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Original Research Article

Clinical And Biochemical Profile of Acute Myocardial Infarction in Young Adults

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Abstract

Background: Coronary artery disease (CAD) is a multifactorial disease involving both genetic and environmental factors, multiprong approach for prevention is warranted since atherosclerosis has its origin in childhood, particularly in Indians; preventive strategy should begin in childhood though it is probably never too late so that younger population in their prime period of life can have better quality of life.

Aim and Objectives: Hence, this work was undertaken in young patients of ischemic heart disease (IHD) to assess clinical, biochemical correlated with significant and non-significant CAD.

Materials and Methods: Weighty nine patients less than 45 years old presenting with acute myocardial infarction (defined by the 4th Universal Definition of Myocardial Infarction) were studied in the Department of Cardiology, Fortis Escorts Heart Institute, Delhi from September 2022 to March 2023. Preformed Questionnaire was used to collect the data and data was entered using Google Forms and MS Excel.

Results: The baseline data showed that mean age of the subjects was 39.3 years with standard deviation of 5.2 years. The youngest subject was 19 years and oldest was 45 years of age. Further the mean height, weight and BMI was 169.1 Cm, 76.3 Kg, 26.2 respectively. 86.5% of the patients among the sample were males. The clinical characteristics showed that mean Hb of the sample was 13.5 g/dl with a std. deviation of 1.8. The platelet count was 248.5 million. Other characteristics of the sample are summarized in Table 05. The number of patients with homocysteine level above normal range were 15 (16.8%) with average level of 59.8 umol/L. LP (a) levels were elevated (30-50 mg/dl) in 6 patients and were very high (>50 mg/dl) in 6 patients. The sample also showed that 62 subjects were ST Elevation MI followed by 25 subjects having NSTEMI. Around 12 subjects were diagnosed with unstable Angina. 88.8% of the patients had PTCA. Comparison of the clinical risk factors with the outcome variables showed no significant difference.

Conclusion: This original research contributes valuable information to the growing body of knowledge surrounding AMI in young adults. The insights gained from this study can guide healthcare providers in delivering more targeted and personalized care to this vulnerable population. By addressing the unique risk factors and implementing early preventive measures, we can strive to curb the rising prevalence of AMI in young adults and ultimately improve their overall cardiovascular health and well-being.

Keywords: Coronary Artery Disease, Acute MI, Young Adults, Biochemical Parameters.

Introduction

Coronary artery disease (CAD) is a major cause of morbidity and mortality worldwide. Earlier CAD was usually found in the older population; however, nowadays, it is often encountered by young adults. An estimated 4%–10% of individuals with documented CAD are seen to be <45 years of age.[1, 2]

Numerous studies over the past 50 years, involving several generations, have consistently shown that the incidence and mortality rates for CAD are 50%–300% higher among overseas Indians compared with compatriots of other ethnicities in several countries.[3] Asian Indians around the globe have the highest rates of PCAD, with clinical

manifestations occurring about 10 years earlier than in other populations.

Risk for developing CVD emerges at a relatively young age in the Indian population, and women have a risk similar to that of men.[4]

When young adults, especially females, experience symptoms of CAD, they may be more likely to have atypical symptoms, leading to delays in presentation or treatment. Finally, young adults may have higher rates of medication nonadherence. [3, 4]

Since CAD is a multifactorial disease involving both genetic and environmental factors, multiprong approach for prevention is warranted since atherosclerosis has its origin in childhood, particularly in Indians; preventive strategy should begin in childhood though it is probably never too late so that younger population in their prime period of life can have better quality of life. Hence, this work was undertaken in young patients of ischemic heart disease (IHD) to assess clinical, biochemical correlated with significant and non-significant CAD.

Material and Methods

Study Area: Department of Cardiology, Fortis Escorts Heart Institute, Delhi

Study Population: All the patients less than 45 years old presenting with acute myocardial infarction to Cardiology Department at Fortis Escorts Heart Institute, Delhi

Inclusion Criteria

Patients of either gender between the ages of 18 to 45 years of age, presenting with Acute Myocardial Infarction as defined by the 4th Universal Definition of Myocardial Infarction presenting to Fortis Escorts Heart Institute.

Exclusion Criteria

- Patients presenting more than 48 hours of index pain. Previous history of myocardial infarction
- Patients who do not under cardiac catheterization Patients with peri-procedural MI
- Patients presenting after receiving any myocardial revascularization therapy from another hospital
- Reluctance to participate

Sample Size: All consecutive patients fitting inclusion criteria during the study duration.

Study Design: The present study is a prospective observational study to be conducted after obtaining approval from hospital's ethical and research committees.

Study Duration: September 2022 to March 2023.

Data Collection Tools: Preformed Questionnaire Data was entered using Google Forms and MS Excel

Statistical Methods

Data will be expressed as mean ± SD. Continuous variables were presented as mean ± standard deviation, while categorical variables were expressed as frequency (percentage). Statistical analysis will be performed using a standard software package. Quantitatively, parametric data will be analyzed using t-test. Qualitative data will be analysed using Chi-square or Fisher's exact test. The difference was considered statistically significant if $P < 0.05$ was obtained.

Ethical Considerations

For the purpose of conducting the thesis, permission will be taken from the Institutional Ethics Committee. After getting the clearance, the study will be done only on those patients who give their written consent to be a part of the study. The patients will not be incurring extra costs for the same

Results

The current study assessed the clinical and biochemical profile of acute myocardial infarction in young adults. The baseline data showed that mean age of the subjects was 39.3 years with standard deviation of 5.2 years. The youngest subject was 19 years and oldest was 45 years of age. Further the mean height, weight and BMI was 169.1 Cm, 76.3 Kg, 26.2 respectively. 86.5% of the patients among the sample were males.

Table 1: Baseline data for Age, Height and Weight of the sample population

	N	Mean	Std. Deviation	Minimum	Maximum
Age	89	39.30	5.20	19.00	45.00
Height	89	169.1	7.38	149.00	183.00
Weight	89	76.3	14.93	20.50	131.00
BMI	89	26.2	7.09	20.2	42.49

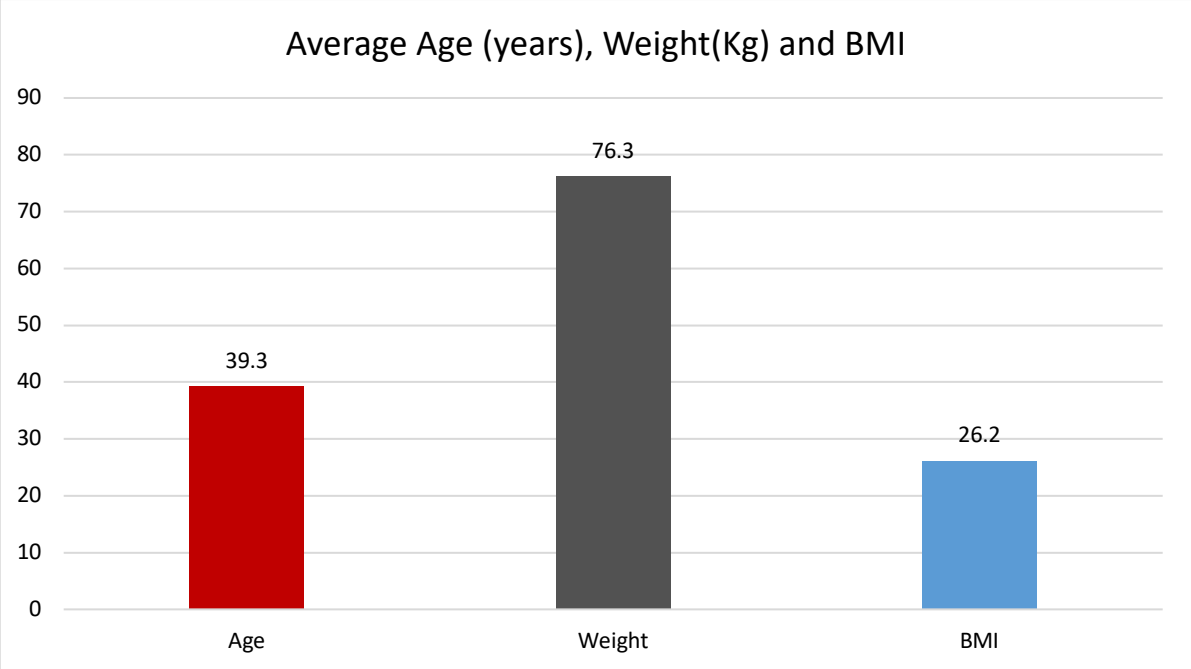

Figure 1: Baseline data for Age, BMI and Weight of the Sample Population

Table 2: Distribution of the sample with respect to Gender

Gender	Frequency	Percent
Male	77	86.5
Female	12	13.5
Total	89	100.0

The clinical characteristics showed that mean Hb of the sample was 13.5 g/dl with a std. deviation of 1.8. The platelet count was 248.5 million. Other characteristics of the sample are summarized in Table 05. The number of patients with homocysteine level above normal range were 15 (16.8%) with average level of 59.8 umol/L. LP (a) levels were elevated (30-50 mg/dl) in 6 patients and were very high (>50 mg/dl) in 6 patients.

Table 3: Clinical Characteristics of the sample

Parameters	N	Minimum	Maximum	Mean	Std. Deviation
HB	89	8.90	19.90	13.58	1.8
PLT	89	60.00	404.00	248.5	72.80
CREAT	89	.18	2.00	.89	.23
BUN	89	6.00	50.00	13.19	6.35
CK	89	22.00	5602.00	452.82	889.18
CPKMB	89	.35	305.00	30.78	60.94
Triglyceride	89	89.00	260.00	151.37	36.77
Total Cholesterol	89	130.00	276.00	185.98	30.013
HDL	89	25.00	62.00	39.01	5.95
LDL	89	72.00	170.00	99.2135	23.07718
Troponin T	89	3.00	10050.00	459.23	1260.16
Hbac1	89	4.80	12.00	5.88	1.65
Homocysteine	89	4	90	15.6	21.08
Lipoproteins	89	4	95	13.9	17.6
HsCRP	89	0.32	21	2.35	3.76

The sample also showed that 62 subjects were ST Elevation MI followed by 25 subjects having NSTEMI. Around 12 subjects were diagnosed with unstable Angina. 88.8% of the patients had PTCA.

Table 4: Frequency Distribution of the STEMI/ NSTEMI/ ANGINA in the sample

	STEMI	NSTEMI	Unstable ANGINA
N	62	15	12
%	69.7%	16.8%	13.5%

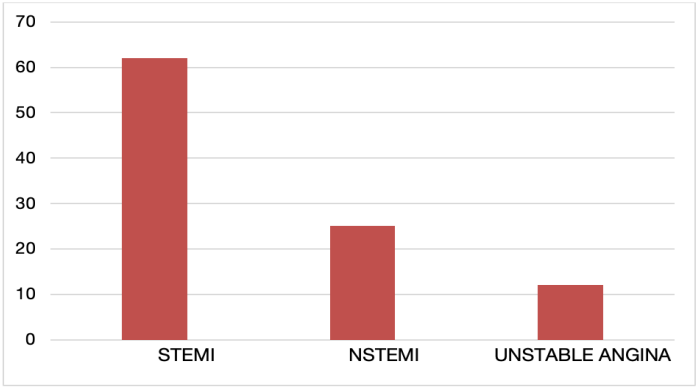

Figure 2: Distribution of the STEMI/ NSTEMI/ ANGINA in the sample

Comparison of the clinical risk factors with the outcome variables showed no significant difference.

Table 5: Comparison of the Risk Factors among the Outcome variables

Risk Factor	Outcome	Mean	SD	p-value
Hb	PTCA Medical CABG	13.5 14.5 12.2	1.9 1.3 1.6	p>0.05
Platelet	PTCA Medical CABG	250.9 230.1 229.0	71.3 65.9 139.3	p>0.05
Creatinine	PTCA Medical CABG	0.87 0.92 1.32	0.21 0.08 0.58	P<0.05*
BUN	PTCA Medical CABG	13.03 11.7143 20.66	6.73 4.231 4.04	p>0.05
CK	PTCA Medical CABG	450.4 587.7143 200.6	889.65 1114.46336 186.7	p>0.05
CPKMB	PTCA Medical CABG	33.8 6.04 7.5	64.03 6.2 6.33	p>0.05
Triglyceride	PTCA Medical CABG	150.3 151.14 178.3	37.19 34.8 28.1	p>0.05
Total Cholesterol	PTCA Medical CABG	185.4 195.5 178.0	30.06 34.8 17.4	p>0.05
HDL	PTCA Medical CABG	38.6 43.0 39.0	5.56 9.74 3.05	p>0.05
LDL	PTCA Medical CABG	97.8 116.8 92.6	21.3 36.2 20.8	p>0.05
Trop T	PTCA Medical CABG	483.5 93.4 673.3	1328.2 141.2 665.15	p>0.05
Hbac1	PTCA Medical CABG	5.76 5.57 7.7	1.57 1.38 2.16	p>0.05
Homocysteine	PTCA Medical CABG	16.4 6.14 17.6	22.0 1.5 17.6	p>0.05
Lipoproteins	PTCA Medical CABG	12.8 27.8 9.0	16.6 26.4 2.0	p>0.05
HsCRP	PTCA Medical CABG	2.33 2.97 1.46	3.8 3.56 1.36	p>0.05

Chi-square test of significance applied, p>0.05- non-significant

Discussion

There have been exponential rise in the CAD globally and also in low and middle income countries. The CVD tend to be more aggressive and start manifesting at a younger age.

The present cross-sectional study assessed the clinical, biochemical and angiographic profile of acute myocardial infarction in young adults.

Gupta et al. have shown that there has been no noticeable decline in the hospitalisation rates among young women and men across all age groups from 2001 to 2010. The explanation to this may be associated genetic factors and higher rates of hospitalisation among those who are more likely to survive previous hospitalisation for AMI.[4]

In India, PURE (Prospective Urban Rural Epidemiology) cohort study with sample size of 24000 Indians reported CVD rate of 6.43/1000 person years compared to 3.99 per 1000 person years in western countries. Also the first MI attack occurs in 4.4% of Asian women and 9.7% of men at age <40 years which is further 2 to 3.5 times higher than in the west European population and is 3rd highest of all regions.[5]

Studies also suggest that Asian in general and Indian in particular are at increased are at increased risk of developing acute MI even at younger age < 40 years. The prevalence of CAD in Indians (<45 years) have been reported to be 12-16%. [29/2/3] Further 25% of the MI occurs in Indians less than 40 years age.[6]

Demographic Profile

The mean age of the sample in the study was 39.3 years which was higher than the study done by Islam KN et al. and Sinha SK et al. (26 years). Pandya et al. also found majority of the patients (40%).

The mean BMI in the group was 26.2 which was higher than study by Islam et al. which reported average BMI of 24.3. Lakka et al. and Sinha et al. [B/22 and B] also reported obesity to be independent risk factor for CAD. Lakka et al. also showed that in combination with smoking, the risk of coronary events increases by 5.5 times in middle aged men. [7]

With respect to Gender, it was observed that 86.5% were males which was in line with the study done by Islam et al. where in group <40 years, 78.3% were males. Male gender is one of the most demonstrated risk factor for the CAD, the skewed distribution is attributed to protective effects of estrogens in preventing the atherosclerosis and also lower prevalence of adverse habits like smoking in females as compared to males which has been evident via multiple epidemiological studies. [8] Deora S et al. also showed male predominance in both STEMI and NSTEMI/UA groups. [9] Ali et al. also showed male predominance (93.7%) in the study of 95 patients less than 40 years and who had undergone CAG recently. Similar observations have been made by Dwivedi et al and Wong et al. where male gender is 4:1 and 33.3:1 times higher in the AMI groups. [10]

Gupta et al. have reported that young females had higher in hospital mortality compared to men across age group in young adults. Women have longer presentation and treatment times after symptom onset compared with men, which may account for their worse in-hospital mortality. [4]

STEMI/NSTEMI

The present study showed that majority of the cases presented with STEMI i.e. 69.7% The histopathological studies plaques in younger patients develop more quickly and contain more lipids with lack of cellular scar tissue. Such plaques are prone to rupture and thus attributes more STEMI at younger age than chronic stable angina. [B/19] Also Sinha et al. showed that high frequency of stress events may also accounts for instability of plaques and ultimately rupture at younger age. [11] In the study done by Deora S et al. 3/4th of the sample exhibited STEMI and ¼ demonstrated NSTEMI/UA which was in line with other study which showed dominance of the STEMI in the sample. Further Tungsubutra et al. also reported that among 544 patients with <45 years age and acute coronary syndrome, 67.3% were STEMI and 19.3% & 13.4% were NSTEMI and US respectively.[10]

In India, Prajapati et al. also demonstrated that in Gujarati patients with ACS and aged <40 years, 85% had STEMI and only 15% had NSTEMI/UA. Such studies demonstrate evidence-based information about the distribution of the patients based on their presentations which verifies the predominance of STEMI among the young adults. Adhikari CM et al. also reported that there were 66.6% STEMI, 9.2% NSTEMI and 24.2% unstable angina patients which was in line to our study results. [12]

Hyperhomocysteinemia and Elevated Lp (a)

In the present study 16.8% and 13.4% of the patients had Hyperhomocysteinemia and Elevated Lp (a). Other studies have demonstrated that elevated Lp (a) and high levels of homocysteine have played an important role in MMI. [12] Further reports have shown that 10-20% of the cases of CAD have linkages to elevated levels of serum homocysteine. Even Lp (a) have been considered as 10 times more atherogenic in comparison to LDL-C.

Homocysteine levels are reported to be higher in the Asian Indians due to tendency to be vegetarians and vegetarians have been reported to be 3 times higher risk of hyperhomocysteinemia compared with others. Bhandari et al reported incidence of 42% hyperhomocysteinemia and another study by Arumalla Reddy et al. also reported

hyperhomocysteinemia in 66% of the patients with AMI.

Bhandari et al. have shown 26% cases of Lipoprotein A >30 mg/dl which was higher than current study. Similarly, the same study showed contrasting results with respect to raised homocysteine levels in patients (42% vs 16.8%).[12]

Lp (a) is considered to be a major risk factor in Asian Indians and thus should be treated as a potential risk factor. In Indians, the high level of Lp (a) is shown to be most prevalent dyslipidaemia. The effect of the Lp (a) on the atherogenicity is not additive but works in multiplication manner. Thus Lp (a) should be treated as independent risk factor for CAD. The Lp (a) incidence in the current study was lower than reported by Prajapati et al. (21.5%) and Schaefer et al. (21.5%). [13]

Conclusion

Our study revealed that AMI in young adults presents with a unique set of clinical features, often differing from those observed in older individuals. Despite the overall lower prevalence of traditional cardiovascular risk factors in this group, several modifiable risk factors, such as smoking, sedentary lifestyle, and unhealthy dietary habits, emerged as significant contributors to AMI occurrence. This underscores the importance of implementing targeted prevention strategies and raising awareness among young adults about the potential risks they face.

Furthermore, the biochemical analyses demonstrated intriguing patterns, including alterations in lipid profiles, inflammatory markers, and cardiac enzymes. These insights may help in the early identification of young adults at higher risk of AMI, facilitating timely intervention and reducing adverse outcomes. It is essential for clinicians to be vigilant about potential warning signs and consider AMI as a differential diagnosis even in younger patients, as early detection and prompt treatment can significantly improve prognosis.

Our research underscores the necessity of a comprehensive approach to AMI management in young adults, which includes not only the acute phase interventions but also long-term follow-up and secondary prevention strategies. Educating patients about the importance of adherence to medications, lifestyle modifications, and regular cardiovascular check-ups can play a pivotal role in reducing the burden of AMI in this age group.

However, it is essential to acknowledge certain limitations in our study, including its retrospective nature and single-center design, which may limit the generalizability of the findings. Therefore, future multi-center, prospective studies with larger sample sizes are warranted to validate and expand upon our results.

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