Risk factors and clinical features in young patients with myocardial infarction: A cross-sectional study

Shivaprasad Kambanna Rangappa[1], Anil Kumar[2]

[1,2]Assistant Professor, Department of General Medicine, East Point College of Medical Science, Bengaluru, Karnataka, India

ABSTRACT

Background: Changes in lifestyle with increased sedentary lifestyle are associated with its consequences such as obesity, metabolic syndrome, hypertension, diabetes, and eventually myocardial infarction (MI). Coronary artery diseases (CADs) although have been commonly seen in elderly individuals it's now being increasingly recognized in a relatively younger age group (<45 years). The present study was aimed at analyzing risk factors and clinical presentation of MI in young (<45 years). **Aims and Objectives:** The aims of this study were to study risk factors and clinical profile of young patients with MI. **Materials and Methods:** This was a hospital-based prospective cohort study, in which 60 young patients (age <45 years) of age were included on the basis of a predefined inclusion and exclusion criteria. A thorough history was obtained and detailed general and cardiovascular examination was done. Electrocardiogram, basic hematological profile, and 2 D echo were done in all cases. Clinical profile, site of infarction, and severity of systolic dysfunction were studied. $P<0.05$ was taken as statistically significant. **Results:** A total of 60 patients were studied. Out of these 60 cases, there were 48 (80%) males and 12 (20%) females with a M: F ratio being 1:0.25. Although the mean age of female patients (40.25 ± 3.44 years) was more than male patients (38.62 ± 4.43 years), the difference was not found to be statistically significant ($P>0.05$). Obesity, family history of CADs, smoking, dyslipidemia, hypertension, and diabetes were common risk factors in studied cases. Majority of the patients (81.67%) presented with typical chest pain radiating to left arm. The atypical clinical features were seen in 11 (18.33%) patients. In most of the patients (63.33%) there was anterior wall infarction. Inferior wall infarction and anteroseptal MI were seen in 12 (20%) and 10 (16.67%) patients, respectively. **Conclusion:** MI in young patients is increasing. Majority of the risk factors associated with MI in young patients are modifiable risk factors. A high index of suspicion is necessary in diagnosing these patients in time particularly in cases, where there is atypical presentation.

Key words: Myocardial infarction; Young patients; Anterior wall infarction; Ejection fraction

INTRODUCTION

Due to rapid industrialization as well as automation of various industrial processes, the lifestyle of individuals residing in developed world has become largely sedentary. This change in lifestyle is one of the important risk factors for development of obesity, along with its consequences such as development of metabolic syndrome, hypertension and diabetes mellitus, and coronary artery disease (CAD).[1] The pandemic of obesity and metabolic syndrome consequently leading to complications such as CAD is not limited to affluent and developed world but is also spreading its tentacles in developing world and India is expected to bear a large burden of these patients in coming decade.[2] CADs although have been commonly seen in elderly individuals it's now being increasingly recognized

Address for Correspondence:
Anil Kumar, Assistant Professor, Department of General Medicine, East Point College of Medical Science, Bengaluru, Karnataka, India.
Mobile: +91-8050772383. **E-mail:** anilkamble011@gmail.com

in a relatively younger age group (<45 years).[3] Increasing incidence of CAD in young individuals may have a devastating effect not only on the health of individuals but also families as young individuals suffering from myocardial infarction (MI) may have to make substantial changes in lifestyle which may have enormous financial implications. Other than financial implications myocardial in young individuals may have psychological issues which are relatively less common in the elderly individuals.[4]

The conventional risk factors for CAD such as smoking obesity, dyslipidemia, hypertension, diabetes, insulin resistance, and metabolic syndrome which predispose elderly individuals for development of CAD are also important risk factors even in young adults.[5] Other these conventional and widely known risk factors for development of CAD and MI the other risk factors which are more likely in young individuals as compared to older individuals include risk factors such use of cocaine and recreational drugs, hypercoagulable states such as Systemic lupus erythematosus, Factor V Leiden mutation, and nephrotic syndrome.[6] Intravenous drug abuse causing infective endocarditis may also be one of the important causes of MI in young individuals having no other risk factors and this aspect needs to be kept in mind while assessing patients.[7] The strongest genetic factor associated with increased risk of MI is identified on chromosome 9p21.3.[8] Young individuals not only may have different risk factors but also their presentation is also strikingly different from older individuals. While older individuals may have a typical history of gradually worsening symptoms of angina for years culminating finally into MI, the young individuals having MI are more likely to present with first episode of angina developing MI.[9] This is for this reason that young individuals with no history of prior chest pain or CAD are not diagnosed in time particularly in rural areas. To diagnose, young individuals with no prior history of CAD or chest pain require a high degree of suspicion. Needless to say, not diagnosing MI in its early phase may have catastrophic consequences for patients.[10]

We undertook this study to analyze clinical profile and various risk factors in young patients (<45 years of age) presenting with MI.

Aims and objectives
The aims of this study were to study risk factors and clinical profile of young patients with MI.

MATERIALS AND METHODS

This was a cross-sectional study conducted in the department of internal medicine of East Point College of Medical Sciences, Bengaluru, India. Sixty young patients (<45 years of age) admitted to intensive care unit of the internal medicine department and diagnosed with MI were included in this study on the basis of a predefined inclusion and exclusion criteria. A written informed consent was obtained from patients to be part of this study. The Institutional Ethical Committee approved study. The diagnosis of MI was done primarily on the basis of electrocardiogram (ECG). The presence of tall, symmetrical, peaked and widened T waves/slope elevation of the ST segment/increased amplitude of the R wave/changes in the terminal QRS complex for ST segment elevated MI, and ST segment depression and T wave inversion with positive troponin I/T for non-ST elevation MI (NSTEMI) was taken as diagnostic of MI for the purpose of study. A thorough history was taken including demographic details, occupation, and socioeconomic status of patients. Particular attention was given to finding out the family history of CAD, hypertension, and diabetes mellitus. The presence of risk factors in patients such as type of lifestyle, personality, history of smoking, obesity, hypertension, diabetes mellitus, and hyperlipidemia was reviewed and documented. If any risk factor was present, then the duration of presence of such factor was determined by history. Body mass index of all the patients was determined. History of presenting complaints including history and duration of chest pain was determined by history. Basic investigations such as complete blood count, hepatic and renal function tests, fasting and post prandial blood sugar levels, lipid profile, and urine examination were done in all the cases. ECG and echocardiography were also done in all cases.

A thorough general examination was done with particular emphasis on finding out presence of peripheral stigmata of hypercholesterolemia and atherosclerosis such as presence of xanthomas and xanthelasmas. The presence of pedal edema was looked for and documented if it was present. Vitals parameters such as pulse rate, respiratory rate, and blood pressure were recorded. A detailed cardiovascular examination was done with a view to determine whether heart sounds were normal. The presence of any additional sounds such as murmurs, ejection clicks, gallop, or pericardial friction rub was looked for.

Sample size determination
Keeping power (1-β error) at 80% and confidence interval (1-α error) at 95%, the minimum sample size required in each group was 50 patients; therefore, we included 60 (more than minimum required number of cases) specimens in this study.

The data regarding presenting complaints as well as presence of risk factors were analyzed. Microsoft Excel

was used to present data. For statistical analysis, SSPS 21.0 software was used. P<0.05 was taken as statistically significant.

Inclusion criteria
The following criteria were included in the study:
1. Patients who gave informed and written consent to be part of the study.
2. Patients below age of 45 years.
3. Confirmed cases of MI as determined by presence of tall, symmetrical, peaked and widened T waves/slope elevation of the ST segment/Increased amplitude of the R wave/Changes in the terminal QRS complex for ST segment elevated MI, and ST segment depression and T wave inversion with positive troponin I/T for NSTEMI.

Exclusion criteria
The following criteria were excluded from the study:
1. Those who refused consent.
2. Age <18 years or above 45 years.
3. Patients having comorbid cardiac conditions such as rheumatic valvular heart disease and congenital heart diseases.

RESULTS

A total of 60 patients were studied. Out of these 60 cases, there were 48 (80%) males and 12 (20%) females with a M: F ratio being 1:0.25. The analysis of the patients on the basis of age at presentation showed that the most common age group at the time of first presentation was between 41 and 45 years (60%) followed by 36–40 years (21.67%) and 31–35 years (13.33%). Only three patients (5%) presented before 30 years of age. The mean age of male as well female patients was found to be comparable with no statistically significant difference (P=0.240) (Table 1).

The analysis of risk factors for showed that most of the patients (81.66%) were either overweight or obese and only 11 (18.33%) were having healthy weight. Twenty-two (36.67%) patients were active smokers, whereas 38 (63.33%) patients had no history of smoking. IN 12 (20%) patients both parents had history of CAD, whereas in 26 (43.33%) patients, one parent had history of CAD. Serum cholesterol was either borderline high (36.67%) or high (40%) patients. Twenty-two (36.67%) were having type II diabetes, whereas 32 (53.33%) patients were hypertensive (Table 2).

The analysis of presenting complaints of the studied cases showed that out of 60 studied cases, majority of the patients (81.67%) presented with typical chest pain radiating to the left arm. The atypical clinical features were

Table 1: Age distribution of the studied cases

Age in Years	Number of patients (%)	
	Male	Female
<30 years	3 (5.00)	0
31–35 years	7 (11.67)	1 (1.67)
36–40 years	11 (18.33)	2 (3.33)
41–45 years	27 (45.00)	9 (15.00)
Total	48 (80.00)	12 (20.00)
Mean age (years)	38.62±4.43	40.25±3.44

P=0.240 (not significant)

Table 2: Risk factors in studied cases

Risk factor	Number of patients (%)
Body mass index	
Healthy weight (18.5–24.9)	11 (18.33)
Overweight (25–29.9)	32 (53.33)
Obese (30 or above)	17 (28.33)
Smoking	
Present	22 (36.67)
Absent	38 (63.33)
Family history of coronary artery disease	
Father only	20 (33.33)
Mother only	6 (10.00)
Both parents	12 (20.00)
Absent	22 (36.67)
Serum cholesterol	
Desirable (<200 mg %)	14 (23.33)
Borderline high (200–239%)	22 (36.67)
High (≥240 mg %)	24 (40.00)
Hypertension	
Present	32 (53.33)
Absent	28 (46.67)
Diabetes mellitus	
Present	22 (36.67)
Absent	38 (63.33)

seen in 11 (18.33%) patients. The most common atypical presentation was found to be heaviness of chest (6.67%), followed by breathlessness (5%), sweating (3.33%), and intense nausea (3.33%) (Figure 1).

The analysis of patients on the basis of site of MI showed that in most of the patients (63.33%), there was anterior wall infarction. Inferior wall infarction and anteroseptal MI were seen in 12 (20%) and 10 (16.67%) patients respectively. Assessment of the left ventricular function showed that in 31 (51.67%) patients that there was moderate left ventricular dysfunction, whereas mild ventricular dysfunction was seen in 22 (36.67%) patients. In 7 (11.67%), severe systolic dysfunction was seen (Table 3).

DISCUSSION

With increasing prevalence of sedentary lifestyle with its consequences such as obesity, metabolic syndrome, hypertension, and diabetes mellitus occurring in young

Table 3: Site of myocardial infarction and severity of left ventricular dysfunction

Risk factor	Number of patients (%)
Type of myocardial infarction	
Anterior wall infarction	38 (63.33)
Inferior wall infarction	12 (20.00)
Antero-septal infarction	10 (16.67)
Left ventricular dysfunction	
Absent (>50%)	6 (10.00)
Mild (40–49%)	25 (41.67)
Moderate (30–39%)	21 (35.00)
Severe (<30%)	8 (13.33)
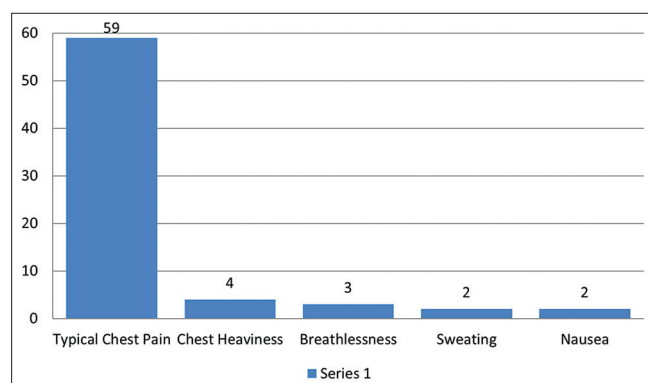
Figure 1: Clinical presentation of studied cases

individuals, there is a considerable rise in incidence of MI at a relatively young age (below 45 years). In our study of 60 young patients (below 45 years of age) admitted with MI, there was a male preponderance with M: F ratio being 1:0.25. Conti et al., conducted a study of MI in young patients.[11] The authors retrospectively studied 236 patients after acute MI. The authors assessed risk factors the treatment used, the pattern of coronary artery obstruction, left ventricular ejection fraction, and complications. The authors reported that out of 236 patients there were 182 males and 54 females with a M: F ratio of 1:0.29. The other studies such as those conducted by Sinha et al.,[12] and Maas and Appelman[13] also reported male preponderance in cases of MI in young patients.

In our study, the mean age of male patients was found to be 38.62±4.43 years, whereas the mean age of female patients was found to be 40.25±3.44 years. The mean age of male as well female patients was found to be comparable with no statistically significant difference. Shah and Jain conducted a study to analyze clinical profile of acute MI in young adults.[14] For this purpose, the authors undertook a cross-sectional prospective study in patients aged ≤40 years and admitted to the hospital with a diagnosis of acute coronary syndrome. History collection, clinical examination, ECG, echocardiography, and laboratory investigations were performed as a part of routine diagnosis and treatment for all the patients. The risk factors for MI were also recorded. Coronary angiography was performed in all patients. The

mean age of young patients with MI in this study was found to be 35.00±4.67 years. Similar age distribution was also reported by the authors such as Akram et al.,[15] and Deora et al.[16]

IN our study obesity, family history of CAD, hypercholesterolemia, smoking, diabetes, and hypertension were significant risk factors seen in young patients with MI. Bhardwaj et al., conducted a prospective study of 124 consecutive patients presenting with AMI at <40 years of age were studied for risk factors.[17] Seventy-three patients (58.8%) were smoker, 55 were hypertensive (44.35%), ten were diabetic (8.06%). Family history of CAD was present in 22 (17.7%) patients. Low high-density lipoprotein was seen in 53 patients (42.7%), and high triglycerides in 60 patients (48.38%). Significant CAD was found in 88 (70.96%) patients and 13 (10.48%) had normal coronaries. Single vessel disease was seen in 57 patients, two-vessel disease in 15 patients, and three-vessel disease in eight patients. Total 125 lesions were seen and left anterior descending (LAD) was the commonest vessel involved, with 78 lesions (62.4%). The findings of this study were similar to our study in respect to the risk factors for development of MI in young adults. Similar risk factors were also reported by the authors such as Nadeem et al.,[18] and Wahrenberg et al.[19]

Anterior wall infarction was the most common type of infarction in our study followed by inferior wall infarction and anteroseptal infarction. Majority of the young patients with MI were having either mild (41.67%) or moderate (35%) systolic dysfunction as assessed by 2 D Echo. Deshmukh et al., conducted a study of young patients who presented with MI.[20] The study was aimed at evaluating the clinical and angiographic profile in these patients. This cross-sectional study included 41 patients of STEMI with a mean age of 27±2.8 years. Risk factors were male gender (95.1%), dyslipidemia (51.2%), tobacco consumption (48.8%), obesity (34.1%), and smoking (29.3%). Anterior wall MI was the most common presentation (82.9%) with obstructive CAD noted in 61% cases frequently due to LAD coronary artery involvement (46.4%). The most common site of involvement in this study was similar to our study, that is, anterior wall.

Limitations of the study

Although the strongest genetic factor associated with increased risk of MI is identified on chromosome 9p21.3, we could not analyze this in our study.

CONCLUSION

Incidence of MI is increasing in young patients. Majority of risk factors associated with increased susceptibility to

MI are modifiable risk factors. A high index of suspicion is required for the diagnosis particularly in cases who present with atypical presentation.

REFERENCES

1. Delaney JA, Daskalopoulou SS, Brophy JM, Steele RJ, Opatrny L and Suissa S. Lifestyle variables and the risk of myocardial infarction in the general practice research database. BMC Cardiovasc Disord. 2007;7:38.
   https://doi.org/10.1186/1471-2261-7-38

2. Kumar AS and Sinha N. Cardiovascular disease in India: A 360 degree overview. Med J Armed Forces India. 2020;76(1):1-3.
   https://doi.org/10.1016/j.mjafi.2019.12.005

3. Singh A, Collins B, Qamar A, Gupta A, Fatima A, Divakaran S, et al. Study of young patients with myocardial infarction: Design and rationale of the YOUNG-MI registry. Clin Cardiol. 2017;40(11):955-961.
   https://doi.org/10.1002/clc.22774

4. Serrano-Rosa MÁ, León-Zarceño E, Giglio C, Boix-Vilella S, Moreno-Tenas A, Pamies-Aubalat L, et al. Psychological state after an acute coronary syndrome: impact of physical limitations. Int J Environ Res Public Health. 2021;18(12):6473.
   https://doi.org/10.3390/ijerph18126473

5. Hajar R. Risk factors for coronary artery disease: Historical perspectives. heart views. 2017;18(3):109-114.
   https://doi.org/10.4103/HEARTVIEWS.HEARTVIEWS_106_17

6. Maino A, Rosendaal FR, Algra A, Peyvandi F and Siegerink B. Hypercoagulability is a stronger risk factor for ischaemic stroke than for myocardial infarction: A systematic review. PLoS One. 2015;10(8):e0133523.
   https://doi.org/10.1371/journal.pone.0133523

7. Rezkalla SH and Kloner RA. Cocaine-induced acute myocardial infarction. Clin Med Res. 2007;5(3):172-176.
   https://doi.org/10.3121/cmr.2007.759

8. Almontashiri NA. The 9p21.3 risk locus for coronary artery disease: A 10-year search for its mechanism. J Taibah Univ Med Sci. 2017;12(3):199-204.
   https://doi.org/10.1016/j.jtumed.2017.03.001

9. DeVon HA, Mirzaei S and Zègre-Hemsey J. Typical and atypical symptoms of acute coronary syndrome: Time to retire the terms? J Am Heart Assoc. 2020;9(7):e015539.
   https://doi.org/10.1161/JAHA.119.015539

10. Graff LG, Wang Y, Borkowski B, Tuozzo K, Foody JM, Krumholz HM, et al. Delay in the diagnosis of acute myocardial infarction: Effect on quality of care and its assessment. Acad Emerg Med. 2006;13(9):931-938.
    https://doi.org/10.1197/j.aem.2006.04.016

11. Conti RA, Solimene MC, da Luz PL, Benjo AM, Neto PA and Ramires JA. Comparison between young males and females with acute myocardial infarction. Arq Bras Cardiol. 2002;79(5):510-525.
    https://doi.org/10.1590/s0066-782x2002001400009

12. Sinha SK, Krishna V, Thakur R, Kumar A, Mishra V, et al. Acute myocardial infarction in very young adults: A clinical presentation, risk factors, hospital outcome index, and their angiographic characteristics in North India-AMIYA study. ARYA Atheroscler. 2017;13(2):79-87.

13. Maas AH and Appelman YE. Gender differences in coronary heart disease. Neth Heart J. 2010;18(12):598-602.
    https://doi.org/10.1007/s12471-010-0841-y

14. Shah V and Jain U. Clinical profile of acute myocardial infarction in young adults. Int J Med Sci Public Health. 2016;5:1709-1713.
    https://doi.org/10.5455/ijmsph.2016.28062016533

15. Akram MV, Zaidi F, Bansal S and Kishore K. A study of risk factors in young patients of myocardial infarction. Int J Res Med Sci. 2015;3(10):2677-2681.
    https://doi.org/10.18203/2320-6012.ijrms20150813

16. Deora S, Kumar T and Ramalingam R. Demographic and angiographic profile in premature cases of acute coronary syndrome: Analysis of 820 young patients from South India. Cardiovasc Diagn Ther. 2016;6(3):193-198.
    https://doi.org/10.21037/cdt.2016.03.05

17. Bhardwaj R, Kandoria A and Sharma R. Myocardial infarction in young adults-risk factors and pattern of coronary artery involvement. Niger Med J. 2014;55(1):44-47.
    https://doi.org/10.4103/0300-1652.128161

18. Nadeem M, Ahmed SS, Mansoor S and Farooq S. Risk factors for coronary heart disease in patients below 45 years of age. Pak J Med Sci. 2013;29(1):91-96.
    https://doi.org/10.12669/pjms.291.2828

19. Wahrenberg A, Magnusson PK, Discacciati A, Ljung L, Jernberg T, Frick M, et al. Family history of coronary artery disease is associated with acute coronary syndrome in 28,188 chest pain patients. Eur Heart J Acute Cardiovasc Care. 2020;9(7):741-747.
    https://doi.org/10.1177/2048872619853521

20. Deshmukh PP, Singh MM, Deshpande MA and Rajput AS. Clinical and angiographic profile of very young adults presenting with first acute myocardial infarction: Data from a tertiary care center in Central India. Indian Heart J. 2019;71(5):418-421.
    https://doi.org/10.1016/j.ihj.2019.12.004

Authors Contribution:
SK- Concept and design of the study, interpreted the results, prepared first draft of manuscript and critical revision of the manuscript, statistically analysed and interpreted, reviewed the literature, and manuscript preparation; **AK-** statistically analysed and interpreted data, preparation of manuscript, and revision of the manuscript, Concept and coordination of the overall study.

Work attributed to:
Department of General Medicine, East Point College of Medical Science, Bengaluru, Karnataka, India.

Orcid ID:
Shivaprasad Kambanna Rangappa - https://orcid.org/0000-0003-1677-3465
Anil Kumar - https://orcid.org/0000-0002-7811-6359

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