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Cardiovascular Risk Factors in Patients of Type 2 Diabetes Mellitus – A Cross Sectional Study

[1]Dr Shirish Pichke, [2]Dr Abrar Tattapure, [3]Dr Pranav Tahakik, [4]Dr Anjali Shivpuje

Corresponding Author: Dr Shirish Pichke

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Abstract

Diabetes mellitus is a well-established risk factor for cardiovascular disease. People with type 2 diabetes mellitus have a higher cardiovascular morbidity and mortality, and are disproportionately affected by cardiovascular disease. Study was conducted among 250 study participants with Type 2diabetes mellitus at tertiary care hospital. Hypertension and raised total cholesterol were cardiovascular risk factors among patients of type 2 diabetes mellitus. Weakly positive correlation was seen for HbA1C, Systolic BP, Total Cholesterol and ASCVD (Atherosclerotic cardiovascular disease) risk score. A statistically significant association was seen between ASCVD risk and hypertension, hypercholesterolemia, age and sex among study participants. Age ≥50 years, male gender, hypertension and raised total cholesterol were cardiovascular risk factors among patients of type 2 diabetes mellitus. Diabetes mellitus is an established risk factor for cardiovascular disease. People with type 2 diabetes mellitus have a higher cardiovascular morbidity and mortality, and are disproportionately affected by cardiovascular disease compared with non-diabetic subjects. Hypertension is most common cardiovascular risk factor among patients of Type 2 diabetes mellitus followed by obesity, physical inactivity, hypercholesterolemia, alcohol consumption and smoking respectively. Cardiovascular disease is associated with non-modifiable risk factors like increasing age and male gender and modifiable risk factors like hypertension and raised total cholesterol. ASCVD risk estimator is useful tool for risk stratification and management recommendations according to risk status.

Keywords: Atherosclerotic cardiovascular disease, Body mass index, cardiovascular disease, Diabetes mellitus, Hypercholesterolemia, HBA1c

Introduction

Diabetes mellitus is a chronic condition that occurs when the body cannot produce enough or effectively use of insulin, and are induced by a genetic predisposition coupled with environmental factors.[1]

Three hundred sixty six million people have Diabetes mellitus in 2011; half of these (183 million people) are undiagnosed. The number of people with Diabetes mellitus worldwide is increasing and by 2030 this will have risen to 552 million.[2]DM is a well-established risk factor for cardiovascular disease. People with type 2 diabetes mellitus have a higher cardiovascular morbidity and mortality, and are disproportionately affected by cardiovascular disease compared with non-diabetic subjects.[3]Diabetic vascular disease is responsible for two-four-fold rise in the occurrence of coronary artery disease and stroke, and two-eight-fold improve in the risk of heart failure. [4] Prospective studies have demonstrated that diabetic patients have a two- to fourfold propensity to develop coronary artery disease and myocardial infarction5,establishing that type 2 diabetes mellitus is an independent risk factor for stroke and heart disease.[6] Indeed, about 70% of type 2 diabetes mellitus at an age ≥65 years die fromcardiovascular disease.Therefore this trial was done to study Cardiovascular risk factors among patients of type 2 diabetes mellitus at tertiary care centre during study period.

Material and methods

Study design: Cross Sectional Study

Study period: November 2020 to November 2022

Study setting: Medicine department of a Tertiary Rural Health Care Centre

Study population" OPD and IPD Patients of Type 2 Diabetes Mellitus attending Tertiary Rural Health Care Centre who fulfil the following criteria for study.

Sample size: With reference to study by**Tripathy JP et al** [8] **,**Overall prevalence of diabetes mellitus among the study participants was found out to be 8.3%.

Sample size =Sample Size for present study will be calculated by following formula

$N=\frac{4 \times P \times Q}{L^2}$

Where P (prevalence)=8.3

Q (100-P) =100-8.3=91.7

Allowable error= L=4 % absolute

N=4 ×8.3× 91.7 / 16

N=190.27

However, 250 subjects were included in the study.

Sampling method: A consecutive sampling method was used till desired sample size was achieved.

Ethical Clearance: Ethical clearance was obtained from institutional ethics committee.

Inclusion criteria

All diagnosed patients of Type 2 Diabetes Mellitus attending Outpatient department and Inpatient department of Tertiary Hospital.

Exclusion criteria

Patients with Gestational Diabetes Mellitus

Known Cardiovascular Disease i.e. - Coronary Artery Disease, Cerebrovascular Disease and Peripheral Vascular Disease.

Research methodology specified for Data collection

The patients fulfilling to the inclusion criteria were enrolled into the study after being explained the proceedings of the study and after they signed the consent form. Predesigned and pretested case record form was used as tool for data collection. Data was collected about sociodemographic characteristics of study subjects like age, sex, occupation, socioeconomic status and education.

•Anthropometric measurements were done to calculate BMI and Waist hip ratio.

•BMI = Weight in kgs / height in m^2

Classification (kg/m^2).

Underweight- < 18.

Normal - 18.5 – 22.99

Overweight - 23 – 24.99

Obesity - >/= 25

Weight was measured with help of Analogue Weight Machine.

Hip circumference was measured at the level of greater trochanter of femur.

Operational definitions

Diabetes Mellitus

Diabetes is diagnosed at fasting blood glucose of greater than or equal to 126 mg/dl and

2-hour plasma glucose greater than or equal to 200 mg/dl

OR

Diabetes is diagnosed at random blood glucose of greater than or equal to 200 mg/dl.

OR

HbA1c - Normal - less than 5.6%

Prediabetes- 5.7% to 6.4%

Diabetes-6.5% or higher

ASCVD (Atherosclerotic Cardiovascular Disease) risk score[7]

It is a national guideline developed by the American College of Cardiology. It is a calculation of 10-year risk of having a cardiovascular problem, such as coronary artery disease or stroke. This risk estimate considers

1.Age

2.Gender

3.Race

4.Cholesterol levels

5.Blood pressure

6.Medication use

7.Diabetic status

8.Smoking status.

ASCVD (Atherosclerotic Cardiovascular Disease) risk score is given as a percentage.

There are different treatment recommendations depending on risk score

0-4.9 percent risk = low risk

5-7.4 percent risk = borderline

7.5-20 percent risk = intermediate

> 20 percent risk = high

Statistical Analysis

The collected data was entered in Microsoft excel.The categorical variables were presents as number and percentage whereas for continuous variable were presented as mean and SD. Chi square test $\chi 2$ and Pearson's correlation coefficient (r) were used as test of significance. p value of <0.05 was considered statistically significant. ASCVD risk score was estimated by using AHA (American heart association)/ACC(American college of cardiology) ASCVD risk score calculator.

Results and Observations

Table 1: Distribution of study participants according to age (N=sample size=250)

Age (In years)	Frequency	Percentage
< 40	32	12.8
40-50	91	36.4
>50	127	50.8
Total	250	100

Above table shows that, majority of study participants were from age group > 50 years contributing 127 (50.8%) followed by 40-50 years 91 (36.4%) and <40 years 32(10%) respectively.

Table 2: Distribution of study participants according to gender (N=250)

Sex	Frequency	Percentage
Male	158	63.2

Female	92	36.8
Total	250	100

Above table shows that, most of the study subjects were males contributing 158 (63.2%) and females 92(36.8%).M:F ratio is 1.71:1.

Table 3: Distribution of study participants according to Education (N=250)

Education	Frequency	Percentage
Illiterate	15	6
Primary	30	12
Secondary	33	13.2
Higher secondary	51	20.4
Intermediate	87	34.8
Graduate or Post graduate	34	13.6
Total	250	100

Above table shows that majority of study subjects were educated upto Intermediate level contributing 87 (34.8%) followed by Higher secondary 51 (20.4%), Graduate or Postgraduate 34 (13.6%),secondary 33 (13.2%), primary 30(12%) and illiterate 15 (6%) respectively.

Table 4: Distribution of study participants according to occupation(N=250)

Occupation	Frequency	Percentage
Unemployed	15	6
Unskilled/Semiskilled	29	11.6
Skilled	54	21.6
clerk, shop owner, farmer	136	54.4
Professional	16	6.4
Total	250	100

Above table shows that majority of study subjects were having occupations like clerk, shop owner, farmer contributing 136 (54.4%) followed by Skilled 54 (21.6%), Unskilled/Semiskilled 29 (11.6%), Professional 16 (6.4%), and Unemployed 15 (6%) respectively.

Table 5: Distribution of study participants according to Socioeconomic status (N=250)

SE class	Frequency	Percentage
I	28	11.2
II	40	16
III	84	33.6
IV	54	21.6
V	44	17.6
Total	250	100

Above table shows that majority of study subjects were belonging to SEC III contributing 84(33.6%) followed by Class IV 54 (21.6%) ,Class V 44 (17.6%),Class II 40 (16%) and Class I 28 (11.2%) respectively.

Table No.6: Descriptive statistics (N=250)

Variable	Mean	SD	95% CI
Age(Yrs)	49.68	8.11	49.68 ±1.006
SBP(mm/Hg)	131.11	11.71	131.116 ±1.452
DBP(mm/Hg)	83.48	7.93	83.48 ±0.983
Total Cholesterol(mg/dl)	183.92	36.36	183.92 ±4.508
High density lipoprotein Cholesterol(mg/dl)	39.56	7.39	39.56 ±0.917
Fasting BSL(mg/dl)	115.344	18.31	115.344 ±2.27
PP BSL(mg/dl)	204.388	35.86	204.388 ±4.446
HbA1c (gm%)	7.8372	0.70	7.8372 ±0.0873
BMI(Kg/m^2)	24.442	2.48	24.442 ±0.309

ASCVD score(%)	10.4436	10.02	10.4436 ±1.242

Mean age of study participants was 49.68 ±1.006 years. Mean ASCVD risk score among all participants was 10.4436 ±1.242 %. Mean HbA1c (gm%) was 7.8372 ±0. 0873.Mean BMI was 24.442 ±0.309 Kg/m^2

Table 7: Cardiovascular risk factors among patients of Type 2 DM (N=250)

Risk Factor	Frequency	Percentage
Hypertension	190	76
Hypercholesterolemia	90	36
Smoking	78	31.2
Physical Inactivity	130	52
Obesity	176	70.4
Alcohol	92	36.8

Hypertension was most common Cardiovascular risk factors among patients of Type 2 DM contributing 190(76%) followed by obesity (BMI>25 Kg/m2) 176 (70.4%), Physical Inactivity 130 (52%), Hypercholesterolemia (TC > 200 mg/dl) in 90(36%), Alcohol consumption in 92 (36.8%) and Smoking 78(31.2%) respectively.

Table 8: 10-year ASCVD Risk among study participants (N=250)

ASCVD Risk (%)	Frequency	Percentage
Low Risk (0-4.9%)	104	41.6
Borderline risk(5-7.4%)	28	11.2
Intermediate Risk(7.5-20%)	80	32
High Risk (>20%)	38	15.2
Total	250	100

10-year Atherosclerotic cardiovascular (ASCVD) Risk as per AHA/ACC among study participants shows that, majority of study subjects were at low risk contributing 104 (41.6%) followed by Intermediate Risk in 80(32%),High Risk 38(15.2%) and 28(11.2%) were having Borderline risk respectively.

Table 9: Correlation between cardiovascular risk factors and ASCVD risk score among study participants (N=250)

Variable	Pearson's r	P value	Remark
Age	0.612	<0.0001	Moderate positive
Body mass index	-0.1606	0.011	Weakly Negative
HbA1C	0.3497	< .00001	Weakly positive
Systolic BP	0.432	< .00001	Weakly positive
Total Cholesterol	0.3564.	< .00001	Weakly positive

Above table shows that, Moderate positive correlation was there between age and ASCVD risk score among study participants. (Pearson's correlation coefficients r=0.612). Weakly positive correlation was seen for HbA1C(r=0.3497), Systolic BP(r=0.432), Total Cholesterol(r=0.3564) and ASCVD risk score.

Table 10: Association between cardiovascular risk factors and ASCVD risk among study participants (N=250)

Risk Factor	Sub Group	N	ASCVD risk		P Value
			Low to Borderline	Intermediate to High	
			N	N	
Age	<50	105	93	12	< 0.00001*
	≥50	145	39	106	

Sex	Male	158	74	84	0.013*
	Female	92	58	34	
Smoking	Yes	78	43	35	0.619
	No	172	89	83	
Physical Inactivity	Yes	130	71	59	0.549
	No	120	61	59	
Hypertension	Yes	190	75	115	< 0.00001*
	No	60	57	03	
Hypercholesterolemia	Yes	90	28	62	< 0.00001*
	No	160	104	56	

Above table shows that, a statistically significant association was seen between ASCVD risk and Hypertension ($p<0.00001$), Hypercholesterolemia ($p<0.00001$), age ($p<0.00001$) and sex ($p=0.013$) among study participants.

Age >50 years, Male gender, Hypertension and raised total cholesterol were cardiovascular risk factors among patients of type 2 DM.

Conclusion

The present cross-sectional study was conducted among 250 study participants with Type 2 DM at medicine department of a tertiary care hospital. Subjects were enrolled consecutively as per inclusion criteria till achievement of sample size. A predesigned and pretested study proforma was used a tool for data collection. Data was collected in Microsoft excel spreadsheet and analyzed using SPSS ver 20 software. ASCVD risk was estimated using AHA/ACC ASCVD Risk estimator.

Present study revealed following findings

- Majority of study participants were from age group > 50 years contributing 127 (50.8%) followed by 40-50 years 91 (36.4%) and <40 years 32(10%) respectively.
- Most of the study subjects were males contributing 158 (63.2%) and females 92(36.8%).
- Male: Female ratio is 1.71:1.
- Majority of study subjects were educated up tointermediate level contributing 87 (34.8%) followed by higher secondary 51 (20.4%), graduate or postgraduate 34 (13.6%), secondary 33 (13.2%), primary 30(12%) and illiterate 15 (6%) respectively.
- Majority of study subjects were having occupations like clerk, shop owner, farmer contributing 136 (54.4%) followed by skilled 54 (21.6%), unskilled/semiskilled 29 (11.6%), professional 16 (6.4%), and unemployed 15 (6%) respectively.
- Majority of study subjects were belonging to SEC III contributing 84(33.6%) followed by Class IV 54 (21.6%), Class V 44 (17.6%), Class II 40 (16%) and Class I 28 (11.2%) respectively.
- Mean age of study participants was 49.68 ±1.006 years. Mean ASCVD risk score among all participants was 10.4436 ±1.242 %. Mean HbA1c (gm%) was 7.8372 ±0. 0873.Mean BMI was 24.442 ±0.309 Kg/m^2
- Hypertension was most common Cardiovascular risk factors among patients of Type 2 DM contributing 190(76%) followed by obesity (BMI>25 Kg/m2) 176 (70.4%), physical Inactivity 130 (52%),

hypercholesterolemia (TC > 200 mg/dl) in 90(36%), alcohol consumption in 92 (36.8%) and smoking 78(31.2%) respectively.

- Age and gender were non modifiable risk factors for ASCVD among study participants.
- Hypercholesterolemia and hypertension were modifiable risk factors for ASCVD among patients of type 2 DM.
- 10-year Atherosclerotic cardiovascular (ASCVD) Risk as per AHA/ACC among study participants shows that, majority of study subjects were at low risk contributing 104 (41.6%) followed by Intermediate Risk in 80(32%), High Risk 38(15.2%) and 28(11.2%) were having Borderline risk respectively.
- Moderate positive correlation was there between age and ASCVD risk score among study participants. (Pearson's correlation coefficients r=0.612).
- Weakly positive correlation was seen for HbA1C(r=0.3497), Systolic BP(r=0.432), Total Cholesterol(r=0.3564) and ASCVD risk score.
- A statistically significant association was seen between ASCVD risk and Hypertension ($p<0.00001$), Hypercholesterolemia ($p<0.00001$), age ($p<0.00001$) and sex ($p=0.013$) among study participants.
- Age ≥50 years, Male gender, Hypertension and raised total cholesterol were cardiovascular risk factors among patients of type 2 DM.
- DM is an established risk factor for cardiovascular disease. People with type 2 diabetes mellitus have a higher cardiovascular morbidity and mortality, and are disproportionately affected by CVD compared with non-diabetic subjects. Hypertension was most common cardiovascular risk factors among patients of Type 2 DM followed by obesity,physical Inactivity,hypercholesterolemia,alcohol consumption andsmoking respectively.
- CVD are associated with non-modifiable risk factors like increasing age and male gender and modifiable risk factors like hypertension and raised total cholesterol.
- AHA/ACC ASCVD risk estimator is useful tool for risk stratification and management recommendations according to risk status.

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