Original Article

DOI: 10.7860/JCDR/2020/43858.13705

A Comparative Study of Clinical and Angiographic Profile of Acute Coronary Syndrome in Young Diabetics and Non-diabetics

Internal Medicine Section

B LAKSHMI NARAYANAN[1], MOHAMED HANIFAH[2], B AMIRTHA GANESH[3]

ABSTRACT

Introduction: The clinical presentations and angiographic findings of Coronary Artery Disease (CAD) vary from diabetic and non-diabetic patients and also vary with the age of patients. CAD in patients below the age of 45 is a special subset. Clinical presentations of CAD in young patients with various risk factors differ, which may play an important role in management strategies.

Aim: To compare the clinical and angiographic profile in patients presenting as Acute Coronary Syndrome (ACS) with Diabetes Mellitus (DM) and without DM below the age of 45 years.

Materials and Methods: It was a comparative observational study done between the time period of January 2018 to June 2019. in patients presenting with symptoms suggestive of ACS. Patients below 45 years of age were subdivided into two major groups, Group A (ACS with DM) and Group B (ACS without DM) and analysed for the clinical and angiographic pattern. The data was analysed using SPSS software. Significance was assessed with Chi-square test.

Results: Eighty ACS patients were analysed. Mean age was found to be 41.2±4.01 years, with a mean Glycated Haemoglobin (HbA1c) value of 8.65±3.3%. Clinical profile and pattern of involvement of coronary arteries, as assessed by coronary angiography were found to be different in younger CAD patients; ST-Elevation Myocardial Infarction (STEMI) was the most common type of ACS. Single Vessel Disease (SVD) was the most common angiographic finding and Echocardiography (ECHO) showed normal Left Ventricular (LV) function. Atypical chest pain and multiple vessel disease were common in diabetics with higher HbA1c (p=0.001).

Conclusion: Younger and non-diabetic ACS patients get lesser burden of disease as compared with diabetics and elderly people. This finding might help in prognostication of disease.

Keywords: Coronary imaging, Glycaemic control, Ischemic heart disease, Nonelderly, Prognosis

INTRODUCTION

CAD is a major cause of death all over the world. Traditionally, CAD was considered as the disease of old age group [1]. The incidence of CAD in the young people is increasing rapidly which is secondary to risk factors like stress, sedentary life style, altered food habits, which in turn predispose to the development of risk factors like DM, Metabolic syndrome, obesity which in turn propagate to CAD [2]. Other unidentified novel risk factors like lipoprotein (a), prothrombotic factors also contribute to CAD in the young [3].

The clinical presentations and the management strategies are different in younger cardiac patients as compared to their older counterpart [4]. The reasons for the differences in the clinical presentations of CAD in the younger age group are because of their varying pathophysiology and nature of coronary involvement and hence the management strategies also differ [5]. More aggressive interventions are required in many of them for improving the morbidity and mortality [1]. At present, the arbitrary age of 45 years and below is taken as cut-off age to say young in most of the studies [6]. Among the modifiable and non-modifiable risk factors, DM stands first in the list of the modifiable risk factors for CAD [7].

In young patients the incidence of CAD is higher in people with DM of relatively new onset. The spectrum of CAD includes chronic stable angina, unstable angina, Non-ST-Elevation Myocardial Infarction (NSTEMI) and STEMI. The clinical presentations vary depending on the spectrum [8]. According to most of the Western and Indian literature. typical anginal pain and dyspnea before admission is less common in the younger age group with CAD than in the older age group [9]. This is one of the reason why many of these patients reach hospital very late and hence there is an increase in morbidity and mortality.

Therefore, a high index of suspicion and a low threshold for further evaluation is required in these young patients when they present with atypical symptoms, especially when they have risk factors like DM, smoking, etc. SVD and Left Anterior Descending (LAD) artery involvement is more common in younger individuals [10].

Very less data is available to compare the clinical and angiographic profile of young diabetic CAD with young non-diabetic which plays a crucial role in management.

The present study was done in a tertiary care center which is best suited to study these young cardiac patients and to find the differences between young diabetic and non-diabetic CAD. This might help in formulating a management strategy and help in preventing CAD in the community [11].

MATERIALS AND METHODS

It was a tertiary care hospital based comparative study, which was conducted in the Department of General Medicine and Cardiology in a tertiary care hospital in Pondicherry, India. Patients who presented with symptoms suggestive of ACS were selected as study subjects between the time period of January 2018 to June 2019. The study was approved (PG DISSERTATION/12/2017/116) by Institutional Ethical Committee.

The prevalence of CAD was taken as 0.15 [1]. Sample size was calculated based on the formula for comparative and calculated a total sample size of 80. Each group required minimum of 35 patients.

Inclusion criteria: Age below 45 years; Subjects presenting with ACS-Unstable angina; STEMI or NSTEMI; Those who underwent coronary angiogram with above criteria; Diabetics or with other risk factors for atherosclerosis (hypertension, dyslipidaemia, smoking and other prothrombotic state).

Definition

- **Unstable Angina** (UA) is an ACS that is defined by the absence of biochemical evidence of myocardial damage. It is characterised by specific clinical findings of prolonged (>20 minutes) angina at rest; new onset of severe angina; angina that is increasing in frequency, longer in duration, or lower in threshold; or angina that occurs after a recent episode of Myocardial Infarction (MI) [12].
- **STEMI** is defined as in the appropriate clinical context, a STEMI is diagnosed clinically when there is **new (or increased) and persistent** ST-segment elevation in at least two contiguous leads of:
  - ≥2.5 mm in men <40-year-old
  - ≥2 mm in men >40-year-old
  - ≥1.5 mm in women in V2-V3 and/or ≥1 mm in the other leads.
  - 1 mm=1 small square (at a standard ECG calibration of 10 mm/mV).
  - Contiguous ECG leads lie next to each other anatomically and indicate a specific myocardial territory [13].
- The initial ECG in NSTEMI may show no abnormality or show ST depressions, T-wave inversions, ST elevations. STEMI evaluation is recommended in patients with persistent ST elevation, evidence of posterior MI, new left bundle branch block. It can be distinguished from UA pectoris by normal serial troponin [14].
- **Cut-off for diagnosis of DM**
  - Fasting Plasma Glucose ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8-hour or 2-hour plasma glucose ≥200 mg/dL or A1C ≥6.5% or in a patient with classic symptoms of hyperglycaemia or hyperglycaemic crisis, a random plasma glucose ≥200 mg/Dl [15].

Exclusion criteria: Patient with renal failure and history of previous cardiac interventional procedure were excluded from the study.

Procedure

After obtaining informed consent, the study population was divided into two groups. Based on their risk factors, initially study population was divided into Group 1(DM patients with ACS) and Group 2 (ACS patients without DM). Investigations like Cardiac troponin, ECG, ECHO were done. Then all patients underwent coronary angiogram and their angiographic involvement was compared. Cut-off HbA1c was taken as 10 [16].

STATISTICAL ANALYSIS

The data was entered into a data collection proforma sheet and MS Excel spreadsheet sequentially. Statistical analysis was carried out using SPSS version 19.0 (IBM SPSS, US) software. Results on continuous measurements are presented on Mean±SD (min/max) and results on categorical measurements are presented in number (%). Significance was assessed at 5% level of significance. Chi-square/Independent t-test/ANOVA test has been used to find the significance of study parameters. The p-value <0.05 was considered significant.

RESULTS

Mean age was found to be 41.2±4.01 years. Mean HbA1c value of 8.65±3.3%.

Typical (classic) angina chest pain: (1) Substernal chest pain or discomfort; (2) Provoked by exertional or emotional; and (3) relieved by rest or nitroglycerine (or both).

Atypical (probable) angina chest pain applies when 2 out of 3 criteria of classic angina are present.

Non-specific chest pain: If ≤1 of the criteria of classic angina is present, symptoms are classified as Non-specific [17].

[Table/Fig-1] shows typical chest pain was the most common presentation in both diabetic and non-diabetic. In this population majority were males.

Characterstics	No of patients in Group A (ACS with DM)	No of patients in group B (ACS without DM)	p-value
Sex			
Male	35	34	0.17
Female	8	3	0.17
Clinical Feature			
Atypical	10	2	0.05
Typical	33	35	0.05

[Table/Fig-1]: Clinical profile of diabetic CAD patients.

[Table/Fig-2] shows STEMI was the most common type of ACS with anterior wall being the commonly involved wall. ECHO with mild dysfunction was predominate in both the group.

Variables	No of patients in Group A	No of patients in Group B
ECG		
NSTEMI	7	3
STEMI	24	26
Unstable angina	12	8
Anterior wall MI	22	19
Inferior wall MI	2	4
Posterior wall MI	1	0
Right ventricle MI	0	1
Lateral wall MI	1	0
ECHO		
Mild LV dysfunction	11	14
Moderate LV dysfunction	9	5
Severe LV dysfunction	1	2

[Table/Fig-2]: ECG and ECHO characteristic of diabetic and non-diabetics.
Statistical analysis with Pearson chi-square with a p-value of 0.6

On looking at the angiographic profile LAD artery was the most commonly involved artery in both diabetics and non-diabetics [Table/Fig-3].

Variables	No. of patients in Group A	No. of patients in Group B	p-value
LAD	32	25	**0.02**
RCA	10	7	
LCX	4	6	

[Table/Fig-3]: Angiography profile.
LAD : Left anterior descending artery; RCA: Right coronary artery; LCX: Left circumflex artery

[Table/Fig-4] shows double ad triple vessel disease were high in diabetics with HbA1c above 10% with a p-value of (0.001).

CAD severity	HbA1c category		p-value
	5.1-10	10.1-15	
Normal	1	2	**0.001**
Single vessel	4	13	
Double vessel	1	16	
Triple vessel	0	3	

[Table/Fig-4]: Comparison of coronary involvement and HbA1c status in diabetic patients.

DISCUSSION

This study showed that atypical presentation was more common in diabetic patients. STEMI was the most common type of MI in both diabetic and non-diabetic population. Severe LV dysfunction was more common in diabetic population. Anterior wall MI was the most common type of MI in both the diabetic and non-diabetic

population. On analysing the Angiogram SVD was common in both the groups and LAD was the commonest involved vessel. Among the diabetic population, patients with higher HbA1c (more than 10), had significantly increased proportion of multiple vessel involvement than patients with lower HbA1c.

In this study the total sample size was 80. Among them 69 (70%) were male and 11 (30%) were female patients which is similar to a previous study [18]. In age group below 45 years, lesser incidences of cardiac events are seen because of anti-atherosclerotic effect of estrogen [19].

In this study, patients presented with typical chest pain and atypical chest pain in equal proportion. Typical chest pain was more common among diabetics but proportion of atypical pain as presenting feature was high in diabetics when compared to non-diabetic population. Other studies in the literature showed typical chest pain was found to be the most common presenting symptom in both diabetics and non-diabetic which is consistent with this study [5]. This study had 62% of STEMI, 25% of UA and 12% of NSTEMI. Similarly, in the previous studies most of the patients had higher incidence of STEMI in young CAD [2,20,21].

In India and elsewhere most common MI was anterior wall MI [3,20,22]. This study also had higher incidence of anterior wall MI (82%) followed by inferior wall MI and lateral wall MI with 16%and 2%, respectively. LV Ejection fraction showed normal LV function in most of the individuals. This correlates well with the study done by others [1,20].

Angiographic pattern of young CAD patients is distinct from angiographic pattern of patients with CAD in older age group. SVD was the most common type of angiographic pattern in all studies globally, with highest incidence of 67% was seen in a study [1]. Lowest incidence of 39% seen in a study done by Zimmerman FH et al., [23]. In the index study, there was an incidence of 48% of SVD, 18% of DVD and 7% of TVD among diabetic population [23]. Another study also showed a similar pattern of involvement [20]. On comparing the angiographic pattern of CAD patients below the age of 45 years, LAD artery was the most commonly involved artery [5,20,24].

In this study, least commonly involved artery was LCX, which constituted about 7% in non-diabetic patients which was similar to another study [25]. In diabetics LCX, involvement was only 5%. Pattern of involvement of coronaries in correlation with HbA1c varies, in this study patients with HbA1c level between 5-10% had 85% of SVD followed 11% of DVD and 3% of TVD but patients with HbA1c level above 10% had 24% of SVD and 54% of DVD and 20% of TVD. This was also similar to another study [26].

Limitation(s)

A follow-up study is needed to find the long-term outcome of the younger patients with MI, both in the diabetics and non-diabetics; particularly emphasising on the cardiac remodeling.

CONCLUSION(S)

Young diabetic ACS presents with atypical chest pain and angiographic profile of them with higher HbA1c showed more of triple vessel disease/Multivessel involvement. Strict glycaemic control in early stages itself is needed in these high risk patients. Large multicenter study is needed, which may reveal better understanding regarding pathology of diabetic and non-diabetic coronary disease.

REFERENCES

[1] Iragavarapu T, Radhakrishna T, Jagadish Babu K, Sanghamitra R. Acute coronary syndrome in young- A tertiary care centre experience with reference to coronary angiogram. J Pract Cardiovasc Sci. 2019;5(1):18-25.

[2] Tungsubutra W, Tresukosol D, Buddhari W, Boonsom W, Sanguanwang S, Srichaiveth B. Acute coronary syndrome in young adults: The Thai ACS Registry. J Med Assoc Thail Chotmaihet Thangphaet. 2007;90 Suppl 1:81-90.

[3] Sinha SK, Krishna V, Thakur R, Kumar A, Mishra V, Jha MJ, 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.

[4] Rivera JJ, Nasir K, Cox PR, Choi EK, Yoon Y, Cho I, et al. Association of traditional cardiovascular risk factors with coronary plaque sub-types assessed by 64-slice computed tomography angiography in a large cohort of asymptomatic subjects. Atherosclerosis. 2009;206(2):451-57.

[5] Nagamalesh UM. Clinical profile of young Indian women presenting with acute coronary syndrome. J Clin Prev Cardiol. 2018;7(3):106-10.

[6] Fabian B, Nina D, Michael SD, Sujith SK, Maros F, Javed B, et al. Association between cardiovascular risk profiles and the presence and extent of different types of coronary atherosclerotic plaque as detected by multidetector computed tomography. Arterioscler Thromb Vasc Biol. 2008;28(3):568-74.

[7] Kumar A, Kaur H, Devi P. Coronary artery disease in women: How does it differ from men? JIACM. 2011;13(1):43-47.

[8] Sunman H, Yorgun H, Canpolat U, Hazırolan T, Kaya EB, Ateş AH, et al. Association between family history of premature coronary artery disease and coronary atherosclerotic plaques shown by multidetector computed tomography coronary angiography. Int J Cardiol. 2013;164(3):355-58.

[9] Starkman HS, Cable G, Hala V, Hecht H, Donnelly CM. Delineation of prevalence and risk factors for early coronary artery disease by electron beam computed tomography in young adults with Type 1 diabetes. Diabetes Care. 2003;26(2):433-36.

[10] Otaki Y, Gransar H, Cheng VY, Dey D, Labounty T, Lin FY, et al. Gender differences in the prevalence, severity, and composition of coronary artery disease in the young: A study of 1635 individuals undergoing coronary CT angiography from the prospective, multinational confirm registry. Eur Heart J Cardiovasc Imaging. 2015;16(5):490-99.

[11] Raj KB, Sivachandran G. A study on clinical profile of acute coronary syndrome in type 2 diabetes mellitus patients with relevance to HbA1c. IAIM.2018;5(8):01-08.

[12] Unstable angina-Symptoms, diagnosis and treatment | BMJ Best Practice [Internet]. [cited 2020]. Available from: https://bestpractice.bmj.com/topics/en-gb/149.

[13] ST-elevation myocardial infarction - Symptoms, diagnosis and treatment | BMJ Best Practice [Internet]. [cited 2020]. Available from: https://bestpractice.bmj.com/topics/en-gb/3000103.

[14] Non-ST-elevation myocardial infarction- Symptoms, diagnosis and treatment | BMJ Best Practice [Internet]. [cited 2020]. Available from: https://bestpractice.bmj.com/topics/en-us/151.

[15] American Diabetes Association. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes-2019 | Diabetes Care. Diabetes Care 2019 Jan; 42(Supplement 1): S13-S28. Available from: https://care.diabetesjournals.org/content/42/Supplement_1/S13.

[16] Saleem T, Mohammad KH, Abdel-Fattah MM, Abbasi AH. Association of glycosylated haemoglobin level and diabetes mellitus duration with the severity of coronary artery disease. Diab Vasc Dis Res. 2008 Sep;5(3):184-89.

[17] Hermann LK, Weingart SD, Yoon YM, Genes NG, Nelson BP, Shearer PL, et al. Comparison of frequency of inducible myocardial ischemia in patients presenting to emergency department with typical versus atypical or nonanginal chest pain. Am J Cardiol. 2010;105(11):1561-64.

[18] Vikulova D, Grubisic M, Zhao Y, Lynch K, Humphries KH, Pimstone SN, et al. Premature atherosclerotic cardiovascular disease: trends in incidence, risk factors, and sex-related differences, 2000 to 2016. J Am Heart Assoc. 2019;8(14):e012178.

[19] Aggarwal A, Srivastava S, Velmurugan M. Newer perspectives of coronary artery disease in young. World J Cardiol. 2016;8(12):728-34.

[20] Esteban MR, Montero SM, Sánchez JJA, Hernández HP, Pérez JJG, Afonso JH, et al. Acute coronary syndrome in the young: Clinical characteristics, risk factors and prognosis. Open Cardiovasc Med J. 2014;8:61-67.

[21] Iyengar SS, Gupta R, Ravi S, Thangam S, Alexander T, Manjunath CN, et al. Premature coronary artery disease in India: Coronary artery disease in the young (CADY) registry. Indian Heart J. 2017;69(2):211-16.

[22] Bhardwaj R, Kandoria A, Sharma R. Myocardial infarction in young adults-risk factors and pattern of coronary artery involvement. Niger Med J. 2014;55(1):44-47.

[23] Zimmerman FH, Cameron A, Fisher LD, Grace N. Myocardial infarction in young adults: Angiographic characterization, risk factors and prognosis (coronary artery surgery study registry). J Am Coll Cardiol. 1995;26(3):654-61.

[24] Narayanaswamy AG, Kumar PV, Shahid M, Porchelvan S, Meenakshi K, Srinivasan V, et al. Coronary angiographic profile of patients with acute coronary syndrome <45 years of age in rural population of Tamil Nadu. IJSS. 2018;6(1):74-77.

[25] Hegde SS, Mallesh P, Yeli SM, Gadad VM, Giri PM. Comparitive angiographic profile in diabetic and nondiabetic patients with acute coronary syndrome. J Clin Diagn Res JCDR. 2014;8(9):MC07-10.

[26] Saleem T, Mohammad KH, Abdel-Fattah MM, Abbasi AH. Association of glycosylated haemoglobin level and diabetes mellitus duration with the severity of coronary artery disease. Diab Vasc Dis Res. 2008;5(3):184-89.

PARTICULARS OF CONTRIBUTORS:
1. Postgraduate, Department of General Medicine, Mahatma Gandhi Medical College and Research Institute, Puducherry, India.
2. Associate Professor, Department of General Medicine, Mahatma Gandhi Medical College and Research Institute, Puducherry, India.
3. Pofessor and Head, Department of Cardiology, Mahatma Gandhi Medical College and Research Institute, Puducherry, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Mohamed Hanifah,
M.R.Villa, VIP Nagar, Pattanur, Dhanvantri Nagar Post, Pondicherry-605006, India.
E-mail: hanifah4u@yahoo.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Feb 08, 2020
- Manual Googling: Mar 24, 2020
- iThenticate Software: Apr 21, 2020 (18%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Feb 07, 2020**
Date of Peer Review: **Mar 05, 2020**
Date of Acceptance: **Apr 03, 2020**
Date of Publishing: **May 01, 2020**