

Myocardial Infarction in Young versus Older Adults An Analysis of Differences in Proportion Risk Factors Clinical Demographics Angiographic Findings and In Hospital Outcomes

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Abstract:

Background: Coronary Artery Disease (CAD) has alarmingly increased in India due to the epidemiological change, happening about ten years earlier than in populations in the West. Young adults' acute myocardial infarction (AMI) is becoming a significant public health burden with distinctive features.

Objective: To assess the clinical profile, risk factors, angiographic patterns, and in-hospital outcomes of patients with AMI who are younger (≤ 45 years) and older (> 45 years).

Methods: Over the course of eighteen months, this prospective observational study was carried out at 2 centres DMCH, Darbhanga & RIMS, Ranchi, a tertiary care hospital in India. 500 patients with an AMI diagnosis were divided into two groups: Group A (young, n = 200) and Group B (older, n = 300).

Results: Males made up the majority of young patients (88%). The most common risk factor among young people was smoking (72%), while the elderly group had far higher rates of diabetes and hypertension. Angiographically, the older population was characterized by Multi-Vessel Disease (MVD), whereas Single Vessel Disease (SVD) was the predominant pattern in younger patients (62%). The younger group had a far lower in-hospital death rate (3.5%) than the older group (12.3%).

Conclusion: MI in young Indians differs from that in the elderly and is primarily caused by lifestyle factors, including as smoking and dyslipidemia, rather than degenerative comorbidities. The study emphasizes how vital it is to reach younger populations with primordial prevention.

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Introduction

Despite being the primary cause of death worldwide, cardiovascular disease (CVD) disproportionately affects low- and middle-income nations like India. The country's epidemiology is rapidly changing, moving from infectious diseases to lifestyle conditions that are not communicable. In

this context, the "Asian Indian Phenotype" which is defined by central obesity, elevated visceral fat, insulin resistance, and dyslipidemia predisposes this group to Coronary Artery Disease (CAD) at a much earlier age than their Caucasian counterparts [1]. Although Acute

Myocardial Infarction (AMI) has traditionally been thought of as a degenerative illness that primarily affects the elderly, current statistics show a concerning shift in the disease's demographic distribution toward younger persons.

According to data from recent registries, Indians have CAD five to ten years earlier than other populations, and a sizable percentage of MIs happen to people under 45 [2]. This phenomenon indicates a fundamental difference in pathophysiology rather than just a statistical anomaly. Diffuse atherosclerosis, hardened arteries, and other comorbidities such as chronic hypertension and diabetes are common in older persons. Younger patients, on the other hand, typically exhibit "soft" plaque rupture in less calcified veins, which is often caused by lifestyle factors, acute thrombosis, and inflammation [3]. It is essential to comprehend these differences in order to customize therapeutic management procedures.

The Socio-Economic Burden on Developing Nations

Myocardial infarction in young adults has significant socioeconomic ramifications that are different from those in the elderly population. People under 45 make up the majority of the workforce and frequently provide their families with their only source of income. In this population, a MI event causes significant "Years of Life Lost" (YLL) and "Disability-Adjusted Life Years" (DALYs). Long-term lost productivity and the psychological strain on young families are among the financial consequences that go beyond the acute costs of medical care [4]. The goal for young patients is to secure decades of event-free survival, which raises the stakes of beginning therapy significantly compared to older patients, when the goal is typically palliation and sustaining quality of life.

The Changing Landscape Post-COVID-19

The cardiovascular equation now includes additional factors due to the current COVID-19 pandemic. It is known that SARS-CoV-2 causes hypercoagulability and endothelial dysfunction. According to recent research, the systemic inflammation linked to even modest COVID-19 infections may hasten atherothrombosis in young people who are genetically predisposed [5]. The post-pandemic era has witnessed an anecdotal increase in young patients presenting with MI who do not have typical comorbidities, despite the continued dominance of traditional risk factors. This calls for a reevaluation of risk profiles in the current clinical environment.

Objectives

The purpose of this study is to conduct a thorough comparison between young persons (≤ 45 years) and elderly adults (> 45 years) who present with AMI at an Indian tertiary care facility. The particular goals are as follows:

1. To assess variations in gender variance and demographic distribution.
2. To compare the frequency of lifestyle-related and conventional risk variables.
3. To contrast angiographic patterns, particularly the location and degree of coronary involvement (single vs. multi-vessel).
4. To evaluate hospital outcomes, such as death rates and complications.

Methodology

Study Design and Setting

In order to get actual data about cardiac crises, this study was designed as a prospective, hospital-based observational study. The study was carried out in the two centre of cardiology department of a busy tertiary care hospital in India that serves a wide range of patients, from rural agricultural laborers to urban professionals. The 18-month data collection period started in January 2023 and ended in June 2024.

The Institutional Ethics Committee examined and approved the study protocol, guaranteeing compliance with the Declaration of Helsinki with regard to human beings.

Sample Size and Population

A total of 500 consecutive patients with Acute Myocardial Infarction (including both ST-Elevation Myocardial Infarction [STEMI] and Non-ST-Elevation Myocardial Infarction [NSTEMI]) were registered in order to guarantee statistical validity. Using a 95% confidence interval and a 5% margin of error, the sample size calculation was based on the prevalence of MI in young adults, which was estimated at roughly 12–16% based on historical Indian registry data. For comparison analysis, the research population was divided into two separate cohorts: Group A, referred to as "Young Adults," consisted patients who were 45 years of age or younger ($n = 200$), and Group B, referred to as "Older Adults," comprised patients who were 45 years of age or older ($n = 300$).

Inclusion and Exclusion Criteria

To preserve the study population's homogeneity, strict eligibility requirements were implemented. According to the Third Universal Definition of Myocardial Infarction, only individuals admitted to the Coronary Care Unit (CCU) with a verified diagnosis of AMI were eligible for inclusion. This needed the identification of at least one indication of ischemia, such as clinical symptoms, new electrocardiographic (ECG) abnormalities, or imaging evidence of a new loss of viable myocardium, along with a spike or reduction in cardiac biomarkers, primarily cardiac troponin. Written informed consent was given by each subject.

On the other hand, patients having a history of revascularization, such as Percutaneous Coronary Intervention (PCI) or Coronary Artery Bypass Grafting (CABG), were excluded from the study in order to isolate the features of de novo coronary events.

Additionally, the final study did not include patients with non-ischemic aetiologies, such as myocarditis or cardiomyopathy, or those who passed away before angiographic examination could be carried out.

Data Collection

The process of gathering data was thorough and varied. Using a pre-structured proforma intended to record demographic information and particular cardiovascular risk factors, a thorough clinical history was gathered upon admission. A blood pressure reading of more than 140/90 mmHg or the present usage of antihypertensive medication were considered indicators of hypertension. An HbA1c of more than 6.5% or a history of oral hypoglycemic medication or insulin use were indicators of diabetes mellitus. LDL values above 100 mg/dL or continuous statin therapy were indicative of dyslipidemia. Patients' smoking status was meticulously documented, classifying them as either non-smokers, former smokers, or current smokers. If a first-degree relative had experienced an early cardiovascular incident, this was considered a good family history. Every patient had coronary angiography after clinical stabilization. Significant stenosis was defined as more than 70% luminal narrowing in epicardial vessels or more than 50% in the Left Main coronary artery. The severity of the disease was classified as Single Vessel Disease (SVD), Double Vessel Disease (DVD), or Triple Vessel Disease (TVD).

Statistical Analysis

Thorough statistical processing was applied to the gathered data. The student's *t*-test was used to compare continuous data, like age and lipid profiles, which were reported as Mean \pm Standard Deviation (SD). When appropriate, the Chi-square test or Fisher's exact test were used to evaluate categorical data, such as risk factors and clinical outcomes, which were displayed as percentages. The criterion for statistical

significance was set at a p-value of less than 0.05.

Results

Demographic Profile

The research population's analysis showed clear demographic patterns. 54.2 ± 12.6 years was the average age of all 500 participants. Group A (Young) had a mean age of 38.4 ± 4.5 years, while Group B (Older) had a mean age of 62.1 ± 9.8 years. The distribution of genders revealed a notable discrepancy in the younger group. Compared to 68% (n = 204) in Group B, 88% (n = 176) in Group A were men. This large difference (p < 0.001) supports

the finding that premature myocardial infarction is overwhelmingly a male-predominant event in this demographic, most likely as a result of greater rates of smoking among young males and hormonal protection in premenopausal women.

Clinical Presentation

There were significant differences in the symptomatology between the age groups. Even though retrosternal chest pain was still the most common sign of AMI, younger individuals were far more likely to have this "classic" angina. On the other hand, "atypical" equivalents were often seen in older persons, which could cause delays in diagnosis.

Table 1 Comparison of Clinical Presentation Symptoms

Clinical Symptom	Group A (≤ 45 yrs) n=200	Group B (> 45 yrs) n=300	P-value
Typical Angina (Chest Pain)	170 (85.0%)	210 (70.0%)	< 0.01
Dyspnea	12 (6.0%)	60 (20.0%)	< 0.001
Diaphoresis (Sweating)	140 (70.0%)	180 (60.0%)	0.02
Epigastric Distress/Vomiting	10 (5.0%)	36 (12.0%)	0.01
Silent MI / Syncope	8 (4.0%)	14 (4.7%)	0.76 (NS)

(NS: Non-Significant)

Older patients were much more likely to arrive with dyspnea than pain, as Table 1 illustrates. This finding is frequently associated with underlying diastolic dysfunction or diabetic neuropathy, which obscures pain perception.

Risk Factor Analysis

The assessment of cardiovascular risk variables showed that in the elderly, metabolic concerns replaced lifestyle-driven risks. Almost three-quarters of the younger cohort smoked, making it the most common risk factor. On the other hand, diabetes and hypertension were more prevalent in the elderly population.

Table 2 Comparison of Cardiovascular Risk Factors

Risk Factor	Group A (≤ 45 yrs) n=200	Group B (> 45 yrs) n=300	P-value
Smoking	144 (72.0%)	102 (34.0%)	< 0.001
Diabetes Mellitus	44 (22.0%)	144 (48.0%)	< 0.001
Hypertension	64 (32.0%)	192 (64.0%)	< 0.001
Dyslipidemia	110 (55.0%)	126 (42.0%)	0.015
Family History of CAD	58 (29.0%)	42 (14.0%)	< 0.001
Obesity (BMI >25)	70 (35.0%)	84 (28.0%)	0.09 (NS)

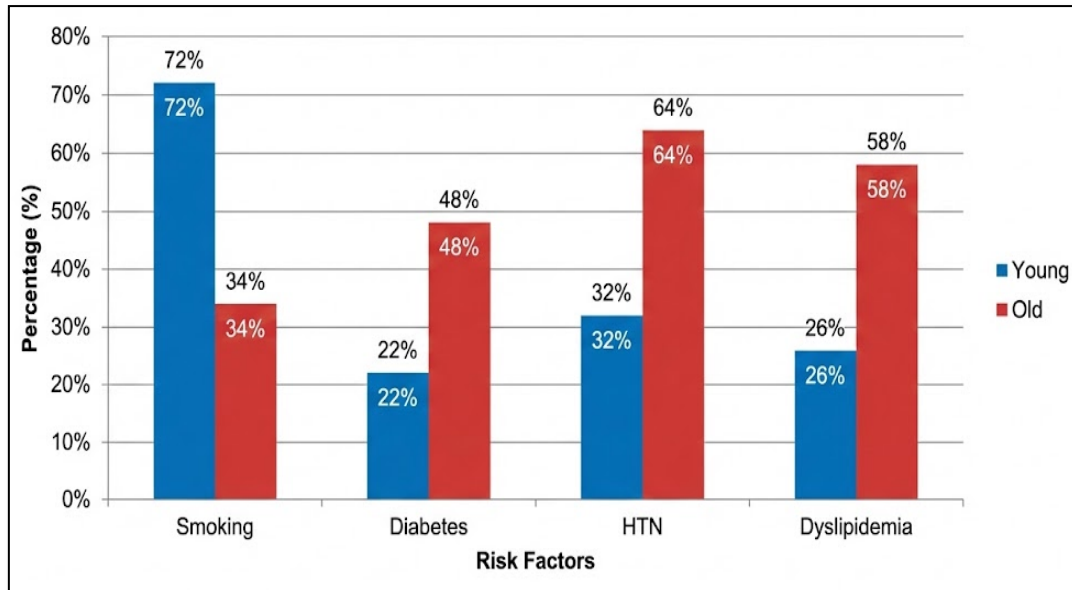


Figure 1 Comparative Prevalence of Major Cardiovascular Risk Factors

Angiographic Findings

An important source of information about the anatomical variations of the illness was coronary angiography. The Left Anterior Descending (LAD) artery was the most often affected vascular in Group A's 62% of patients with Single vascular Disease (SVD). Group B, on the other hand, had a 58% prevalence of Multi-Vessel Disease

(MVD), which is indicative of the progressive nature of atherosclerosis. It's interesting to note that 8% of the younger patients had Myocardial Infarction with Non-Obstructive Coronary Arteries (MINOCA), but just 2% of the older group had this condition. This suggests that the younger patients may have non-atherosclerotic processes like spasm or embolism.

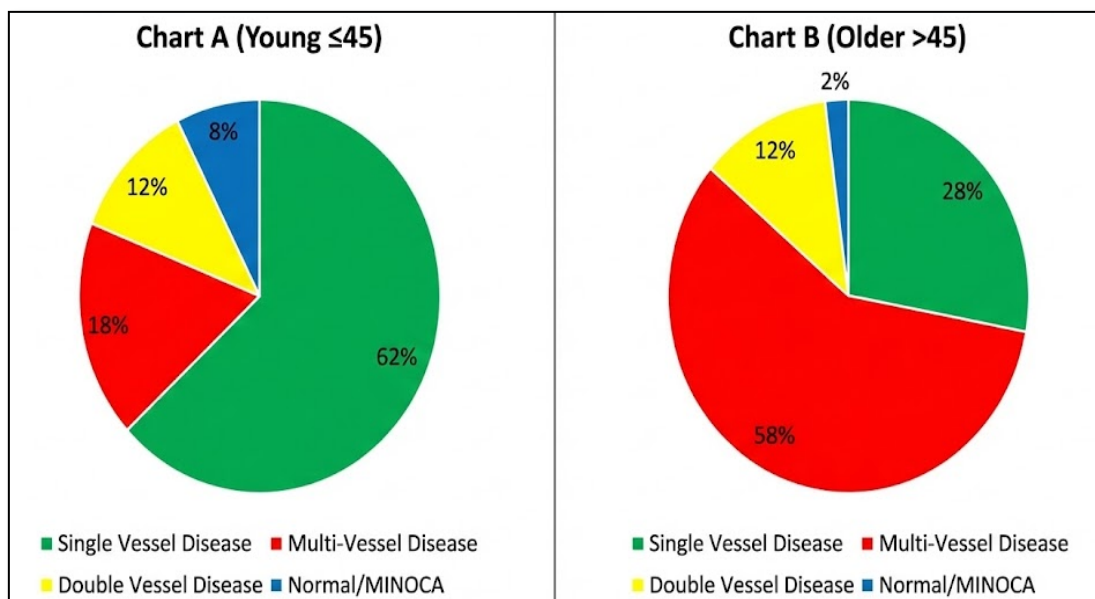


Figure 2 Comparison of Angiographic Patterns in Young (Group A) vs. Older (Group B) Patients

In-Hospital Outcomes

During the hospital stay, there were considerable variations in the clinical

course. While older patients had a higher risk of pump failure and death, younger patients typically recovered more quickly.

Table 3 In-Hospital Complications and Mortality

Outcome / Complication	Group A (≤ 45 yrs) n=200	Group B (> 45 yrs) n=300	P-value
Cardiogenic Shock	10 (5.0%)	45 (15.0%)	< 0.001
Heart Failure (Killip Class III/IV)	18 (9.0%)	72 (24.0%)	< 0.001
Ventricular Arrhythmias (VT/VF)	16 (8.0%)	30 (10.0%)	0.45 (NS)
Major Bleeding	2 (1.0%)	15 (5.0%)	0.01
In-Hospital Mortality	7 (3.5%)	37 (12.3%)	< 0.001

(NS: Non-Significant)

Because of acute ischemia in a large region (LAD) without collateral circulation, young patients have a similar risk of life-threatening arrhythmias as older adults, although having a lower risk of death or heart failure (Table 3).

Discussion

The current study supports the increasing body of evidence showing, depending on the age at which it first appears, coronary artery disease in India essentially presents as two different diseases. Our discovery that a sizable fraction of the study cohort was 45 years of age or younger is consistent with national statistics from the CREATE registry, which reported a "youth bulge" in cardiac cases that is unmatched in the West [6].

The "Smoker's Disease" of the Young

The young cohort's enormous smoking prevalence (72%) is our most startling discovery. This is consistent with research by Masood et al. and Gupta et al., which found that among young Indians, tobacco smoking was the most important preventable risk factor [7, 8]. Cigarette smoke causes a virulent pro-thrombotic condition by raising fibrinogen levels and platelet aggregation while also reducing endothelial vasodilation, which is a unique pathophysiology. This causes abrupt

thrombotic blockage, frequently in the LAD, in young arteries that are not yet severely calcified or stenosed, resulting in major STEMIs. This lends credence to the theory that younger MI is primarily a "clot" issue, while older MI is a "plaque" issue including calcification and progressive stenosis.

Metabolic Profile

Young persons were far from metabolically healthy, while older adults had the predicted burden of diabetes and hypertension. Dyslipidemia was present in more than half (55%). In particular, the typical "Asian Indian Phenotype" of low HDL and elevated triglycerides was noticeable. This implies that insulin resistance, which is well-documented in the INTERHEART study [9], is causing atherogenesis in young Indians even in the absence of obvious diabetes. Additionally, although it was not always examined in this group, increased Lipoprotein(a), a genetic risk factor that is quite common among South Asians, probably contributes to this accelerated atherosclerosis [10].

Angiographic Severity and Revascularization

Our young cohort's 62% prevalence of Single Vessel Disease (SVD) is in line with the findings of Sricharan et al.'s study [11]. There are important treatment implications for this angiographic pattern. Because the

non-culprit veins are usually healthy and malleable, young patients are frequently the best candidates for Primary Percutaneous Coronary Intervention (PCI), which has a high procedural success rate. On the other hand, older patients with Multi-Vessel Disease (MVD) frequently face a difficult choice between Coronary Artery Bypass Grafting (CABG) and Multi-Vessel PCI. Furthermore, the fact that 8% of young patients have MINOCA calls for further research into non-atherosclerotic causes, such as coronary vasospasm (which may be brought on by stress or substance abuse) and hypercoagulable conditions like hyperhomocysteinemia, which is common in Indians because of vegetarianism and vitamin B12 deficiency [12, 13].

The "Paradox" of Outcomes

The "smoker's paradox"—that smokers seem to have decreased mortality after MI—is frequently cited in literature. This finding typically confounds age because smokers tend to be younger. According to our research, in-hospital mortality is substantially lower for younger patients (3.5% vs. 12.3%). Better physiological reserve and fewer comorbidities are responsible for this survival benefit [14]. But this "success" in the near term conceals a long-term burden. Living with a damaged myocardial for more than 40 years is necessary to survive a large anterior wall MI at age 35. According to Akanda et al., there is still a significant chance of cardiac failure or remodeling in later life [15]. For this age range, the lifelong financial cost of secondary preventive medicines and possible repeat surgeries is enormous.

Limitations

There are obvious limitations to this study. The results might not accurately represent the varied demographics of rural India because it was single-center observational research. Furthermore, because of resource limitations, not all patients were evaluated for new biomarkers such homocysteine and lipoprotein, which are especially important

in young MI. Additionally, long-term follow-up was outside the purview of this work, which limited our capacity to evaluate the young survivors' heart failure trajectory.

Conclusion

Young Indian individuals are increasingly experiencing myocardial infarction, which has a distinct risk profile and clinical trajectory. This study unequivocally shows that the disease process in young people is a separate clinical entity rather than just an early commencement of the geriatric condition. The young patient is usually a male smoker with particular lipid abnormalities who presents with single-vessel thrombotic occlusion, in contrast to the elderly who suffer from degenerative, multi-vessel atherosclerosis caused by hypertension and diabetes.

There are obvious and pressing implications for public health. First, as smoking cessation is still the most effective intervention for avoiding MI in this population, it must be aggressively addressed at adolescents and young adults. Second, considering the high frequency of metabolic disorders, Indian males should be required to undergo early screening for dyslipidemia by the age of 25 instead of waiting until midlife. Lastly, even though revascularization is frequently simple in young people, strong primary prevention must become the therapeutic focus in order to preserve the remaining healthy arteries and avoid the catastrophic socioeconomic loss that comes with heart disease in one's prime.

References

1. Enas EA, Senthilkumar A. 3. Coronary Artery Disease in Asian Indians: An Update and Review..... 21.
2. Xavier D, Pais P, Devereaux PJ, Xie C, Prabhakaran D, Reddy KS, Gupta R, Joshi P, Kerkar P, Thanikachalam S, Haridas KK. Treatment and outcomes of acute coronary syndromes in India (CREATE): a prospective analysis of

- registry data. *The Lancet*. 2008 Apr 26;371(9622):1435-42.
3. Libby P, Ridker PM, Maseri A. Inflammation and atherosclerosis. *Circulation*. 2002 Mar 5;105(9):1135-43.
 4. Gaziano TA, Bitton A, Anand S, Abrahams-Gessel S, Murphy A. Growing epidemic of coronary heart disease in low-and middle-income countries. *Current problems in cardiology*. 2010 Feb 1;35(2):72-115.
 5. Xie Y, Xu E, Bowe B, Al-Aly Z. Long-term cardiovascular outcomes of COVID-19. *Nature medicine*. 2022 Mar;28(3):583-90.
 6. Masood I, Brar BS, Singla N. Comparative single-center study between young and old patients presenting with Acute Coronary Syndrome. DOI: <https://doi.org/10.51470/AMSR>. 2024;2.
 7. Murat B, Murat S. Comparison of clinical profiles, angiographic features and outcomes of young and elderly patients with ST-segment elevation myocardial infarction. *Acta Medica*. 2022 Mar 17;53(1):44-52.
 8. Gupta R, Gupta VP, Sarna M, Bhatnagar S, Thanvi J, Sharma V, Singh AK, Gupta JB, Kaul V. Prevalence of coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch-2. *Indian heart journal*. 2002 Jan 1;54(1):59-66.
 9. Yusuf S, Hawken S, Ôunpuu S, Dans T, Avezum A, Lananç F, McQueen M, Budaj A, Pais P, Varigos J, Lisheng L. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *The lancet*. 2004 Sep 11;364(9438):937-52.
 10. Virani SS, Alonso A, Benjamin EJ, Bittencourt MS, Callaway CW, Carson AP, Chamberlain AM, Chang AR, Cheng S, Delling FN, Djousse L. Heart disease and stroke statistics—2020 update: a report from the American Heart Association. *Circulation*. 2020 Mar 3;141(9):e139-596.
 11. Vasavi C. Study on acute myocardial infarction in young adults in a tertiary care hospital, Guntur. *IJBAMR*. 2015;4:510-5.
 12. Puri A, Gupta OK, Dwivedi RN, Bharadwaj RP, Narain VS, Singh S. Homocysteine and lipid levels in young patients with coronary artery disease. *J Assoc Physicians India*. 2003 Jul 1;51:681-5.
 13. Iyengar SS, Gupta R, Ravi S, Thangam S, Alexander T, Manjunath CN, Keshava R, Patil CB, Sheela A, Sawhney JP. Premature coronary artery disease in India: coronary artery disease in the young (CADY) registry. *Indian heart journal*. 2017 Mar 1;69(2):211-6.
 14. Alexander T, Kumbhani DJ, Subban V, Sundar H, Nallamothu BK, Mulasari AS. Acute ST-elevation myocardial infarction in the young compared with older patients in the Tamil Nadu STEMI program. *Heart, Lung and Circulation*. 2021 Dec 1;30(12):1876-82.
 15. Akanda AK, Ali Z, Sayami LA, Huda RM, Debnath L, Hossain MA, Alam A, Hossain S, Mohsin M. In-Hospital Outcomes of Patients with Acute Myocardial Infarction-An Analysis of Two Age Groups. *J Cardiol Clin Res*. 2015;3(1):1042.