease.

The detailed history of patients was taken at the time of admission and all baseline laboratory tests [Complete Blood Count (CBC), electrolyte levels and lipid profile] were carried out. The blood sample was drawn within 30 minutes of admission. All the conventional risk factors were recorded after confirmation from previous medical history. Dyslipidemia was defined as high levels of serum cholesterol >200 mg/dl, high levels of serum triglycerides >150 mg/dl, high levels of serum LDL >130 mg/dl and low serum levels of HDL <40 mg/dl.

An automated haematology analyzer, SYSMEX XN-1000 was used to measure haematological indices. Electrolyte levels were measured by Roche Cobas c501 chemistry analyzer (Roche Diagnostics). Fasting lipid panels were measured by standard enzymatic methods.

STATISTICAL ANALYSIS

The data was tested for normality by Shapiro-Wilk test. Patients were stratified by gender and age for analysis. Continuous variables were presented as mean ± Standard Deviation (SD) and median Interquartile Range (IQR). Categorical variables were expressed as frequency (percentages). The difference between the groups was compared using Student's t-test or Mann Whitney test and, chi-square test or Fisher's exact test for continuous and categorical variables, respectively. A two tailed p-value of less than 0.05 was considered statistically significant. All analyses were performed with SPSS Statistics, version 17.0 (IBM SPSS Inc., Chicago, IL).

RESULTS

Baseline characteristics and clinical presentation of patients is shown in [Table/Fig-1]. In total, 65.2% (n=163) of the patients were males and 34.8% (n=87) were females. Patients were divided into two groups according to their age, those within the age bracket of 18-45 years were considered younger patients while those >45 years were considered elderly patients. Mean age of patients enrolled in this study was 41.3 ± 5.0 years for younger groups and 64.1 ± 7.0 years for elderly patients. Males on average were nearly five years younger than females (p=0.006). The mean levels of Systolic Blood Pressure (SBP) (p=0.027) and Left Ventricular Ejection Fraction (LVEF) (p<0.001) were higher in females. At the time of admission, prior Myocardial Infarction (MI) (p<0.001) and history of Chronic Kidney Disease (CKD) (p=0.010) was more frequent in elderly patients than in young ones. Moreover, a greater percentage of females had a history of prior MI than males (p=0.032). The levels of Creatine Kinase (CK) (p<0.001) and CK-MB (p<0.001) were found to be higher in males than in females. Similarly, there was a greater frequency of male patients with Troponin T positive as compared to female patients (p<0.001).

In the studied sample, the most prevalent risk factor was dyslipidemia (91.2%), followed by hypertension (70.4%), diabetes (51.2%), family history of CAD or MI (40.0%) and smoking (29.2%). Diabetes (p<0.001) and dyslipidemia (p=0.001) were more frequent in elderly patients than in young ones while smoking (p=0.431), hypertension (p=0.957) and family history of CAD or MI (p=0.401) were similar between the two groups. Diabetes (p=0.012) and hypertension (p=0.024) were more frequent in females than in males while smoking (p<0.001) was more frequent in males than in females. Frequency of dyslipidemia (p=0.529) and family history of CAD or MI (p=0.255) were similar in both genders. 98.4% of all patients presented with at least one risk factor: 10.4% had one, 25.2% had two, 33.2% had three, 26.4% had four and 3.2% had all five risk factors [Table/Fig-2].

The blood lipid analysis illustrated that mean levels were 168.13±69.49 mg/dl for triglycerides, 90.90±25.42 mg/dl for LDL, 35.88±5.49 mg/dl for HDL and 169.44±38.75 mg/dl for cholesterol. Cholesterol levels were found to be higher in females than in males (p<0.001) and higher in elderly patients than in younger ones (p=0.002). HDL levels were found to be higher in females than in males (p=0.032) and higher in younger patients than in older ones (p<0.001). At least one abnormal level in lipid profile was found in 91.2% of patients and this finding was more frequent in elderly patients than in young ones (p<0.001). The most frequent lipid alteration was low levels of HDL (78.0%), followed by high levels of triglycerides (57.2%), high levels of cholesterol (24.4%) and high levels of LDL (3.6%) [Table/Fig-3].

The level of Hb, RBC and Hct was found to be higher in males than in females (Hb: p<0.001; RBC: p<0.001; Hct: p<0.001) and higher in younger patients than in older ones (Hb: p=0.001; RBC: p=0.014; Hct: p=0.042). Similarly, the levels of WBC count, neutrophils and lymphocytes were found to be higher in males than females (WBC: p=0.002; neutrophils: p<0.001; lymphocytes: p=0.035) and higher in young patients than in older ones (WBC: p=0.003; neutrophils: p<0.001; lymphocytes: p<0.001). Platelet count was found to be lower in elderly patients than in young ones (p<0.001). The median levels of serum Na (p<0.001) and serum K (p<0.001) were found to be considerably higher in elderly patients than in young ones. In addition, there was a statistically significant decrease in serum K levels in females as compared to males (p<0.001). The levels of other electrolytes were similar in different age groups and gender [Table/Fig-4].

A detailed literature review was done and a comparison of the main findings of the present study with all the relevant studies from South East Asia is shown in [Table/Fig-5].

DISCUSSION

Worldwide, the incidence of CVD is increasing, especially in the middle-income and low-income countries. The escalation in the number of patients succumbing to CVD is fundamentally due to the rising prevalence of the conventional risk factors which, if tackled could significantly reduce the burden of CVD [11].

A total 98.4% of the patients included in our study presented with at least one conventional risk factor out of five. This figure was even higher than the one reported in the study done in Mexico City, in which 95.7% of the patients had a conventional risk factor present; however, that study did not include past history of CAD/MI as an identifiable risk factor [7]. Greenland P et al., on his analysis of three cohort studies concluded that there was a high occurrence of at least one or more conventional risk factors in patients with varying outcomes of CAD [12]. The number and presence of conventional risk factors being interlinked with hospital mortality in patients

Characteristics	Gender			Age Group (years)		
	Male (n=163)	Female (n=87)	[a]p-value	18 to <45 (n=102)	>45 (n=148)	[a]p-value
Age [years]	53.17+12.65	57.85+12.73	[b]0.006	41.29+5.04	64.11+6.95	[b]<0.001
Male, n (%)	-	-	-	65 (63.7%)	98 (66.2%)	0.685
Area (Urban), n (%)	120 (73.6)	63 (72.4)	0.838	71 (69.6)	112 (75.7)	0.287
Heart rate [bpm]	82.84+15.70	84.25+18.10	[b]0.521	84.73+15.16	82.36+17.44	[b]0.267
Systolic BP [mm Hg]	126.53+27.92	135.15+31.30	[b]0.027	129.00+30.34	129.90+28.77	[b]0.813
Diatolic BP [mm Hg]	80.99+18.69	83.26+19.78	[b]0.369	81.80+18.84	81.76+19.29	[b]0.986
LVEF [%]	44.52+11.77	50.93+10.13	[b]<0.001	45.92+11.93	47.32+11.40	[b]0.351
Medical History, n (%):						
Prior MI	78 (47.9)	54 (62.1)	0.032	37 (36.3)	95 (64.2)	<0.001
Prior PCI	22 (13.5)	14 (16.1)	0.578	20 (19.6)	16 (10.8)	0.052
Prior CABG	6 (3.7)	1 (1.1)	[d]0.427	4 (3.9)	3 (2.0)	[d]0.448
CKD	12 (7.4)	9 (10.3)	0.418	3 (2.9)	18 (12.2)	0.010
NODV, n (%):			0.958			0.612
Single-vessel disease	69 (42.3)	36 (41.4)		43 (42.2)	62 (41.9)	
Two-vessel disease	50 (30.7)	26 (29.9)		28 (27.5)	48 (32.4)	
Three-vessel disease	44 (27.0)	25 (28.7)		31 (30.4)	38 (25.7)	
NYHA, n (%):			0.391			0.171
1	44 (27.0)	15 (17.2)		23 (22.5)	36 (24.3)	
2	65 (39.9)	39 (44.80		47 (46.1)	57 (38.5)	
3	29 (17.8)	18 (20.7)		13 (12.7)	34 (23.0)	
4	25 (15.3)	15 (17.2)		19 (18.6)	21 (14.2)	
Killip Class, n (%):			0.592			0.238
1	98 (60.1)	59 (67.8)		57 (55.9)	100 (67.6)	
2	45 (27.6)	18 (20.7)		31 (30.4)	32 (21.6)	
3	8 (4.9)	5 (5.7)		5 (4.9)	8 (5.4)	
4	12 (7.4)	5 (5.7)		9 (8.8)	8 (5.4)	
Cardiac Enzymes:						
CK [IU/L]	281.00 (603.80)	99.00 (118.50)	[c]<0.001	198.50 (463.60)	154.00 (359.50)	[c]0.421
CK-MB [IU/L]	53.75 (51.80)	34.00 (25.00)	[c]<0.001	45.00 (43.80)	46.25 (54.70)	[c]0.767
Troponin T +	124 (76.1)	41 (47.1)	<0.001	71 (69.6)	94 (63.5)	0.317

[Table/Fig-1]: Baseline characteristics and clinical presentation of patients.
[a]p value <0.05 were considered statistically significant; [b]Independent t-test and [c]Mann Whitney U test was used to compare quantitative data without normal distribution. [d]Fisher's exact test and x^2 test (Pearson's chi-square test) were used to compare categorical variables. Data presented as mean+standard deviation, median (interquartile range) and frequency (percentages).
BP: blood pressure; LVEF: left ventricular ejection fraction; CK: creatinine kinase; CK-MB: creatine kinase MB isoenzyme; MI: myocardial infarction; NYHA: New York Heart Association; CABG: coronary artery bypass grafting: PCI: percutaneous coronary intervention; CAD: coronary artery disease; UA: unstable angina; NSTEMI; non-ST elevation myocardial infarction; STEMI: ST elevation myocardial infection; NODV: number of diseased vessel

Characteristics	Gender			Age Group (years)		
	Male (n=163)	Female (n=87)	[a]p-value	18 to <45 (n=102)	>45 (n=148)	[a]p-value
Conventional risk factors, n (%):						
Smoking	65 (39.9)	8 (9.2)	<0.001	27 (26.5)	46 (31.1)	0.431
Diabetes	74 (45.4)	54 (62.1)	0.012	37 (36.3)	91 (61.5)	<0.001
HTN	107 (65.6)	69 (79.3)	0.024	72 (70.6)	104 (70.3)	0.957
Dyslipidemia	150 (92.0)	78 (89.7)	0.529	86 (84.3)	142 (95.9)	0.001
Family History of CAD or MI	61 (37.4)	39 (44.8)	0.255	44 (43.1)	56 (37.8)	0.401
Number of Risk Factors, n (%):			0.186			0.207
0	2 (1.2)	2 (2.3)	0.520	2 (2.0)	2 (1.4)	0.706
1	19 (11.7)	7 (8.0)	0.373	15 (14.7)	11 (7.4)	0.064
2	44 (27.0)	19 (21.8)	0.371	30 (29.4)	33 (22.3)	0.203
3	50 (30.7)	33 (37.9)	0.246	31 (30.4)	52 (35.1)	0.434
4	40 (24.5)	26 (29.9)	0.361	22 (21.6)	44 (29.7)	0.150
5	8 (4.9)	0 (0.0)	[b]0.053	2 (2.0)	6 (4.1)	0.478

[Table/Fig-2]: The prevalence of conventional risk factors in different age group and gender.
[a]p<0.05 was considered statistically significant
[b]Fisher's exact test and x^2 test (Pearson's chi-square test) were used to compare categorical variables.
Data presented as frequency (percentages).
HTN: hypertension; CAD: coronary artery disease; MI: myocardial infarction

Characteristics	Gender			Age group (years)		
	Male (n=163)	Female (n=87)	[a]p-value	18 to <45 (n=102)	>45 (n=148)	[a]p-value
Lipid profile:						
Cholesterol [mg/dl]	157.73+33.21	191.38+39.05	[b]<0.001	160.92+29.80	175.31+43.00	[b] 0.002
Cholesterol >200 [mg/dl], n (%)	22 (13.5)	39 (44.8)		15 (14.7)	46 (31.1)	
Cholesterol <200 [mg/dl], n (%)	141 (86.5)	48 (55.2)	<0.001	87 (85.3)	102 (68.9)	0.003
HDL [mg/dl]	34.91+6.29	36.57+4.81	[b]0.032	37.68+4.82	33.98+6.05	[b]<0.001
HDL >40[mg/dl], n (%)	26 (16.0)	29 (33.3)		36 (35.3)	19 (12.8)	
HDL <40[mg/dl], n (%)	137 (84.0)	58 (66.7)	0.002	66 (64.7)	129 (87.2)	<0.001
LDL [mg/dl]	88.88+24.98	94.69+25.94	[b]0.085	91.95+23.53	90.17+26.69	[b]0.588
LDL >130 [mg/dl], n (%)	5 (3.1)	4 (4.6)		2 (2.0)	7 (4.7)	
LDL <130 [mg/dl], n (%)	158 (96.9)	83 (95.4)	0.723	100 (98.0)	141 (95.3)	0.317
Triglycerides [mg/dl]	167.78+72.39	168.78+64.10	[b]0.914	172.78+74.29	164.93+66.05	[b]0.381
Triglycerides >150[mg/dl], n (%)	90 (55.2)	53 (60.9)		60 (58.8)	83 (56.1)	
Triglycerides <150[mg/dl], n (%)	73 (44.8)	34 (39.1)	0.385	42 (41.2)	65 (43.9)	0.667
Dyslipidemia, n (%):	150 (92.0)	78 (89.7)	0.529	86 (84.3)	142 (95.9)	0.001

[Table/Fig-3]: Lipid profile status in different age group and gender.
[a]p value <0.05 were considered statistically significant; [b]Independent t-test was used to compare quantitative data.
Data presented as mean+standard deviation and frequency (percentages). HDL: high density lipoprotein; LDL: low density lipoprotein

Characteristics	Gender			Age Group (years)		
	Male (n=163)	Female (n=87)	[a]p-value	18 to <45 (n=102)	>45 (n=148)	[a]p-value
Haematological indices:						
WBC count [$\times 10^3/\mu L$]	12.39+3.40	10.66+5.41	[b]0.002	12.76+3.44	11.12+4.67	[b]0.003
Neutrophil [$\times 10^3/\mu L$]	7.16+1.23	6.53+1.0.4	[b]<0.001	7.29+1.07	6.70+1.23	[b]<0.001
Lymphocyte [$\times 10^3/\mu L$]	2.82+1.05	2.56+0.87	[b]0.035	3.21+0.80	2.40+0.99	[b]<0.001
Hemoglobin [gm/dl]	13.02+2.16	10.21+2.26	[b]<0.001	12.64+2.06	11.64+2.80	[b]0.001
RBC count [$\times 10^6/\mu L$]	4.77+0.77	3.99+0.74	[b]<0.001	4.66+0.78	4.39+0.87	[b]0.014
Haematocrit [%]	39.15+6.05	33.22+5.81	[b]<0.001	38.11+5.81	36.39+7.02	[b]0.042
Platelet count [$\times 10^3/uL$]	253.18+105.16	269.60+95.73	[b]0.227	292.53+127.01	235.72+72.41	[b]<0.001
MPV [fL]	10.40+1.19	10.61+1.24	[b]0.183	10.57+1.19	10.41+1.22	[b]0.305
RDW [%]	14.60 (2.30)	14.60 (2.60)	[c]0.455	14.50 (2.13)	14.65 (2.75)	[c]0.367
Electrolytes:						
Sodium [mEq/L]	136.0 (6.5)	136.0 (6.0)	[c]0.667	135.00 (6.00)	137.00 (8.00)	[c]<0.001
Potassium [mEq/L]	4.30 (0.82)	4.00 (0.90)	[c]<0.001	4.05 (0.80)	4.30 (0.98)	[c]<0.001
Chloride [mEq/L]	97.43+8.54	97.89+7.86	[b]0.676	97.61+10.87	97.57+5.95	[b]0.971
Magnesium [mg/dl]	2.11+0.17	2.07+0.21	[b] 0.192	2.11+0.18	2.08+0.19	[b]0.287
Calcium [mg/dl]	8.93+0.49	8.95+0.46	[b] 0.764	8.92+0.53	8.94+0.44	[b] 0.636
Phosphate [mg/dl]	3.37+0.59	3.30+0.55	[b] 0.363	3.31+0.61	3.36+0.55	[b] 0.499

[Table/Fig-4]: The status of electrolytes and haematological indices in different age group and gender.
[a]p value <0.05 were considered statistically significant; [b]Independent t-test and cMann Whitney U test was used to compare quantitative data without normal distribution.
Data presented as mean+standard deviation and median (interquartile range)
WBC: white blood cell; RBC: red blood cell; MPV: mean platelet volume; RDW: red cell distribution width; BUN: blood urea nitrogen

who suffer from a first MI was discussed by Canto JG et al., who corroborated that 81% of patients included, had three identifiable risk factors present [13].

Dyslipidemia was found to be the most frequent risk factor (91.2%) in our sample. This is similar to the finding by Saleheen D et al., in which the comparison of risk factor profiles in both young and old patients revealed that dyslipidemias, specifically low HDL levels, were the most commonly encountered risk factor [14]. However, this is in contrast to the findings of the INTERHEART study, which included 29000 individuals from 52 different countries and established that smoking and an unusual relation between apolipoprotein B/apolipoprotein A-1 were the two common risk predictors for an acute MI [11].

Diabetes and dyslipidemias were both shown to be higher in elderly patients as compared to young patients. This lines up with previously published literature that shows that diabetes is more common in the elderly [15]. Hypertension was shown to be a more common finding in females than in males (79.3% vs 65.6%). Mansur AP et al., in his study, says that systemic arterial hypertension was found to be the major risk factor for females to develop CAD both before and after menopause [16]. Smoking, however, was more common in males i.e., 39.9% as female smoking in Pakistan is against conservative beliefs.

Fresco C et al., evaluated the changes in lipid levels in patients who had a MI or an event of UA [17]. Total cholesterol and LDL-C levels underwent a change of 7% and 10% respectively in those who had experienced MI and 5% and 6% in those with UA taken from the time of admission to the next morning. Owing to the marked changes that occur in lipid profiles following ACS, current guidelines emphasize on the measurement of serum lipids after admission

Author Year	Type of Study	Size of Population Studied	Findings of this Study	Findings of Our Study
James C et al., [35] 2013	Cross-sectional Study	496	Irrespective of gender, diabetes and dyslipidemia were found to be the major risk factors owing to CAD.	Dyslipidemia and HTN were found to be the top two contributing factors to CAD.
Khan MA et al., [36] 2012	Retrospective Study	3025	The frequency of CAD showed a significant increase in the local population, more so in women. There was increasing trend of CAD in the younger age group over the time span.	The majority of the patients enrolled in our study were males and of the older age bracket, however we did not investigate this trend over the years.
Butt Z et al., [3] 2010	Cross-sectional Study	100	Females have a higher prevalence of diabetes and HTN and less prevalence of smoking as compared to males.	Consistent with the findings of this study.
Jayachandra S et al [4] 2014	Cross-sectional Study	190	HTN and smoking were the most common risk factors in young patients. Along with HTN, diabetes and CKD were found in elderly patients.	Diabetes and dyslipidemia were more frequent risk factors in elderly patients, whereas smoking, HTN and a family history of MI or CAD were similar between the two age groups.
Saleheen D et al., [14] 2004	Cross-sectional Study	976	Majority of the patients admitted were males and older than 45 years of age. Young AMI patients had a positive history of HTN, family history of CAD, high cholesterol, high LDL and high triglycerides as compared to older patients.	Majority of the patients enrolled were males and in the older age bracket. HTN and a positive family history of CAD as risk factors were common between the two age groups. High cholesterol levels were more prevalent in the older age bracket.
Goel PK et al [22] 2002	Retrospective Study	2656	In north Indians, CAD occurs at much lower levels of total cholesterol and LDL. Hypertriglyceridemia is widely prevalent in this population. Smoking and family history of CAD were most commonly associated risk factors in younger patients.	Dyslipidemia and HTN were most commonly associated risk factors in younger patients
Naqvi SM et al., [23] 2015	Prospective Observational Study	162	Mean Hb levels decreased as the severity of CAD increased, however this association was not statistically significant	Mean Hb levels and red cell indices were higher in males and those in the young age bracket. We did not see the correlation of Hb with the severity of the disease.

[Table/Fig-5]: Comparison of the findings of present study with other studies from South East Asia.
AMI: acute myocardial infarction; CAD:coronary artery disease; CKD: chronic kidney disease; Hb: hemoglobin; HTN: hypertension; LDL: low density lipoprotein; MI: myocardial infarction

for ACS patients. Testing of lipid levels and their comparison with baseline values play a role in helping to determine whether a patient has 'dyslipidemia' and also aid in the selection and quantization of lipid lowering therapy.

In addition to the importance of elevated total cholesterol and LDL-C levels in cardiovascular events, low HDL-C levels have also been shown to be independent risk predictors for CAD [18] hence, were included in our study. The most frequent lipid alteration was low levels of HDL i.e., 78%. This is in accordance with previous studies done on ACS patients [19]. Low levels of HDL can be credited to the rising prevalence of diabetes, obesity and metabolic syndrome [20]. Elevated cholesterol was also noted in 24.4% of the patients in our study. Previous literature describes that South Asians 'total cholesterol and LDL-C levels are comparable to those of whites and Afro-Caribbean, but they have higher triglyceride and low HDL-C levels [21]. Goel PK et al., discussed how the South Asian population has a lower set value of hypercholesterolemia for the development of CAD [22].

A previous study conducted showed that haemoglobin levels in ACS patients were higher in men than in women [23]. This lines up with the findings of our study in which males were found to have higher levels of Hb, Hct and RBC count, however it also showed that anaemia was more prevalent in females. The RBC indices were also lower in elderly patients. Mahlknecht U and Kaiser S conducted a study on 1724 hospitalized patients to see if age affected their peripheral blood indices and the results showed that erythropoiesis related indices were, indeed, affected by progressing age [24]. This can be attributed to reduced number of haematopoietic stem cells, finite cell divisions and ineffective progenitor cells [25,26]. It is important to take notice of these varying Hb levels, as baseline Hb acts as prognostic indicators after an ACS episode [27].

The levels of WBC count, neutrophils and lymphocytes were found to be higher in males and in young patients, which is consistent with previous studies [28,29]. It is well established that smoking increases the leukocyte count and this has been documented in multiple studies [30,31]. Since smoking, in Pakistan, is a more common culture in young males, it can justify the elevated leukocyte count. In a study of patients presenting with chest pain, smokers as compared with nonsmokers had an increased WBC count and epicardial coronary endothelial dysfunction [32]. Our study demonstrated a lower WBC count in the elderly as compared to young patients. Bone marrow depression and a decreased turnover is commonly present in the aged which decreases the WBC count, in general, as well as in ACS patients.

There is a lack of literature on how baseline electrolyte levels vary during CAD; however, it is well established that electrolyte abnormalities like hypokalemia can lead to fatal arrhythmias and hence, there is a need to implement proper supplementation [7]. Our study revealed that the median levels of Na and K were significantly higher in elderly patients ($p<0.001$). Peng Y et al ., aimed to showcase the association between K levels and long term mortality after ACS and his study also corroborated with the finding that K levels increased with age [33]. The Centre of Disease Control revealed that hypokalemia owing to renal dysfunction was more prevalent in females, which supported our finding of statistically significant decreased serum K levels in females (4.0 vs. 4.3). Hence, anomalies in electrolyte levels not only lead to severe ventricular arrhythmias, but may also help in predicting renal dysfunction, which, even when mild, is associated with an increased chance of mortality after ACS [34].

LIMITATION

This study had certain limitations. Being a single center cross-sectional study, the sample size was small and geographically limited. Therefore, it is necessary to do a large population based study in order to adequately identify the conventional risk factor associations, as well as the changes that occur in baseline indices of CAD patients. Identification of risk factor was based on the information given by patients or their family members and, hence, may be erroneous. The lipid profile, haematological indices and electrolyte levels were from blood samples taken only once within the first 24 hours of admission.

CONCLUSION

Our study documented a strikingly high prevalence of conventional risk factors among the Pakistani population with CAD. The most

commonly reported risk factor was dyslipidemia, followed by hypertension and diabetes. Therefore, appropriate and timely efforts are needed to reverse dyslipidemia and also, decrease the burden of metabolic abnormalities. We also evaluated significant variations in baseline indices. Early assessment of these indices may help to implement proper supplementation and reduce the severity and possible implications of CAD.A large multicentre research focusing on novel biochemical markers like hs-CRP, homocysteine, fibrinogen and apo-B is required to design a proper preventive strategy specifically for the Pakistani population, who are at a higher risk for developing CAD.

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