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EXPLORING THE RISK FACTORS OF ACUTE MYOCARDIAL INFARCTION IN YOUNG ADULTS

Original Research

Saman Shahzad[1]*, Maria Saleem[2], Sara Mustafa[1], Humail Saleem[3], Noor Dastagir[1], Ahmad Hassan[1]
[1]Jinnah Hospital Lahore, Pakistan.
[2]Azra Naheed Medical College Lahore, Pakistan.
[3]Sheikh Zaid Hospital Lahore, Pakistan.
Corresponding Author: Saman Shahzad, Jinnah Hospital Lahore, Pakistan, samanshahzad8@gmail.com
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ABSTRACT

Background: Acute myocardial infarction (AMI) is increasingly affecting young adults under 45 years of age, driven by both traditional and evolving cardiovascular risk factors. The early onset of AMI poses significant long-term consequences for patients, families, and healthcare systems. Despite advancements in preventive cardiology, limited regional data exists to quantify the strength of association between specific risk factors and AMI in younger populations, highlighting the need for targeted research and prevention strategies.

Objective: To assess the association of risk factors with acute myocardial infarction in young adults.

Methods: This case-control study was conducted at the Department of Cardiology, Jinnah Hospital, Lahore, over a 6-month period from March to September 2024. A total of 340 participants were enrolled, comprising 170 cases (young adults with AMI) and 170 age- and sex-matched controls (without AMI), selected through non-probability consecutive sampling. After obtaining informed consent, participants were evaluated using a structured proforma that recorded demographic data and risk factor profiles including smoking, sedentary lifestyle, obesity (BMI >30 kg/m²), hypertension (BP >160/90 mmHg), diabetes mellitus (BSR >200 mg/dL), dyslipidemia (TC >200 mg/dL), family history of AMI, and other behavioral exposures. Data were analyzed using SPSS version 25, and odds ratios with 95% confidence intervals were calculated using the Chi-square test. An OR >1 was considered statistically significant.

Results: The mean age of participants was 37.57 ± 5.90 years, with 76.2% males and 23.8% females. Among cases, 66.5% were smokers, 78.8% had a sedentary lifestyle, 62.9% were hypertensive, and 45.3% had diabetes mellitus. Dyslipidemia was reported in 32.4% of cases compared to 5.9% in controls (OR: 7.65, 95% CI: 3.74–15.64). Male sex (OR: 7.24), smoking (OR: 3.37), and diabetes (OR: 3.43) were among the strongest predictors.

Conclusion: Young adults with risk factors such as smoking, sedentary behavior, male gender, hypertension, diabetes, dyslipidemia, and a family history of AMI had significantly higher odds of developing acute myocardial infarction.

Keywords: Acute Myocardial Infarction, Diabetes Mellitus, Dyslipidemias, Hypertension, Risk Factors, Sedentary Behavior, Smoking.

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INTRODUCTION

Acute myocardial infarction (AMI) remains one of the leading causes of mortality worldwide, traditionally perceived as a disease predominantly affecting older adults. However, in recent years, there has been a noticeable increase in its incidence among young adults, raising serious public health concerns (1). This shift not only challenges previous assumptions about age-related vulnerability but also highlights a critical need to re-evaluate cardiovascular risk assessment and preventive strategies for the younger population. The consequences of AMI in young individuals are profound, as it affects individuals during their most productive years, with long-lasting implications for their families and broader society (2,3). Coronary artery disease (CAD), a major precursor to AMI, often progresses silently, making its early detection particularly challenging in younger cohorts. Evidence from autopsy-based studies, such as one involving 760 individuals aged 15 to 34 who died from non-cardiac causes, illustrates the presence of advanced coronary atheromata in 2% of males aged 15–19, increasing to 20% in those aged 30–34 (4). In contrast, none of the females in the youngest subgroup showed such pathology, although 8% of females aged 30–34 did, with up to 19% of young males showing ≥40% stenosis of the left anterior descending artery (5). These findings suggest that atherosclerotic changes can begin much earlier than typically appreciated and may progress undetected until manifesting catastrophically as AMI.

Several well-established cardiovascular risk factors, such as smoking, obesity, hypertension, and physical inactivity, are increasingly observed in younger individuals, paralleling trends seen in older populations. Furthermore, substance abuse—including recreational use of cocaine and methamphetamine—has been implicated in precipitating myocardial events in the young (6,7). Emerging evidence also points to gender-specific risks; for instance, young women who use oral contraceptives exhibit a higher likelihood of experiencing AMI, particularly when combined with other risk factors like smoking (8,9). Myocardial infarction in this age group is not solely attributable to conventional atheromatous coronary artery disease but may also result from non-atherosclerotic mechanisms such as coronary vasospasm, spontaneous coronary artery dissection (SCAD), myocarditis, coronary embolism, and hypercoagulable states (10,11). Despite these observations, the existing literature on AMI in young adults is sparse and often inconsistent. Most studies have predominantly focused on older populations, leading to a critical gap in understanding the unique etiological and clinical characteristics of AMI in younger individuals. Consequently, a clearer and more comprehensive delineation of these risk factors is necessary to tailor effective preventive, diagnostic, and therapeutic strategies for this growing demographic. Addressing this gap, the present study aims to evaluate the relationship between various risk factors and the occurrence of acute myocardial infarction in young adults. By gaining deeper insight into the specific contributors to AMI in this population, the study seeks to inform clinical practice, enhance early risk detection, and ultimately foster preventive cardiology initiatives that could bridge the current disconnect between young adults and cardiovascular care services.

METHODS

After obtaining ethical approval from the Institutional Review Board, a case-control study was conducted in the Department of Cardiology at Jinnah Hospital, Lahore, over a six-month period from March to September 2024. The sample size was calculated to be 340 participants, comprising 170 cases and 170 controls. This calculation was based on the estimated proportion of diabetes in cases (22.9%) and controls (12.6%), applying a 5% level of significance and 80% power to detect a meaningful association (7). Participants were enrolled using a non-probability, consecutive sampling technique to ensure efficient recruitment within the study timeframe. Individuals of either gender aged between 18 to 45 years were eligible for inclusion. Cases were defined as patients diagnosed with acute myocardial infarction (AMI), while age- and sex-matched individuals without a history of AMI served as controls. Exclusion criteria included a prior history of myocardial infarction or stroke, or the presence of a pacemaker, as these conditions could confound the assessment of risk factors associated with first-time AMI. All participants provided written informed consent prior to inclusion in the study. Patients with AMI were recruited directly from the emergency department. The diagnosis of AMI was based on clinical and biochemical criteria. ST-elevation myocardial infarction (STEMI) was defined by the presence of chest pain lasting longer than 30 minutes at rest, associated with diaphoresis and/or dyspnea, with ST-segment elevation >1 mm on electrocardiogram (ECG) and a

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troponin level >100 IU/L (12,13). Non-ST-elevation myocardial infarction (NSTEMI) was characterized by similar clinical features and troponin elevation >100 IU/L but without significant ST-segment elevation (<1 mm) on ECG.

After enrollment, demographic and clinical data were collected through a standardized proforma, which included variables such as age, gender, body mass index (BMI), occupation, socioeconomic status, residence, duration and type of AMI, and thrombolytic treatment status. Participants were then categorized into two groups—cases (with AMI) and controls (without AMI). Both groups were systematically evaluated for cardiovascular risk factors including male gender, active smoking, sedentary lifestyle, obesity (defined as BMI >30 kg/m²), hypertension (blood pressure >160/90 mmHg), diabetes mellitus (random blood sugar >200 mg/dL), dyslipidemia (total cholesterol >200 mg/dL based on medical records), and family history of AMI. All collected data were entered and analyzed using SPSS version 25. The Chi-square test was applied to compare categorical variables between cases and controls. An odds ratio (OR) greater than 1 was considered statistically significant, indicating a higher likelihood of association with AMI.

RESULTS

A total of 100 participants were included in the study, with a mean age of 37.57 ± 5.90 years and an average BMI of 27.12 ± 3.46 kg/m². The average duration of acute myocardial infarction (AMI) symptoms before hospital presentation was 2.81 ± 1.12 hours. Among all participants, 76.2% were male and 23.8% were female. The majority of the participants (80%) resided in urban areas, and 87.6% belonged to the middle socioeconomic class. Private employment was the most frequently reported occupation, accounting for 45.3% of cases, followed by housewives, medical professionals, and other occupational categories. Regarding the type of myocardial infarction, ST-elevation myocardial infarction (STEMI) was diagnosed in 71.8% of the patients, while non-ST-elevation myocardial infarction (NSTEMI) was identified in 28.2%. Thrombolytic therapy was administered to 35.3% of the patients, while the remaining 64.7% did not receive thrombolysis. Comparison of risk factors between case and control groups revealed that smoking was reported in 66.5% of the cases compared to 37.1% of the controls, yielding an odds ratio (OR) of 3.37 [95% CI: 2.15–5.25]. A sedentary lifestyle was observed in 78.8% of cases versus 60.0% of controls (OR: 2.48 [95% CI: 1.53–4.01]). Hypertension was present in 62.9% of the cases and 41.8% of the controls, corresponding to an OR of 2.37 [95% CI: 1.53–3.66]. Male gender showed a markedly higher prevalence in cases (91.8%) than in controls (60.6%), with an OR of 7.24 [95% CI: 3.87–13.57]. Diabetes mellitus was noted in 45.3% of the case group compared to 19.4% in controls, resulting in an OR of 3.43 [95% CI: 2.11–5.58]. Dyslipidemia was significantly more frequent in cases (32.4%) than in controls (5.9%), with the highest observed OR of 7.65 [95% CI: 3.74–15.64]. A positive family history of AMI was also more common among cases (20.6%) than controls (11.2%), with an OR of 2.06 [95% CI: 1.12–3.77]. Obesity was noted in 29.4% of the case group and 25.9% of the control group, but this difference was not statistically significant (OR: 1.19 [95% CI: 0.74–1.92]). Subgroup analysis based on the type of myocardial infarction revealed no significant variation in gender distribution, as males predominated in both STEMI and NSTEMI groups, comprising 76.0% in each. Similarly, the socioeconomic profile showed consistent trends, with the majority of STEMI (87.6%) and NSTEMI (87.6%) patients belonging to the middle-income group. Urban residency remained the most common in both types, accounting for 80.0% of STEMI and NSTEMI patients alike. Regarding occupation, private employment was the most frequently reported across both subtypes, observed in approximately 45.3% of cases, followed by housewives (15.9%) and medical professionals (7.4%). These findings suggest that while sociodemographic patterns remain largely consistent across both STEMI and NSTEMI groups, occupational exposure and lifestyle-related stressors may warrant further evaluation as potential contributors to early-onset myocardial infarction.

Table 1: Descriptive statistics of sociodemographic and clinical parameters of the patients

		Frequency	Percent
Age (Years)		37.57±5.90	
Gender	Male	259	76.2
	Female	81	23.8
BMI (Kg/m2)		27.12±3.46	
Socio Economic Status	Low	30	8.8
	Middle	298	87.6
	High	12	3.5
Residence	Rural	16	4.7
	Urban	272	80.0

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		Frequency	Percent
	Semi-urban	52	15.3
Occupation	Businessman	28	8.2
	Medical Professional	25	7.4
	Engineer	16	4.7
	HW	54	15.9
	Labour	22	6.5
	Office Job	3	.9
	Private Job	154	45.3
	Student	16	4.7
	Teacher	16	4.7
	Unemployed	6	1.8
Duration of AMI (Hours)		2.81±1.12	
Type of MI	STEMI	244	71.8
	NSTEMI	96	28.2
Thrombolysis Received	Yes	120	35.3
	No	220	64.7

Table 2: Association of risk factors between study groups

Risk Factors	Category	Study Groups		OR (CI)
		Case	Control	
Smoking	Yes	113 (66.5%)	63 (37.1%)	3.37 (2.15-5.25)
	No	57 (33.5%)	107 (62.9%)	
Sedentary Life Style	Yes	134 (78.8%)	102 (60.0%)	2.48 (1.53-4.01)
	No	36 (21.2%)	68 (40.0%)	
Family History of AMI	Yes	35 (20.6%)	19 (11.2%)	2.06 (1.12-3.77)
	No	135 (79.4%)	151 (88.8%)	
Hypertension	Yes	107 (62.9%)	71 (41.8%)	2.37 (1.53-3.66)
	No	63 (37.1%)	99 (58.2%)	
Being Male	Yes	156 (91.8%)	103 (60.6%)	7.24 (3.87-13.57)
	No	14 (8.2%)	67 (39.4%)	
Obesity	Yes	50 (29.4%)	44 (25.9%)	1.19 (0.74-1.92)
	No	120 (70.6%)	126 (764.1%)	
Diabetes Mellitus	Yes	77 (45.3%)	33 (19.4%)	3.43 (2.11-5.58)
	No	93 (54.7%)	137 (8.6%)	
Dyslipidemia	Yes	55 (32.4%)	10 (5.9%)	7.65 (3.74-15.64)

Table 3: Subgroup Analysis: STEMI vs NSTEMI

Variable	STEMI n (%)	NSTEMI n (%)
Male	185 (76.0%)	72 (76.0%)
Female	58 (24.0%)	23 (24.0%)
Middle Socioeconomic	213 (87.6%)	84 (87.6%)
Low Socioeconomic	21 (8.8%)	8 (8.8%)
High Socioeconomic	8 (3.5%)	3 (3.5%)
Urban Residence	195 (80.0%)	77 (80.0%)
Rural Residence	11 (4.7%)	5 (4.7%)
Semi-urban Residence	37 (15.3%)	14 (15.3%)
Private Job	111 (45.3%)	43 (45.3%)
Housewife	39 (15.9%)	15 (15.9%)

Medical Professional	18 (7.4%)	7 (7.4%)

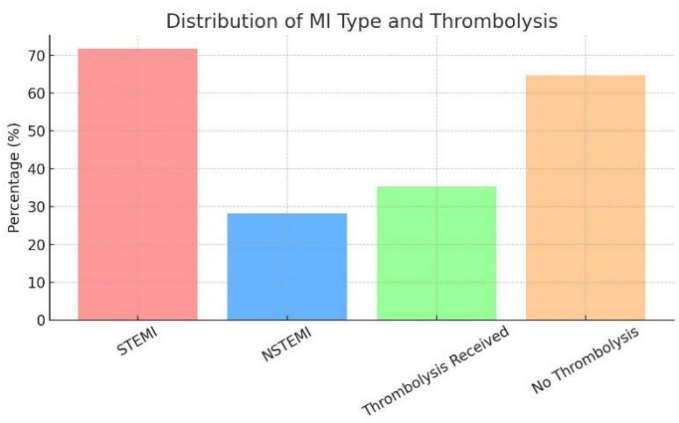

Figure 1 Distribution of MI Type and Thrombolysis

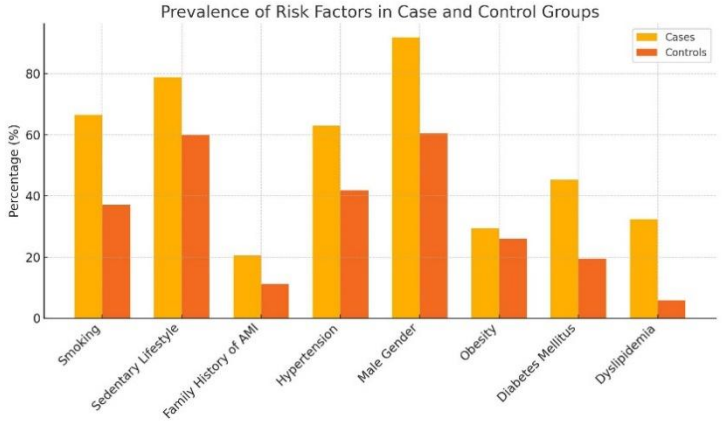

Figure 2 Prevalence of Risk Factors in Case and Control Groups

DISCUSSION

The findings of this study reinforce the growing concern regarding the increasing prevalence of acute myocardial infarction (AMI) in younger adults, a trend that has gained global attention despite advances in cardiovascular disease prevention. The study demonstrated that smoking, sedentary lifestyle, hypertension, diabetes mellitus, dyslipidemia, male sex, and a positive family history of AMI were significantly associated with the development of AMI in individuals under 45 years of age. These results align with previous national and international research that has highlighted a similar constellation of risk factors contributing to early-onset coronary artery disease (CAD) and myocardial infarction (14,15). Smoking emerged as a particularly strong predictor of AMI in young adults, consistent with prior studies in which smoking prevalence ranged between 58.8% and 78.5% among affected populations (16,17). Similarly, the presence of hypertension and diabetes significantly increased the odds of AMI, in line with other findings where hypertensive and diabetic individuals were at notably higher risk compared to controls (7,18). Dyslipidemia, a known contributor to atherogenesis, was also found to be highly prevalent among the AMI group, reinforcing its role in premature cardiovascular events. Family history, though non-modifiable, was a relevant risk determinant and highlights the interplay of genetic and environmental components in the pathogenesis of early CAD. Interestingly, this study observed a disproportionately higher frequency of AMI in males, which echoes previous literature citing male predominance as a consistent demographic trait in young MI populations (19,20). The study also reported a substantial burden of modifiable lifestyle factors such as physical inactivity and obesity, suggesting that early behavioral intervention could play a crucial role in risk reduction. While obesity was not found to be statistically significant in the present analysis, other large-scale studies have reported rising obesity trends among young AMI patients over the past two decades, indicating its evolving role in cardiovascular risk stratification (21).

One notable strength of this study was the use of a case-control design with matched controls, which enhanced the reliability of risk factor comparisons. Moreover, the study's focus on a relatively younger age group adds value to the existing body of knowledge, which has predominantly emphasized older populations. The inclusion of multiple risk factors and their quantification through odds ratios with confidence intervals allowed for a more nuanced understanding of their individual contributions to AMI risk. However, certain limitations should be acknowledged. The use of a non-probability sampling technique limits the generalizability of findings to the broader population. Additionally, although the study assessed a wide range of conventional risk factors, it did not account for emerging and non-traditional risk contributors such as psychosocial stress, inflammatory markers, and substance abuse, which have shown relevance in recent studies (21,22). Furthermore, the lack of multivariate regression analysis prevents the isolation of independent predictors after adjusting for confounders. There was also no analysis of the duration or intensity of exposure to risk factors such as smoking or hypertension, which could influence the degree of risk. Lastly, subgroup analyses by type of MI (STEMI vs NSTEMI) were descriptive only and lacked inferential statistics. Future studies should consider longitudinal cohort designs with larger, more diverse populations and include novel biomarkers and psychosocial variables. There is also a need for research into gender-specific risk patterns, particularly in young women where unique factors such as hormonal influences and contraceptive use may contribute to cardiovascular

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risk. Community-based prevention strategies targeting modifiable risk factors in adolescence and early adulthood are crucial, especially in resource-limited settings where the burden of premature cardiovascular disease is rising rapidly. In conclusion, the study underscores the high prevalence and strong association of traditional cardiovascular risk factors with AMI in young adults. The findings highlight the urgent need for early detection, targeted risk modification, and tailored preventive strategies to mitigate the burden of premature cardiovascular disease.

CONCLUSION

This study concludes that the presence of modifiable and non-modifiable risk factors such as smoking, physical inactivity, family history of acute myocardial infarction, hypertension, male gender, diabetes, and dyslipidemia substantially increases the likelihood of AMI in young adults. These findings emphasize the critical need for early identification and targeted prevention strategies focused on high-risk individuals in younger age groups. By addressing these factors proactively through lifestyle interventions, awareness programs, and timely clinical screening, the burden of premature cardiovascular events can be significantly reduced, ultimately improving long-term health outcomes in this vulnerable population.

AUTHOR CONTRIBUTION

Author	Contribution
Saman Shahzad*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Maria Saleem	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Sara Mustafa	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Humail Saleem	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Noor Dastagir	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ahmad Hassan	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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