Cardiology Section

Study of Acute Myocardial Infarction in Young Adults: Risk Factors, Presentation and Angiographic Findings

SRICHARAN K.N., RAJESH S., RASHMI, MEGHANA H.C., SANJEEV BADIGER, SOUMYA MATHEW

ABSTRACT

Background: Acute Myocardial Infarction (AMI) continues to be a major public health problem in the industrialized world and it is becoming an increasingly important problem in the developing countries also.

Method: The diagnosis of myocardial infarction (MI) was based on the WHO criteria. Patients who were aged <15 years and > 40 years, who did not meet the WHO criteria for the diagnosis of MI were excluded.

The data were prospectively recorded as per the protocol. In all the participants, details of the age, sex and occupation were recorded, together with details of smoking, alcohol use, a known history of diabetes mellitus and hypertension and a signifi-cant family history of ischaemic heart disease. Weight, height, fasting blood glucose, cardiac enzymes (CPK- MB) and the echocardiographic status was evaluated in all the patients.

Results: The mean age of the patients with myocardial infarction was 37.03 years, with a maximum number of patients (70%) in the age group of 35-40 years. There were no patients from the below 25 years age group. Smoking was most common risk factor of MI (70%) in young adults. A family history of ischaemic heart disease (IHD) was present in 13.33% of the patients. Hypertension, diabetes and a body mass index of >25kg/m², each formed 10% of the risk factors. The most common symptom was chest pain (90% patients). Two third of the patients had anterior wall MI. A majority of the patients (57.14%) had single vessel disease, which was seen on coronary angiography.

Conclusion: Smoking was most common cause of the MI (70%) in young adults. The mean time of presentation of MI after the onset of the symptoms was 20.73hrs. Two third of the patients had anterior wall MI.

BACKGROUND

Overall, 4-8% of the patients with acute myocardial infarction (AMI) are less than 40 years of age. A recent Bethesda Conference proposed a classification scheme according to the strength of the evidence that risk factor intervention favourably affected the outcome of AMI [1].

This was partly due to the increased prevalence of the risk factors for atherosclerosis in the younger age group; especially, the increased incidence of impaired fasting glucose, high levels of triglycerides, low high-density lipoprotein levels and an increased waist to hip ratio. However, non-atherosclerotic coronary artery disease or hyper-coagulability should also be investigated or at least suspected in the younger patients [2]. Acute myocardial infarction (AMI), in young adults, presents a typical pattern of the risk factors and the clinical, angiographic and the prognostic characteristics. Consequently, it is possible to hypothesize the presence of a genetic background at the origin of this predisposition [3].

The best estimates for the magnitude of the associated risk were derived from a meta- analysis of nine large prospective observational studies with 4,20,00 participants, who occurred over 4850 CHD events during the follow up [4].

A large series of cross-sectional and retrospective studies indi-cated a positive relationship between mild to moderate hyper homocystinaemia and atherosclerosis. However, because the homocysteine levels increase after MI and stroke [5], such data cannot be used to establish a cause and effect relationship.

Coronary arteriography remains the "GOLD STANDARD" for identifying the presence or absence of the arterial narrowing which is related to atherosclerotic coronary artery disease and it was found to provide the most reliable anatomical information for determining the appropriateness of the medical therapy, percutaneous coronary intervention or coronary artery bypass surgery in patients with ischaemic coronary artery disease [6]. Coronary arteriography can establish the presence or absence of coronary stenosis and it can define the therapeutic option, and determine the prognosis of the patients with AMI at a young age.

So, a study was conducted to learn the profile of young patients (15-40 years) with acute myocardial infarction with an emphasis on:

- Assessment of the risk factors
- Mode of presentation
- Coronary angiographic characterization.

METHOD

The approval of the ethics committee of J.J.M.Medical College, Davangere was obtained. This study was conducted at Bapuji Hospital which was attached to J.J.M.Medical College Davangere, Karnataka, India for 2 years in order to obtain 49 patients. The patients were all below 40 years of age. This was a cross-sectional study (case series) which enrolled the study subjects who fell into the inclusion criteria consecutively for 2 years.

The diagnosis of myocardial infarction was based on the WHO criteria, which required at least 2 of the following 3 to be present:

1. A history of an ischaemic type of chest discomfort
2. Evolutionary changes on the serially obtained ECG tracings.
3. Rise and fall of the serum cardiac markers.

The data were prospectively recorded as per the protocol. In all the participants, details of the age, sex and occupation were recorded with the details of smoking, alcohol use, a known history of diabetes mellitus and hypertension and a significant family history of ischaemic heart disease. Weight, height and waist and hip circumference was recorded for each person. Fasting blood glucose, fasting lipid profile, serial ECGs and the cardiac enzymes (CPK- MB) were evaluated (as at the start of the study, only CPK-MB testing was available at the hospital and Troponin-T and K came up later, which was not considered for study purposes, as (CPK-MB) with ECHO gave a good diagnosis), Echocardiography was done in all the patients. All these patients were taken up for coronary angiography which was performed by the standard Judkin's technique after adequate preparation. The risk factors which were studied were hypertension, diabetes mellitus, smoking habits, overweight (a BMI of > 25 kg/m^2), the waist to hip ratio, (a WHR of >0.91cms was considered as a risk factor), hyperlipidaemia (serum cholesterol of 200 mg%), a past history of IHD (ischaemic heart disease), and a family history of ischaemic heart disease. The patients with a past history of diabetes and/or with a fasting blood sugar value of >125mg% were considered to be diabetic. The patients who were currently smoking and those who claimed to have stopped smoking since one year were considered as smokers and others were considered as non-smokers. The coronary angiographic profile was studied in all these patients to assess the number of vessels which were involved and the type of the vessels which were involved.

RESULTS

The mean age of the patients with myocardial infarction was 37.03 years, with a maximum number of patients (70%) being within the age of 35-40 years and 3.33% of the patients being in the age group of 25-30 years. The youngest patient was age 27 years old and the oldest was 40 years old. 90% of the patients were males. All the patients had a WHR ratio which ranged from 0.87cms to 0.92cms and so the WHR ratio was not an important risk factor in our study.

Smoking was most common risk factor for myocardial infarction (70%) in the young adults, hyperlipidaemia being the second common risk factor (36.67%). 20% of the patients were diabetic, of which 10% were newly detected. 13.33% of the patients had a family history of ischaemic heart disease (IHD). Hypertension and a BMI value of >25kg/m^2, each formed 10% of the risk factors. The most common symptom was chest pain, which was present in 90% of the patients, followed by sweating (50%), breathlessness (20%), restlessness (6.7%) and palpitations (3.3%). The mean time of presentation after the onset of the symptoms was 20.73hrs. 46.67% of the patients had multiple risk factors for acute MI. 46.67% had a single risk factor, while 6.67% had none of the risk factors.

Anterior wall MI was found in 2/3rd of the patients and 1/3rd of them had inferior wall MI. 66% of the patients had septal and apical defects with anterior wall hypokinaesia in the electrocardiogram findings and the remaining 34% had inferior and posterior wall hypokinaesia. A majority of the patients (57.14%) had single vessel disease which was seen on coronary angiography, followed by normal coronaries (22.45%). 16.3% had double vessel disease

Age in yrs	Sex		Total
	Male	Female	
25-30	3.33%	0%	3.33%
31-35	87.5%	12.5%	26.66%
36-40	90.5%	9.5%	70%
Total	90%	10%	

[Table/Fig-1]: Age and Sex distribution of young adults with MI
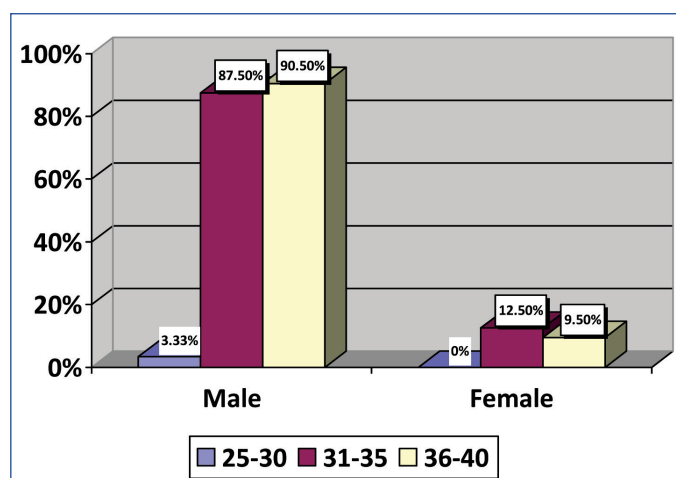
[Table/Fig-2]: Distribution of AMI patients according to sex distribution

Symtoms	Percentage (Number)
Chest pain	90 % (44)
Sweating	50% (25)
Breathlessness	20% (10)
Palpitation	6.7% (33)
Restlessness	3.3% (16)

[Table/Fig-3]: Table to depict Frequency of the Symptoms

Symtoms	Percentage (Number)
Smoking	70% (34)
Hyperlipidemia	36.67% (18)
Diabetes	50% (25)
Family history of IHD	10% (5)
Hypertension	10% (5)
BMI>25	10% (5)
WHR >0.91	0

[Table/Fig-4]: Table to depict Frequency of the Risk factors

Symtoms	Percentage (Number)
Single vessel	57.14% (28)
Double vessel	16.3% (8)
Multiple vessel	4.08% (2)
Normal coronary artery	22.45% (11)

[Table/Fig-5]: Table to depict Vessel involvement on angiography

and 4% had multi vessel disease. 63.33% of the patients had involvement of the left anterior descending artery, 20% had involvement of the right coronary artery and 16.6% had involvement of the left circumflex coronary artery, which was seen on coronary angiography.

DISCUSSION

The distribution of the ages of our patients showed a striking increase of the disease with ageing, even in young adults, which

[Table/Fig-6]: Chart to depict the vessel involved in MI
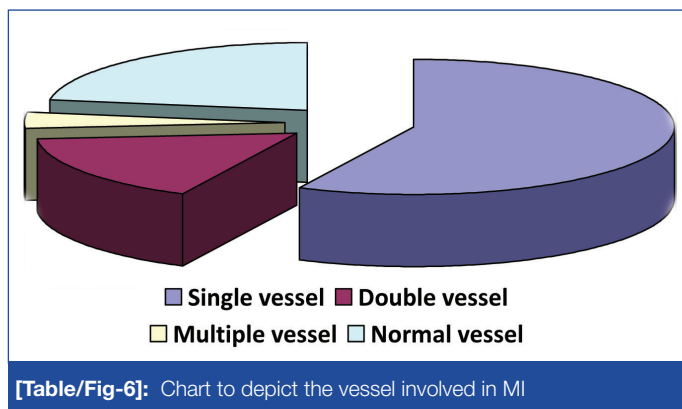
was a very obvious fact which was seen in earlier studies also [6,7]. One of the best documented and the most consistent risk factors for coronary atherosclerosis seems to be the male sex. The protective effects of oestrogens in preventing atherosclerosis have been clearly demonstrated in epidemiologic studies [8]. In another study [9], a profile of acute MI in young patients showed a male: female ratio of 20:1 [9,10,11], where as in our study, it was 9:1, but the trend remains the same.

Among the many factors that have been shown to be important are hyperlipidaemia, hypertension, cigarette smoking, the male sex and diabetes mellitus. These have generally been associated with an increased incidence of fibrous plaques and their sequalae. The associations are relatively strong and they are made on a group comparison basis, although all the studies have demonstrated a high degree of variability among individuals within even the most homogenous of groups [12]. Smoking was the most common risk factor (87%) which was seen in a study [13], which showed a profile of acute MI in young patients (below 40 years) in a rural/semi-urban population. Smoking was established as the main cause of MI and other chronic cardiovascular diseases in many other studies [14-18] and it was established as the main cause in our study also. Cigarette smoking accelerates CHD and increased atherosclerosis, which increase thrombus formation and this could contribute to MI at an earlier age. Most of the MI cases (80-90%) are mostly caused due to cigarette smoking. So, a reduction in smoking, which is one of the main causative factors, can reduce AMI in young adults.

The results of the Lipid Research Clinics Trail [19,20] demonstrated a direct association between the plasma lipoprotein profile, the cholesterol levels and the morbidity and mortality from coronary atherosclerosis. Hyperlipidaemia, which is very common in young Asian adults as per earlier studies [15,19-25], was the second common risk factor in our study.

Diabetes and hypertension were more common as the risk factors among the older MI patients but they were less common in young adults in our study, which was seen in earlier studies also [15, 25]. A positive family history of IHD had been found as a significant cause only among the young adults as compared to the older patients in earlier studies [25-28]. Whereas only 13.3% of patients had a positive family history of IHD in our study [29].

A body mass index of $>30kg/m^2$ was the common cause in all the earlier studies which were done [26,27] but a majority of them were western studies. But Indian studies reported BMI [18] to pose a lesser risk, which was seen in our study also. Chest pain was the most common presentation in our study, which was similar to that which was seen in earlier studies also [30]. The arrival of the patients at the health care facility was mostly delayed by >10 hrs,

as in earlier studies also [31-33]. We too had a mean arrival time of 20.73hrs. As in earlier studies [34,35], in our study too, anterior wall MI was very common among the patients, irrespective of their ages. We could see that single vessel disease was evidently more common among the young adults, which had been reported by others also earlier [15, 35].

LIMITATIONS

This study did not have any control group and so the risk of each factor could not be analyzed. Also, the statistical significance of the factors couldn't be analyzed. There were few lab tests like Troponin-T and K for which the facilities weren't available and so they were not done. As this study was the thesis topic of a postgraduate student, the required sample size wasn't calculated. This was because this study had a time limit and the samples which were available in two years (49) were used to determine the objectives.

CONCLUSION

Smoking was the most common risk factor of MI (70%) which was seen in young adults. The mean time of presentation after the onset of the symptoms was 20.73hrs. 2/3rd of the patients had anterior wall MI. A majority of the patients (57.14%) had single vessel disease which was seen on coronary angiography. The cessation of smoking would play a major role in preventing MI in young adults. Also, on the early hospitalization of these patients, they need to be educated on this topic.

REFERENCES

[1] Fuster V, Pearson TA. Matching the intensity of the risk factors with the hazards for the coronary heart disease events. *J Am Coll Cardiol* 1996;27:957-1047.

[2] Cengel A, Tanindi A. Myocardial infarction in the young. *J Postgrad Med*. 2009 Oct- Dec;55(4):305-13.

[3] The role of genetic polymorphisms in myocardial infarction in the young. *Clinical Hemorheology and Microcirculation*. 2010;46(4): 291-98.

[4] Wibon PW, D' Agostino RB , Levy D. Prediction of coronary heart disease by using the risk factor categories. *Circulation* 1998; 1837-47.

[5] Egeston W, Silberberg J, Cooks R. Serial measures of plasma homocysteine after acute myocardial infarction. *Am J Cardiol* 1996; 77: 759-61.

[6] Popma JJ. "Coronary angiography and intravascular ultrasound imaging". Chapter 18. In Douglas P. Zipes, peter Libby, Robert O, Bonow, Eugene Braunwald (eds), *Braunwald's Heart Disease A textbook of Cardiovascular Medicine*, 7th edition, 2005; 423-55.

[7] Ismail J, Jafor TH, Jafaray FH. Risk factors for non- fatal MI in young south Asian adults. *Heart* 2004; 90:259-63.

[8] Wenger NK, Speroff L, Panhard B. Cardiology heart disease morbidity and mortality in the sexes; A 26 year follow- up of the Framingham population. *Am Heart J* 1986; 113: 383-90.

[9] Siwach SB, Singh H, Sharma D. Profile of acute myocardial infarction in the young in Haryana. *J Assoc Physicians India* 1998 May; 46(5): 424-26.

[10] Mchill HC. Jr. Risk factors for atherosclerosis. *Adv Exp med Biol* 1978; 104:273-80.

[11] Barbash GI, White WD , Modan M. Acute myocardial infarction in the young; the role of smoking. *Eur Hart J* 1995 Mar; 16(3):295-96.

[12] Sozzi FB, Danzi GB, Foco L, Ferlini M, Tubaro M, Galli M, et al. Myocardial infarction in the young: a sex-based comparison. *Coron Artery Dis*. 2007 Sep;18(6):429-31.

[13] Siwas SB, Sing H, Sharma D. Profile of young acute Myocardial Infarction in Haryana. *J Assoc Physicians India* 1998 May; 46(5): 424-26.

[14] Weinberger I, Rotenberg Z, Fuchs J. Myocardial infarction in young adults under 30 years of age; risk factors and clinical course. *Clin Cardiol* 1987 Jan; 10(1):9-15.

[15] Kanitz MG, Giovannucci SJ , Jones JS, Mott M. Myocardial infarction in young adults; risk factors and clinical features. *J Emerge Med* 1996 Mar- Apr; 14(2):139-45.

[16] Hong MK. Cho SY, Hong BK et al. Acute myocardial infarction in young adults. Yonsei Medical Journal 1994;35(2):184-89.

[17] Kennelly BM, Gersh BJ, Lane GK, Beck W. The relationship between the angiographic findings and the risk factors in young men with myocardial infarction. S Afr Med J. 1982 Apr 3;61(14):508-12.

[18] Pais P, Pogue J, Gerstein H. The risk factors for acute myocardial infarction in Indians. A case control study. Lancet 1996; 348: 358-63.

[19] Lipid Research Clinics Program, lipid metabolism, Atherogenesis branch, National Heart, Lung and Blood Institute. The Lipid Research Clinics Coronary Primary Prevention Trial results. JAMA 1984;251: 351-65.

[20] Scandinavian Simvastatin Survival Study Group. Randomized trial of cholesterol lowering in 4444 patients with coronary heart disease. The Scandinavian Simvastatin Survival Study (4S). Lancet 1994; 344: 1383-89.

[21] McKeigue PM, Adlestein AM, Shipley MJ. The dietary and risk factors for CHD in Asian Indians in northwest London. Lancet 1985;11: 1086-90.

[22] Miller GJ, Kotecha S, Wilkinson WH. Dietary and other characteristics which are relevant for CHD in the men of India, west India and European descent in London. Athersclerosis 1988; 70: 63-72.

[23] Gujral, Jaspal S. ST elevation and myocardial infarction in young adult females. Southern Medical Journal: 2009 May;102(5):460.

[24] Tewari S, Kumar S, Kapoor A, Singh U, Agarwal A, Bharti BB. Premature coronary artery disease in north India: an angiography study of 1971 patients. Indian Heart J. 2005 Jul-Aug;57(4):311-18.

[25] Selçoki Y, Makbule NK, Karanfi A, et al. Acute myocardial infarction in an adolescent female with normal coronary arteries. European Journal of General Medicine. 2009;6(3):181-86.

[26] Zimmerman FH, Cameron A, Fisher LD, et al. Myocardial infarction in young adults: angiographic characterization, risk factors and prognosis. J Am Coll Cardiol 1995 Sep; 26(3):654-61.

[27] Giruzzi M, Schargradsky W, Rozlosnik J. The frequency of the family history of AMI in patients with AMI. Am J Cardiol 1997 Jul 15; 80(2): 122-27.

[28] Roncaglioni MC< Santoro L, D'Avanzo B. Role of the family history in patients with MI. An Italian case control study. Circulation 1992 Jun; 85(6):2065-72.

[29] Jensen G, Nyboc J, Appleyard M. Risk factors for acute myocardial infarction in Lopenhagen II. Smoking, alcohol intake, physical activity, obesity, oral contraception, diabetes lipids and blood pressure. Eur Heart J 1991 Mar; 12(3): 298-308.

[30] Woon VC, Lim KH. Acute MI in the elderly – the difference compared with the young. Singapore Med J 2003 Aug; 44(8):414-8.

[31] Sheifer SE, Rathore SS, Hersh BJ. Time to presentation with acute myocardial infarction in the elderly. Circulation 2000 Oct 3; 102(14):1651-56.

[32] Gurwitz JH, McLaughlin TJ, Willson DJ. A delayed hospital presentation in patients who had acute MI. Ann Intern Med 1997 Apr 15; 126(8):652-53.

[33] Kennelly BM, Gersh BJ, Lane GK, Beck W. The relationship between the angiographic findings and the risk factors in young men with myocardial infarction. S Afr Med J. 1982 Apr 3;61(14):508-12.

[34] Badui E, Rangel A, Valdespino A, Gracf A, Plaza A, Chavez, et al. Acute myocardial infarction in young adults. A report of 142 cases. Arch Ins Cardial Mex Nov- Dec 1993; 63(6):529-37.

[35] Shah A, Sreenivasan S, Shah H, Lanjewar C, Nabas A, Nyayadhish P, et al. The clinical , biochemical and the angiographic profile of young (< or equal to 40 years) patients with acute myocardial infarction. Indian Heart Journal 2005;57:423.

AUTHOR(S):

1. Dr. Sricharan K.N.
2. Dr. Rajesh S.
3. Dr. Rashmi
4. Dr. Meghana H.C.
5. Dr. Sanjeev Badiger
6. Dr. Soumya Mathew

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Dept of Medicine, A.J.Institute of Medical Sciences, Mangalore, India.
2. Associate Professor, Dept of Medicine, A.J.Institute of Medical Sciences, Mangalore, India.
3. Corresponding Author,
4. Postgraduate, dept of Oral medicine and Radiology, Bapuji Dental College, Davangere, India.
5. Associate Professor, Dept of Community Medicine,K.S.Hegde Medical Academy, Mangalore-18, India.
6. Assistant Professor, Dept of Medicine, A.J.Institute of Medical Sciences, Mangalore, India.

NAME OF DEPARTMENT(S)/INSTITUTION(S) TO WHICH THE WORK IS ATTRIBUTED:

Department of Medicine, J.J.M.Medical College, Davangere, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Rashmi,
Associate Professor, Dept of Community Medicine,
K.S.Hegde Medical Academy,
Mangalore-18, Nitte University Karnataka, India.
phone: 9880496567
E-mail: dr.rashmi.kundapur@gmail.com