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Original Research Paper

Cardiovascular

ASSESSMENT OF CARDIOVASCULAR RISK IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

BACKGROUND: Type 2 diabetes mellitus (T2DM) is a complex metabolic disorder that is increasing steadily among world population. The increased chance of this multifactorial disease is due to the globalization of the Western lifestyle. The sturdy association between diabetes and CVD was determined in numerous studies, independently of different traditional cardiovascular risk factors. Cardiovascular disease (CVD) is the leading cause of mortality in individuals with type 2 diabetes mellitus (T2DM). The life expectancy of a 50-year-old with diabetes is, on average six years shorter than that of a counterpart without diabetes mellitus. Hyperglycemia and insulin resistance, among different other risk factors, are thought to contribute essentially to atherosclerotic changes and the pathogenesis of macro-vascular complications in diabetes. **METHODOLOGY:** An observational study was conducted in patients with diabetes to find out the association between diabetes mellitus and cardiovascular outcomes. 1000 patients who met the inclusion criteria were included in the study and evaluated for cardiovascular risk. Cardio vascular events identified in the desired population were considered as the clinical outcome. **RESULTS:** No of cardiovascular events in the recruited individuals are calculated and the cardiovascular risk is estimated from the percentage of events from different ages grouped under 4 categories. The risk among males and females is also estimated. **CONCLUSION:** In this study we give an overview that cardiovascular risk is higher among the diabetic patients and the chances of cardiovascular events are more in males when compared to females.

KEYWORDS : Diabetes mellitus, cardiovascular events, cardiovascular risk, risk assessment, coronary heart disease.

INTRODUCTION:

Type 2 diabetes mellitus (T2DM) is a complex metabolic disorder diagnosed in nearly 8.5% of the worldwide population. Over time, the prevalence of Type 2 diabetes mellitus is increasing steadily. As Global World Health Organization (WHO), Adult diabetes prevalence was globally accrued from 4.7% in 1980 to 8.5% in 2014 escalating to a total of 422 million patients.[1] The increased chances of this multifactorial disease across the globe is due to the globalization of the Western lifestyle.

Diabetes may be a vital health problem worldwide, and its impact on cardiovascular disease (CVD) was reported in several studies. The sturdy association between diabetes and CVD was determined in numerous studies, independently of different traditional cardiovascular risk factors.[2-5]

Type 2 DM is a vital risk factor for cardiovascular disease, [6,7] and, also the presence of both type 2 diabetes and cardiovascular disease will have a higher chance of mortality in the individuals.[8]

Cardiovascular disease (CVD) is the leading cause of mortality in individuals with type 2 diabetes mellitus (T2DM), yet a significant proportion of the disease burden cannot be accounted for by conventional cardiovascular risk factors. People with diabetes have a minimum of a two-fold to a four-fold elevated risk of experiencing cardiovascular events and a double risk of death compared with age-matched subjects without diabetes.[8]

Diabetes mellitus is a condition usually associated with disorders of the cardiovascular system. It is well established that three-quarters of diabetic patients aged over 40 years can die from cardiovascular disease and are more likely than non-diabetics to die from their first cardiovascular event. The life expectancy of a 50-year-old with diabetes is, on average six years shorter than that of a counterpart without diabetes mellitus, with ≈60% of the difference in survival attributable to excess vascular deaths.[9]

Disturbed glucose metabolism plays a significant role in atherosclerosis and CVD. Cumulative data suggest that redoubled plasma glucose levels may be a risk factor for CVD regardless of the presence of diabetes.

In the Heart Outcomes Prevention Evaluation (HOPE) study, the risk of cardiovascular events (MI, stroke, and cardiovascular death) within the following 4.5 years will increase by nearly 9% with each 1 mmol/l increase in fasting glucose. Every 1% increase in HbA1c is also correlated with a higher risk of cardiovascular outcomes, with a relative risk of 1.07. These relationships were independent of other cardiovascular risk factors (age, sex, blood pressure, and hyperlipidemia) and remained significant after adjustment for diabetic status.[10]

Cardiovascular disease (CVD) could be a major cause of mortality and disability among individuals with diabetes mellitus.[11,12] Adults with diabetes historically have the next predominance rate of CVD than adults without diabetes,[13] and the hazard of CVD increments ceaselessly with raising fasting plasma glucose levels, indeed sometime recently coming to levels adequate for a diabetes diagnosis.[14] T2DM diminishes life expectancy by as much as ten years, and the major cause of death for patients with diabetes is CVD.[11,12]

Hyperglycemia and insulin resistance, among different other risk factors, are thought to contribute essentially to atherosclerotic changes and the pathogenesis of macro-vascular complications in diabetes. Hyperglycemia has also been involved in the pathogenesis of cardiovascular complications of diabetes. It increments the generation of reactive oxygen species, which inactivates nitric oxide,[15] driving to endothelial dysfunction. On the other hand, expanded ROS generation leads to CVD by triggering the activation of protein kinase C (PKC).

Cardiovascular complications are presently the essential causes of both morbidity and mortality related to diabetes. More than 75% of diabetics, aged over 40 years, will die from cardiovascular disease and are more prone compared to non-diabetics to die from their first cardiovascular event. The relative risk of coronary heart disease was found to be increased by 66% in men and by 20% in females, according to the Framingham study after estimating the risk for major cardiovascular outcomes and after 20 years of follow-up. Diabetic women seem to be more susceptible to cardiovascular risk than men.

The influence of cardiovascular diseases in diabetic subjects in global health is already huge and is continuously elevating. In addition, patients with diabetes experience silent, more advanced, and associated with less favorable prognosis cases of CAD in diabetics than the non-diabetic population.[16]

Diabetes is positively associated with a higher risk of coronary heart disease (CHD). In individuals with no prior history of myocardial infarction (MI), the 7-year risk of MI is 20.2% and 3.5% for diabetics versus non-diabetics, respectively. Similarly, in patients with a history of MI, the 7-year risk of MI is 45.0% and 18.8% for diabetics and non-diabetics, respectively.[17] diabetes also elevates the risk of stroke. The INTERSTROKE study, a case-control study that recruited patients who developed acute stroke and those without a stroke history in 22 countries, demonstrated a 35% increase in stroke risk in patients with a self-reported history of diabetes.[18]

15.4% death rates were recorded in patients with T2DM, with no prior history of myocardial infarction (MI), and 42.0% in patients with incidence of MI. In contrast, the death rates due to cardiovascular causes were 2.1 and 15.9%, respectively[19] in individuals without diabetes.

METHODOLOGY:

Basically this study is a retrospective observational study which was carried out in patients admitted to Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation (Dr. PSIMS & RF) at Gannavaram, Krishna district, Andhra Pradesh, India.

With the permission of Dr. PSIMS & RF a total of 1000 patients who met the inclusion criteria were recruited into the study. The inclusion criteria mainly states that the patients within the age group of 30 -50 years must be recruited in the study. The patients should have medical history of Diabetes mellitus for not less than 5 years. The patients below the age of 30 years and above the age of 50 years were excluded from the study. The patients with a history of prior cardio vascular events such as atherosclerosis, left bundle branch block, cardiomyopathy etc… comes under the exclusion criteria.

A total of 1000 patients who met the inclusion criteria were recruited in the study. All the data essential for the study was collected in a suitable data collection form. All the necessary data including patient demographics such as age, sex, body mass index, medical and medication histories, laboratory parameters (hba1c, RBS, FBS) were collected from the case files and safely documented in suitable forms for the study.

All the case files were carefully analyzed for the type of cardiovascular event observed in the patient and categorized the patients according to the type of event, age group, gender.

The primary clinical outcome was time to first major adverse cardiovascular event in the patients diagnosed with diabetes mellitus since 5 years.

RESULTS:

PATIENT DEMOGRAPHICS

Table 01: All the individuals recruited in the study were categorized according to age and sex

	NO. OF INDIVIDUALS (N)	PERCENTAGE (%)
AGE GROUP		
31-35	93	9.3
36-40	194	19.4
41-45	308	30.8
46-50	405	40.5
SEX		
MALE	548	54.8
FEMALE	452	45.2

The results clearly show that diabetic patients majorly experienced cardio vascular disease (CVD). Among 1000 individuals included in the study, cardiovascular outcomes were identified in 655 patients out of whom 329 members experienced CVD which constitutes about 50.22% of the total population who experienced cardiovascular events. A total of 138 myocardial infarction (MI) cases, 174 angina cases were identified in the study. The death cases were reported to be 14 which constitute just 2.13% of the total cases.

Table 02: Total no. of individuals who experienced various cardio vascular events

	NO.OF PATIENTS EXPERIENCED THE EVENT (N)	PERCENTAGE (%)	NO.OF MALES WHO EXPERIENCED THE EVENT (N)	NO. OF FEMALES WHO EXPERIENCED THE EVENT (N)
MI	138	21	83	55
ANGINA	174	26.56	78	96
CVD	329	50.22	197	132
HOSPITALIZATION FOR LONGER TIME	115	17.55	76	39
DEATH	14	2.13	8	6

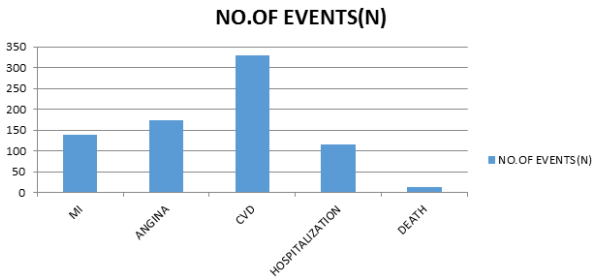


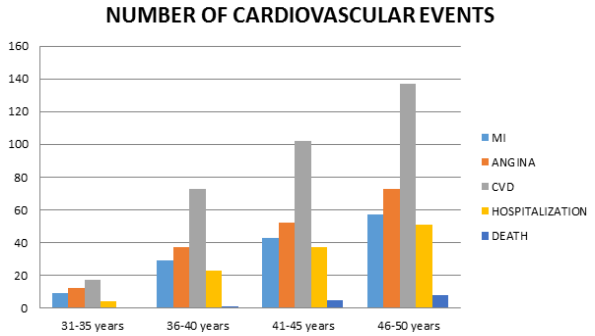
Figure 01: frequency of number of cardiovascular events in patients with diabetes mellitus

In the total events identified in each category, among 138 individuals with myocardial infarction, 83 individuals were male and 55 were female. Similarly from 174 angina cases noted, 78 were male and 96 were female and from a total of 329 CVD events 197 who experienced the event were male and 132 were female. The time of hospitalization for longer duration due to cardiovascular outcomes were observed to be higher in male (76) and lower in female (39). A total of 8 men and 6 women experienced death due to cardiovascular events associated with diabetes.

Table 03: patients who experienced cardiovascular events were grouped as per the age

	MI	ANGINA	CVD	HOSPITALIZATION	DEATH
AGE GROUP					
30-35	09	12	17	4	0
36-40	29	37	73	23	1
41-45	43	52	102	37	5
46-50	57	73	137	51	8

Figure 02: frequency of cardiovascular outcomes according to age



The individuals were categorized into 4 different age groups to estimate the risk of cardiovascular outcomes in patients with diabetes with respect to their age. The results show the 38 cardiovascular events were noted in individuals under the age group of 30-35 years which include 9 cases of MI, 12 cases of angina, 17 cases of CVD and zero cases of death. In the total of 140 CV events observed in the age group of 36-40 years, 29 were MI, 37 were angina, and 73 were CVD and 1 death case. In individuals from ages 41- 45 a total of 202 events were identified constituting 43 MI events, 52 angina, 103 CVD and 5 deaths. A highest of 275 outcomes was recorded in patients under the ages of

46-50. In this group, 57 cases of MI, 73 cases of angina, 138 cases of CVD and 8 cases of death were recorded.

DISCUSSION AND CONCLUSION:

It has been very clear that there is a positive association between diabetes mellitus and cardiovascular risk. Our study aimed to establish the risk of cardiovascular outcomes in patients with diabetes mellitus for an average of 5 years. Among the 1000 individuals recruited in the study between the ages of 30 – 50 years, 655 individuals experienced cardiovascular events out of which CVD has the highest risk constituting 50.22% of the total population with events. Previous studies have shown type 2 diabetes mellitus as a major precipitating factor for the cause of major cardiovascular events.[20,21,22] Globally, overall CVD affects approximately 32.2% of all persons with T2DM.
All the individuals were grouped into four categories according to age (31-35, 36-40, 41-45, 45-50 years) to estimate the risk. Of all the categories patients with DM under the age of 45-50 years have experienced the highest number of events followed by individuals with 41-45 years. Together these two groups experienced 477 cardiovascular events in a total of 655 events. From the previous studies, it is well established that three quarters of diabetics, aged over 40, can die from cardiovascular disease and are more likely than non-diabetics to die from their first cardiovascular event.[23] However we identified only 14 deaths from the total population although the number of cardiovascular events are higher.

Previous studies on cardiovascular risk in diabetes patients have clearly established that diabetic women are more susceptible to cardiovascular risk. Our study findings illustrate that the risk of angina is comparatively high in females (96 out of 174) while the risk of other events such as MI, CVD and Death is more in males. The ratio of events in men are as follows; MI (83 out of 138), CVD (197 out of 329), death (8 out of 14).

The risk of hospitalization for longer duration (7 or more days) was estimated to be higher for patients with myocardial infarction and cardio vascular disease. It was also estimated that the risk of hospitalization is more among patients under the age group of 46-50 years.

Cardiovascular risk stratification is very essential to individualize treatment. In diabetics the life time risk is more elevated when compared with non diabetics. Factors such as age above 40 years old, males can be an additional effect on cardiovascular diseases. Other risk factors such as hypertension, LDL, obesity, social habits should be considered to estimate and quantify the risk exactly. Future research and further studies are essential to develop more accurate tools for risk stratification and promote a better clinical outcome of diabetic patients. Individualization of diabetic drug regimen after considering the risk factors and blood sugar levels might minimize the macro-vascular complications and improve the prognosis of type 2 diabetes mellitus.

ABBREVATIONS:

CAD – coronary artery disease, CVD – cardiovascular disease, DM – diabetes mellitus, MI – myocardial infarction, ROS – reactive oxygen species, PKC – protein kinace C, WHO – world health organization.

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