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Original Research Article

A prospective and observational study on complications of type 2 diabetes mellitus in correlation with body mass index

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ABSTRACT

Background: The aim of this study is to observe the prevalence of complications of diabetes mellitus (Type 2) among patients and to minimize their occurrence through patient education. The study helps to assess the clinical data of patients with diabetes mellitus (Type 2) along with the analysis of patterns, frequencies and predictive factors of microvascular, macrovascular complications and to educate and minimize the complications of diabetes mellitus among patients.
Methods: Prospective and observational study was conducted among the type 2 diabetes mellitus patients at Sree Diabetes Clinic for a period of 6 months. The patients were interviewed using the patient data collection form which included demographic details, chief complaints and different diagnostic tools to detect type of complications. Both micro and macrovascular complications were evaluated.
Results: A total of 150 type 2 diabetic cases were collected. Out of these 38(25.33%) patients were having BMI <25, and 112(74.67%) were having BMI ≥25 (overweight and obese). Out of 150 diabetic cases collected, a total of 131 diabetic complications were found. Out of these, 64(42.6%) were neuropathy, 3(2%) were nephropathy, 20(13.3%) were retinopathy and 17(11.3%) were having cardiovascular complications. Out of 112 patients with BMI ≥25, 60(54%) were found to have diabetic complications and out of 38 patients with BMI <25, 18(47%) were found to have diabetic complications. 90 out of 150 patients had a history of hypertension and 17 out of 150 patients had an abnormal lipid level.
Conclusions: In this study, author found that obesity is a major risk factor for the development of diabetes mellitus and its complications.

Keywords: Body mass index, Diabetic complications, Obesity, Type 2 diabetes mellitus

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a metabolic disorder characterized by insulin resistance, relative insulin deficiency and hyperglycaemia. Over the time, constant hyperglycaemia leads to diabetic complications. Both obesity and type 2 diabetes mellitus are associated with insulin resistance escalating the risk of the complications.[1] The motive of this study was to observe the prevalence of diabetic complications in correlation to the BMI. Of all the diabetic patients included in this study, majority of individuals had the BMI ≥25(74.67%), which resulted in higher number of complications. The prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase of 79.4 million individuals afflicted in India exclusively.[2,3] The objectives of this study were mainly focused on educating and raising awareness of

diabetes mellitus and its complications through data collection (past history and chief complaints), diagnostic test results, prescription analysis and patient counselling in specific.

METHODS

Place of the study was Sree Diabetes Clinic. Study Period was 6 months (August 2018-January 2019). Study population was outpatients, Patients diagnosed with type 2 diabetes mellitus. Sample Size was 150 patients. Study design was a prospective and observational study

Inclusion criteria

- Patients diagnosed with Type 2 diabetes mellitus
- Either gender of the age group from 30 years were considered.
- Diabetic patients with other chronic diseases
- Patients attending a regular follow up
- Pregnant women

Exclusion criteria

- Type 1 diabetes mellitus patients
- Non cooperative patients

Statistical analysis

The study results were analysed by using Chi-square test for independence. p values were reported and interpreted at 5% level of significance.

All the data were entered into MICROSOFT EXCEL 2012 version which includes demographic details such as age, gender, past medical history, habits and drug related details such as systolic blood pressure, diastolic blood pressure, fasting blood sugar levels, random blood sugar levels, HbA1c, Serum creatinine, diabetic complications, lipid profile and BMI. The data were presented as mean±standard deviation to analyse the results.

Null hypothesis

The diabetic patients with BMI ≥25 have an increased risk of developing diabetic complications.

Alternative hypothesis

The diabetic patients with BMI ≥25 do not have an increased risk of developing diabetic complications.

Aims and objectives was the primary objective of this study was to assess clinical data of patients with T2DM along with the analysis of patterns, the frequencies and occurrences of micro and macro vascular complications.

The study aimed to assess the risk factors and complications of diabetes mellitus and to reduce the repercussions of diabetes mellitus. The study also aimed at educating and minimizing the diabetic complications among patients.

RESULTS

The study was conducted among the outpatients of the Sree Diabetes Clinic for a period of six months. The total number of cases collected was 150. The patients were assessed for their demographic details, past medical history, risk factors, laboratory variables, BMI and complications of diabetes mellitus as mentioned in Table-1.

Prevalence of diabetes mellitus with respect to age

With increase in age, incidence of diabetes mellitus has increased sequentially. 50(33%) diabetic patients fall in the age group of 30-50 years which increased to 97(65%) in the age group of 50-70 years. 3(2%) patients were of the age >70 years. 60(61.8%) diabetic complications were found in age group 50-70 years and 3(100%) diabetic complications were found in the age group >70 years proving that diabetic complications constantly increase with respect to age.

Duration and diabetes

The incidence of diabetic complications has profoundly increased with increase in the duration of diabetes. 80% of complications were found in patients with a duration of diabetes >20 years.

Hypertension

Among 40(66.6%) Hypertensive patients were found to have diabetic complications making it as the major risk factor.

Effect of smoking and alcohol in diabetic complications

Over all 61.5% and 69.6% smokers and alcoholics were found to have diabetic complications. The number of diabetic complications in non-alcoholics and nonsmokers was low (48.3% and 48.7%) respectively.

Hence smoking and alcohol are found to be strong risk factors contributing to diabetic complications.

Dyslipidemia

The number of complications found in diabetic patients with Dyslipidemia were Total cholesterol 41(54.6%), Triglycerides 37(45.6%), HDL 6(66.6%), and LDL 31(59.6%).

Diabetic complications were found to be associated significantly with altered lipid profile therefore proving to be a risk factor.

Serum creatinine

Out of 150 patients, 147 had normal serum creatinine levels (<1.6 mg/dl) and 3 patients with serum creatinine levels (>1.6 mg/dl) were also found to have diabetic nephropathy.

Table 1: Demographic and laboratory variables.

	Variable	No. of patients	Percentage	Mean ± S.D
Age	30-50Years	50	33%	54.38±8.70
	50-70 Years	97	65%	
	>70 Years	03	2%	
Gender	Male	102	68%	-
	Female	48	32%	
Height		150	-	157.42±15.3
Weight		150	-	69.4±10.3
BMI	Non-obese (18-24.9)	41	27.3%	27.58±4.0023
	Overweight (25-29.9)	72	48%	
	Obese (>30)	37	23.3%	
Duration	0-5 Years	64	42%	-
	6-10 Years	55	36.6%	
	11-15 Years	18	12%	
	16-20 Years	8	5.3%	
	>20 Years	5	3.3%	
Smoking	Non-smokers	65	43.3%	-
	Smokers	39	23%	
Alcohol	Non-alcoholics	19	12.6%	-
	Alcoholics	33	22%	
Systolic BP	120-139 mmHg	99	-	126.9±12.61
	140-159 mmHg	26		
	>160 mmHg	4		
Diastolic BP (mmhg)	80mg-90	103	-	79.9±6.27
	>90-99	16		
	>100	4		
FBS	80-110mg/dl	56	-	132.7±45.6
	>110mg/dl	85		
PPBS	140-200mg/dl	62	-	175.49±49.79
	>200mg/dl	44		
HDL	35-60mg/dl	117	-	50.3±9.9
	<35mg/dl	6		
LDL	130-140mg/dl	42	-	123.8±24.2
	>160mg/dl	10		
Triglycerides	160-200mg/dl	52	-	158.6±37.6
	>200mg/dl	29		
Total Cholesterol	200-240mg/dl	61	-	201.20±31.5
	>240mg/dl	14		
HbA1c	>8	23	43.3%	-
	<8	43		
Sr. Creatinine	<1.6mg/dl	147	-	-
	>1.6mg/dl	3		
Complications	Neuropathy	64	42.6%	
	Retinopathy	20	13.3%	
	Nephropathy	3	2%	
	Cardiovascular disease	17	11.3%	
	No Complications	72	48%	

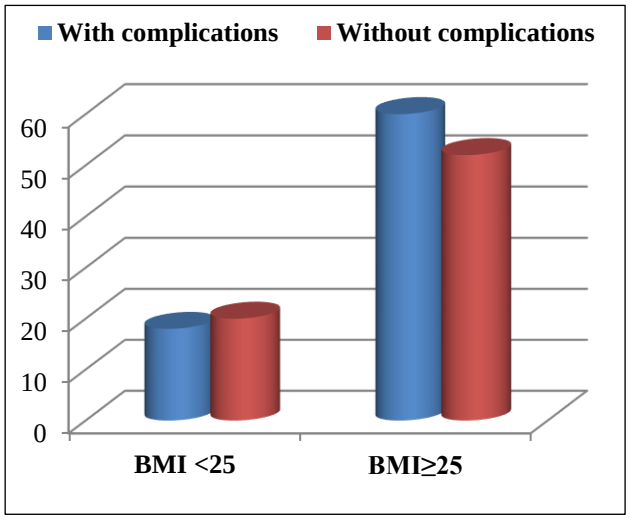

Figure 1: Diabetic complications in correlation to BMI.

Table 2: Types and frequency of the vascular complications in type 2 diabetes mellitus patients.

Type of complication	Total (%)
No complication	72(48%)
With complications	78(52%)
Single complication	
Neuropathy	43(28.66%)
Retinopathy	6(4%)
Coronary artery disease	9(6%)
Double complication	
Neuropathy, Retinopathy	11(7.33%)
Neuropathy, Coronary vascular disease	4(2.66%)
Neuropathy, Nephropathy	2(1.33%)
Retinopathy, Coronary vascular disease	1(0.6%)
Triple complication	
Neuropathy, Nephropathy, Retinopathy	1(0.6%)
Neuropathy, Retinopathy, Coronary vascular disease	1(0.6%)
	150(100%)

HbA1c

Out of 66 patients who have taken the test, 23(15.3%) patients had their HbA1c levels >8 from which 13(56.5%) have diabetic complications.

BMI

Among 112 (74.67%) patients had a BMI ≥25 (overweight and obese) making it to be the leading risk factor for diabetic complications in this study. The number of patients with BMI <25 are 38(25.3%). Patients with longer duration of diabetes also has an increased BMI of ≥25. Out of 60 diabetic-hypertensive patients, 51 were found to have BMI ≥25. 112 patients with BMI ≥25, 60(54%) patients were found to have diabetic complications. 18(47%) out of 38(25.3%) patients with BMI <25 were found to have diabetic complications. These results were clearly shown in Figure 1.

Outcomes of diabetic complications

Out of 150 patients included in the study, 78(52%) patients were found to have diabetic complications and 72(48%) patients have no complications. The number of patients with neuropathy were 64(42.6%), Retinopathy 20(13.3%), Nephropathy 3(2%) and Cardiovascular diseases 17(11.3%).

The complications found in a single patient were further categorized into single, double and triple complications which are explained in detail in Table 2.

DISCUSSION

Type 2 diabetes mellitus is a chronic debilitating disease characterised by Insulin resistance, impaired insulin secretion, and hyperglycaemia. It is the most prevalent metabolic condition and one amongst major health and socioeconomic problems worldwide. It represents more than 90% of total prevalence of diabetes in the world and is responsible for 9% of global mortality corresponding 4 million deaths per year. Untreated diabetes may result in limb amputation, blindness, kidney failure and neuropathy. It is also associated with 4fold increase in risk of cardiovascular events.[4]

The incidence of diabetes mellitus has increased dramatically in recent decades, predominantly because of changes in lifestyle and increase in prevalence of obesity and longevity. The likelihood and severity of T2DM are closely linked with Body Mass Index (BMI).[5] There is a 7 times greater risk of diabetes in obese patients compared to those of a healthy weight with 3fold increase risk of overweight people. Being overweight or obese (A BMI of 25 kg/m^2) is the main modifiable risk factor for Type 2 diabetes mellitus.[6] Global epidemic of diabetes is a serious and major health care concern that results in reduced life expectancy and increased morbidity due to disease specific micro and macro vascular complications. It is notified despite good glycemic control; vascular complications remain in most diabetic patients. In addition, diabetic complications may develop before diagnosis.[7] Micro and macro vascular complications frequently co-exist.[5] In this study, a total of 150 patients were included in which author observed that all patients above the age group of 70 years were found to have higher BMI and diabetic complications which is similar to the case study of Arun kumar et al, where a total number of 554 type 2 diabetic patients were included.[8] Irrespective of gender, the number of complications were found to be higher in both males and females individually. However, 57(56%) of males out of 102 and 21(44%) out of 48 females were found to have diabetic complications respectively. Hypertension and BMI ≥25 along with personal habits like smoking and alcohol

consumption in type 2 diabetic patients from this study contributed to the increased risk of developing diabetic complications. Majority of patients in this study were found to be overweight. Since diabetes is a metabolic disorder, weight gain is usually seen in diabetic patients which led to an increase in number of patients with BMI ≥25. This result is similar to the study performed by Herbert F Jelinek et al.[9] Diabetic patients with a collective history of hypertension and dyslipidemia were found to develop cardiovascular disease exclusively. These patients were also found to have an increased BMI (≥25). According to Herbert F Jelinet et al, diabetic complications were present in over 80% of the investigated cohort where nearly 50% of the patients had 2 or more complications with retinopathy being the most common single complications followed by cardio vascular diseases.[9] In this study, 78 patients who were found to have diabetic complications, 58(74.5%) patients had single complications, 18(23%) had double complications and 2(2.5%) had triple complications.

Among 150 patients included in the study, single complications were neuropathy 43(28.6%), retinopathy 6(4%) and cardiovascular diseases 9(6%). The patients with double complications are neuropathy and retinopathy 11(7.3%), neuropathy and cardiovascular diseases 4(2.6%), neuropathy and nephropathy 2(1.3%), and retinopathy and cardiovascular disease 1(0.6%). The patients with triple complications were neuropathy, nephropathy and retinopathy were 1(0.6%) and neuropathy, retinopathy and cardiovascular diseases were 1(0.6%). This result is similar to the study performed by Iraj Heydari et al, and Sinharoy et al.[5,10] From this study, the majority of patients were found to have single complications of which diabetic neuropathy was found to be major single complication. In this study, the major contributing risk factors for the increased number of diabetic complications are age, longer duration of type 2 diabetes mellitus, personal habits like smoking and alcohol consumption, hypertensive diabetic patients and majorly patients with BMI greater than 25. Early detection of symptoms and use of appropriate diagnostic tools and laboratory tests can help in diagnosis and preventing the prognosis of disease and its complications.

CONCLUSION

This prospective and observational study conducted in real life scenario in south Indian diabetic patients at Sree Diabetes Clinic, Kurnool, Andhra Pradesh reported that most of the diabetic complications were found to exist in patients with BMI greater than 25 when compared to the patients with BMI less than 25. So overweight and obesity associated with other factors are considered to be significant in the occurrences of diabetic complications among diabetic patients. On interaction with patients, non-adherence to the diabetic therapy was also found to be a major contributing factor for the development of diabetic complications. Diabetic neuropathy is the complication which was found at a higher rate among the patients. The majority of cardiovascular diseases were however found to be higher in obese patients with a history of hypertension and dyslipidemia. The patients involved in this study were counselled for medication adherence, lifestyle modifications, and dietary changes in order to reduce the risk of developing diabetic complications and also to increase the quality of life.

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REFERENCES

1. Al-Goblan AS, Al-Alfi MA, Khan MZ. Mechanism linking diabetes mellitus and obesity. Diabet Metab Syndr Obes. 2014;7:587.
2. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabet Care. 2004;27(5):1047-53.
3. Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. Diabet Res Clinic Pract. 2011;94(3):311-21.
4. Patel M, Patel IM, Patel YM, Rathi SK. A hospital-based observational study of type 2 diabetic subjects from Gujarat, India. J Health, Populat, Nutrit. 2011;29(3):265.
5. Heydari I, Radi V, Razmjou S, Amiri A. Chronic complications of diabetes mellitus in newly diagnosed patients. Intern J Diab Mellit. 2010;2(1):61-3.
6. Gatineau M, Hancock C, Holman N, Outhwaite H, Oldridge L, Christie A, et al. Adult obesity and type 2 diabetes. Pub Healt Engl. 2014:5-14.
7. Maghbooli Z, Pasalar P, Keshtkar A, Farzadfar F, Larijani B. Predictive factors of diabetic complications: a possible link between family history of diabetes and diabetic retinopathy. J Diab Metabol Disord. 2014;13(1):55.
8. Arun KS, Subba Rao C, Priyanka D. Study of management of comorbid conditions in type 2 diabetes mellitus. Adv Cell Sci Tissue Cult. 2018;2(1):12-18.
9. Jelinek HF, Osman WM, Khandoker AH, Khalaf K, Lee S, Almahmeed W, et al. Clinical profiles, comorbidities and complications of type 2 diabetes mellitus in patients from United Arab Emirates. BMJ Open Diabet Res Care. 2017;5(1):e000427.
10. Prabhu M, Sudha V, Shashikiran U. Clinical Profile of Type 2 Diabetes Mellitus And Body Mass Index-Is There Any Correlation?. Calicut Med J. 2004;2(4).

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