RESEARCH ARTICLE

Current Clinical Status of Vascular Complications in Diabetes Mellitus Patients and Evaluation of Risk Factors

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Abstract

Objective: The present study aims to give the current clinical status of vascular complications in Diabetes Mellitus and its risk factors evaluation. **Methods:** The present prospective cross sectional study was carried out at St. Joseph Hospital, Guntur, A P., India including both out-patient and in- patient departments. The odds ratio and its 99% confidence interval (CI) were calculated for certain risk factor affecting diabetic complications patients. **Results:** All the results were based on 70 diabetic patient records. The no of female diabetic patients are 35 (50%). Most of the patients, 63.7% have microvascular complications alone, and of these diabetic nephropathy was the most common complication, accounting for 31.8%, followed by neuropathy 17.3%, retinopathy 14.4%, and macrovascular complications like angina (11.5%), atherosclerosis (8.69%) and diabetic foot (4.34%). High LDL and low HDL associated with more diabetic complications. 24% patients reached targeted HbA1c level and 17% had fair fasting plasma glucose concentration. **Conclusion:** From this study, the findings indicated that age, BMI and triglyceride concentrations are associated with vascular complications. More attention must be paid to elderly diabetic patients with appropriate treatment for high triglycerides. Screening and intervention programs should be implemented early at the diagnosis stage, and risk factors should be treated aggressively. Public health strategies are required in order to improve the current status of diabetic patients and to decrease the rate of prevalence of vascular complications.

Key words: Diabetic nephropathy, neuropathy, retinopathy, diabetic foot, microvascular, macrovascular, atherosclerosis.

INTRODUCTION

Diabetes was the 7th leading cause of death in the United States listed on death certificates in 2007.[1] The International Diabetes Federation has predicted that approximately 366 million individuals were afflicted with DM worldwide in 2011, and this is expected to increase to 552 million of the adult population by 2030.[2] It is a group of metabolic diseases characterized by high blood sugar (glucose) levels that result from defects in insulin secretion, or its action, or both. Normally, blood glucose levels are tightly controlled by insulin, a hormone produced by the pancreas. Insulin lowers the blood glucose level. When the blood glucose elevates (for example, after eating food), insulin is released from the pancreas to normalize the glucose level. In patients with diabetes, the absence or insufficient production of insulin causes hyperglycemia. Over time, diabetes can lead to blindness, kidney failure, and nerve

damage. These types of damage are the result of damage to small vessels, referred to as microvascular disease. With this background, the burden of DM is enormous in terms of the magnitude of the population affected as a result of increased disability, reduced life expectancy, impaired quality of life, and enormous health costs.[3] Diabetes is also an important factor in accelerating the hardening and narrowing of the arteries (atherosclerosis),[4] leading to strokes, coronary heart disease[5, 6] and other large blood vessel diseases. This is referred to as macrovascular disease. More than 29 million people in the United States have diabetes, up from the previous estimate of 26 million in 2010, according to a report released today by the Centers for Disease Control and Prevention. One in four people with diabetes doesn't know he or she has it. From an economic perspective, the total annual cost of diabetes in 2011 was estimated to be 174 billion dollars in the United States. This included 116 billion in direct medical costs (healthcare costs) for people with diabetes and another 58 billion in other costs due to disability, premature death, or work loss.[7] Medical expenses for people with diabetes ate over two times higher than those for people who do not have diabetes. There are two major types of diabetes, called type 1 and type 2. Type 1 diabetes was also formerly called insulin dependent diabetes mellitus (IDDM), or juvenile onset diabetes mellitus. In type 1 diabetes, the pancreas undergoes an autoimmune attack by the body itself, and is rendered incapable of making insulin. Type 2 diabetes mellitus (T2DM) accounts for 90–95% of all diagnosed DM cases.[8, 9]

METHODOLOGY

Study location: St. Joseph Hospital, Guntur, A P, India including both out-patient and in- patient departments. Study design: Prospective cross sectional study. Study setting: Study based only on those patients who experience any complication to diabetes mellitus, either during their stay in hospital or outside the hospital and visiting the outpatient and inpatient ward. Inclusions: Patients of both sex, patients of all ages, and all patients receiving drugs related to renal insufficiency. Exclusions: The prescription containing incomplete information would be excluded from the study.

Each prescription will be checked individually for parameters like total number of males and females, average number of males and female patients, total no of patients suffering from Diabetes, total duration of disease, types of complications and risk factors.

Data were recorded on a pre-designed proforma and managed on an MS Office Excel spread sheet. The descriptive statistics are represented by Mean ± SD and percentages. The comparison will be made by regression analysis. Graph Pad In Stat version 3.12 statistical software was used for the data analysis. The Odds ratio and its 99% confidence interval (CI) were calculated for certain risk factor affecting diabetic complications patients. Statistical significance was defined as $p<0.001$. All P values were two tailed. The study was approved by Institutional ethical committee of St. Joseph Hospital, Guntur, A.P., India.

RESULTS AND DISCUSSION

All type 2 diabetic out-patients and in-patients attended diabetic clinic during study period and fulfilled the inclusion criteria were selected. All the results were based on 70 diabetic patient records. The no of female diabetic patients are 35 (50%) and male patients are also 35 (50%). The patients were classified into four groups according to their age namely, below 35 years, 35-50 years, 50- 65 and above 65 years. Table 1 shows the incidence of complications with respect to age in which elderly patients had a higher incidence of complications (34.78%).

Table 1: Incidence of complications with respect to age

Age (years)	No. of patients	Total no. of complications	% complications
< 35	6(8.57%)	12	17.39
35-50	20(28.5%)	15	21.73
50-65	14(20%)	18	26.0
>65	30(42.85%)	24	34.78

This study found that no woman was smoking habituated and some of the men use tobacco in different forms like cigarette, cigar, gutka etc. The incidence of complications is high in patients who are having smoking as a habit.

Table 2: Incidence of complications with respect to smoking

Category	No. of patients	Complications N (%)
Smoking	19	20(66.66)
Non smoking	16	10(33.33)

Patients are divided into two categories based on their physical activity. They are active (those who are having exercised more than 150 min/week) and non-active (those who are having exercised less than 150 min /week). Non active patients are at more risk of developing diabetic complications

Table 3: Incidence of complications with respect to physical activity

Category	No. of patients	Total no. of complications	% Complications
Active	31(43.05)	29	42.02
Non active	41(56.94)	40	57.97

Family history of diabetes has a significant, independent, and graded association with the prevalence of diabetes.

Table 4: Incidence of complications with respect to family history

Family history	No. of patients	Complications N (%)
Yes	9(12.5%)	16(22.22)
No	63(87.5%)	53(73.61)

BMI is a useful measure of overweight and obesity. The higher the BMI, the higher your risk for certain diseases such as heart disease, high blood pressure, type 2 diabetes, gallstones, breathing problems, and certain cancers. It can be calculated by using the formula weight of the body / square of the height. It is measured in kg/m^2

Table 5: Incidence of complications with respect to family history

BMI category (Kg/m2)	No. of patients	Complications N (%)
Under weight (< 18.5)	3(4.1%)	2(2.7)
Normal(18.5 -24.5)	8(11.1%)	4(5.5)
Over weight(24.9-29.9)	34(47.2%)	25(36.2)
Obesity(≥30)	27(37.5%)	38(52.7)

Measuring waist circumference helps screen for possible health risks that come with overweight and obesity. If most of your fat is around your waist rather than at your hips, you're at a higher risk for heart disease and type 2 diabetes. This risk goes up with a waist size that is greater than 35 inches for women or greater than 40 inches for men. Obesity is a great public health concern. It is a significant determinant of hyperinsulinaemia/insulin resistance, high total triglycerides and low HDL cholesterol, suggesting that the achievement of normal weight is desirable.[10]

Patients are divided into two groups namely "those are suffering less than 5 years and those are suffering more than 5 years. In this study 64 (91.42%) patients have less than 5 years of disease duration and 6 (8.57%) have more than 5 years of disease duration. Long duration of disease acts as risk factor for developing micovascular and macrovascular complications.

Laboratory parameters include fasting plasma glucose

(FPG), HbA1c level and lipid profile, systolic and diastolic blood pressures. This indicates the blood glucose levels for the previous two to three months. The HbA1c measures the amount of glucose that is being carried by the red blood cells in the body. For most adults with diabetes, the HbA1c target is < 48 mmol/mol. HbA1c report says that 16 (22.2%) patients have HbA1c level in optimal range. 17 (23.6%) patients have fair HbA1c level which indicates increased risk of diabetic complications and 39 (54.1%) patients have poor HbA1c level which indicates that highly increased risk of diabetic complications.

The normal range is between 70 to 100 mg/dl. Abnormal FPG levels are, indeed, a cause for concern
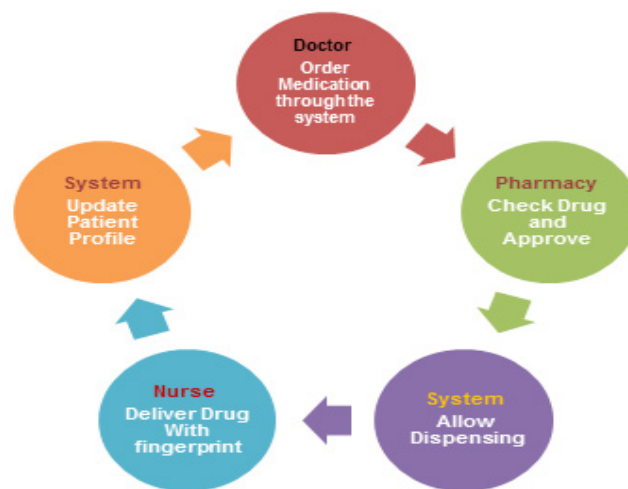

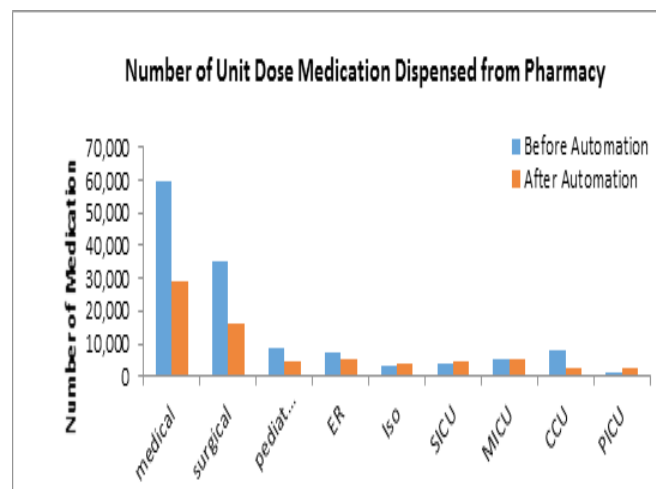Figure 1: Incidence of complications with respect to waist circumference.

Figure 2: Incidence of complications with respect to diabetic duration.
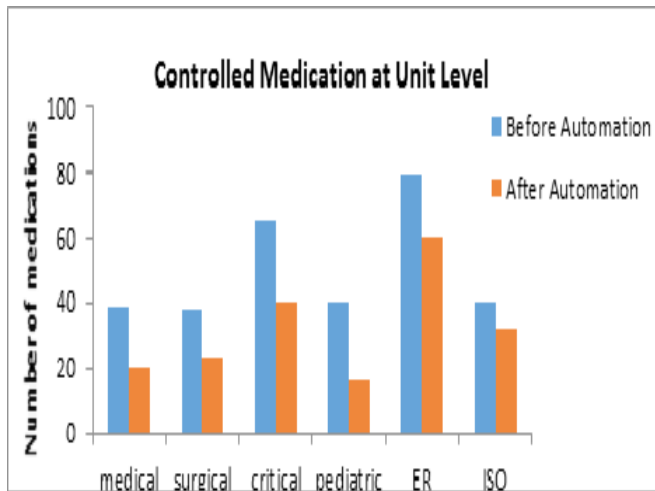
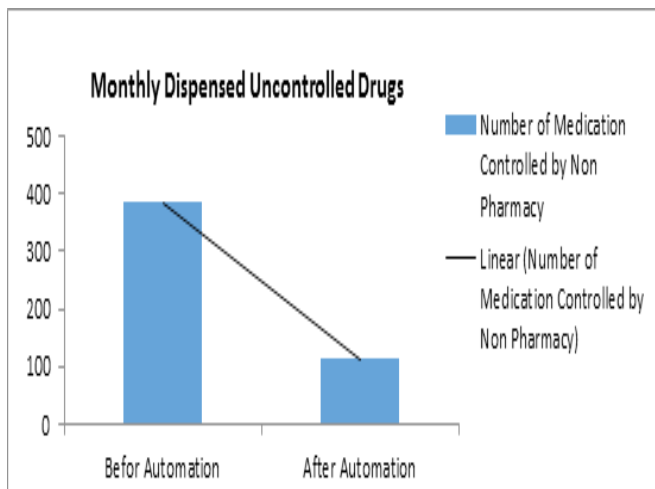Figure 3: Incidence of complications with respect to HbA1c level.

Figure 4: Incidence of complications with respect to FPG level.

A systolic blood pressure number of 140 or higher, on repeated measurements, is considered to be hypertension, or high blood pressure. A diastolic blood pressure number of 90 or higher, on repeated measurements, is considered to be hypertension or high blood pressure. Among total no of patients of 72, 23 patients have SBP below 120 mmhg, 18patients have SBP 120 to 139mmhg, 19 patients have SBP 140 to 159 mmhg and 12 patients have SBP more than 159 mmhg.

The lower your LDL cholesterol, the lower your risk of heart attack and stroke. Most of the patients, 45% have cholesterol level of boarder high followed by normal (26%), high (17%) and very high (3.8%). High LDL associates with more diabetic complications.

High concentrations are better than low ones. An HDL of 60 mg/dL or above may afford some protection against heart disease. The normal HDL cholesterol level varies from male to female. In males the target value is > 1.0 mmol/l (40 mg/dl) and non –target value is ≤ 1.0(≤ 40 mg/dl) mmol/l.
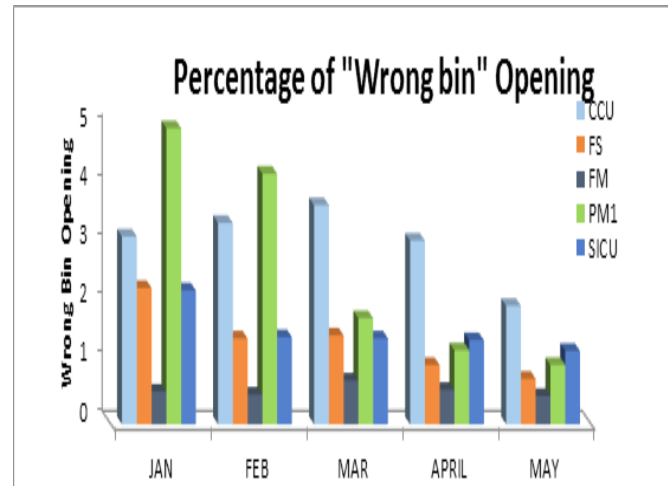

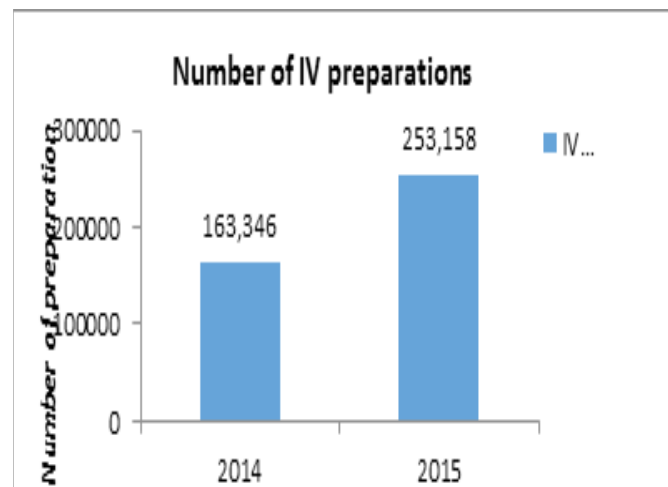Figure 5: Incidence of complications with respect to SBP level.

Figure 6: Incidence of complications with respect to DBP level.

Table 6: Incidence of complications with respect to LDL cholesterol

LDL level	No. of patients	Total no. of complications
Normal <2.6mmol/l	18(26%)	16(23.1%)
Boarder high 2.6-3.3 mmol/l	32(45%)	17(24.6%)
High 3.4-4.1mmol/l	12(17%)	16(23.1%)
Very high >4.1 mmol/l	10(3.8)	20(28.9%)

in females target value is > 1.3 mmol/dl (>50 mg/dl) and non-target value is ≤ 1.3 mmol/dl (≤ 50 mg/dl). Low HDL associates with more diabetic complications.

Most of the patients, 63.7% have microvascular complications alone, and of these diabetic nephropathy was the most common complication, accounting for 31.8%, followed by neuropathy 17.3%, retinopathy 14.4%, and macrovascular complications like angina (11.5%), atherosclerosis (8.69%) and diabetic foot (4.34%). Peripheral neuropathy, with a prevalence of 17.3% in this study, was different from studies

Table 7: Incidence of complications with respect to HDL cholesterol

Gender	HDL level	No. of patients	Complications
Male	Target >1.0mmol/l	24(33.3%)	12(17.3%)
	Non- target ≤ 1.0mmol/l	12(16.6%)	18(26%)
Female	Target > 1.3mmol/l	23(31.9%)	20(28.9%)
	Non-target ≤ >1.3 mmol/l	13(18%)	19(27.5%)

carried out in Canada, the United States, Spain, China and Sweden. [11-15] Some of the combinations of complications were also observed like Retinopathy and neuropathy (4 cases), Retinopathy and nephropathy (6 cases) and Neuropathy and nephropathy (5 cases). Diabetic eye disease, particularly diabetic retinopathy, has become a major cause of blindness throughout the world.[16]
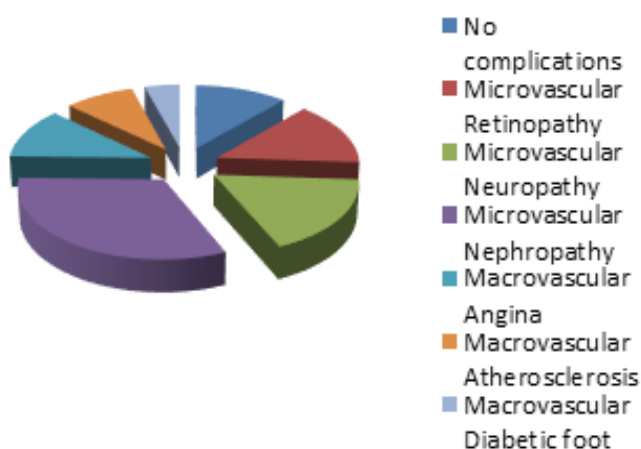

Figure 7: Types of complications Analysis of risk factors affecting the development of complications.

Table 8: Total integration of results

Variable	Crude OR	P- value
Age	1.15(1.11-1.19)	<0.001
BMI	.86(0.82-0.90)	<0.001
WC	0.94(0.92-0.96)	<0.001
Duration of disease	0.12(1.06-1.19)	<0.001
HbA1c	0.97(0.86-1.09)	0.65
FPG	1.04(0.95-1.14)	0.317
HDL	0.93(0.57-1.53)	0.793
LDL	1.07(0.81-1.41)	0.630
SBP	1.02(1.01-1.04)	0.003
DBP	1.01(0.98-1.04)	0.452

If p value is < 0.001, it is significant

CONCLUSION

The rate of vascular complications among type 2 diabetic patients was high. Identifying factors associated with the development of complications would be able to prevent the complications. From this study, the findings indicated that age, BMI and triglyceride concentrations are associated with vascular complications. More attention must be paid to elderly diabetic patients with appropriate treatment for high triglyceride. Diabetic patients need more efforts to be spent on them. Screening and intervention programs should be implemented early at the diagnosis stage, and risk factors should be treated aggressively. Public health strategies are required in order to improve the current status of diabetic patients and to decrease the rate of prevalence of vascular complications.

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