Journal of Cardiovascular Disease Research
ISSN: 0975-3583,0976-2833 VOL 07, ISSUE 04, 2016

EVALUATING MACROVASCULAR AND MICROVASCULAR COMPLICATIONS IN TYPE 2 DIABETES MELLITUS

Dr. Arvind Charan Mangal

Assistant Professor, Department of General Medicine, Kanti Devi Medical College Hospital & Research Centre,

Email - drairwind@gmail.com

==========

ABSTRACT

Background: Along with type 2 diabetes mellitus, obesity and overweight are regarded as significant independent risk factors for cardiovascular illnesses. However, there is a dearth of information on obesity and diabetes consequences.

Aim: The purpose of this study was to evaluate the macrovascular and microvascular consequences in individuals with type 2 diabetes mellitus who were overweight and non-obese as well as those who were overweight and obese.

Methods: 168 individuals with type 2 diabetes mellitus who visited the Institute throughout the research period were evaluated in this study. Following WHO guidelines for Asian participants, each subject's BMI was evaluated and they were split into two groups: obese/overweight and non-obese/overweight. The subjects' duration of diabetes and level of control were evaluated. In accordance with American Diabetes Association recommendations, each participant's macrovascular and microvascular problems were evaluated. Overweight diabetics and individuals with normal BMI were evaluated for complications.

Results: Of the 168 research participants evaluated, 90 (or 53.57%) were female. 66.6% (n=112) of the participants were overweight or obese. 10.71% of diabetics with a normal BMI and 26.79% of those who were overweight or obese developed retinopathy. With a p-value of less than 0.05, Ischemic Heart Disease (IHD) was observed in 28.57% (n=16) and 46.42% (n=52) of participants with normal BMI and those who were overweight or obese, respectively.

Conclusion: individuals with type 2 diabetes mellitus who are overweight or obese are at a higher risk of developing complications, including ischemic heart disease and retinopathy. Additionally, diabetes people who are overweight or obese have poor glycemic control. Microvascular problems arise early in people with diabetes who are overweight or obese.

Keywords: Diabetes mellitus type 2, Obesity, macrovascular complications Microvascular complications, retinopathy

INTRODUCTION

The state of excessive or aberrant fat buildup in the body's adipose tissues to the point that it may compromise health is known as obesity. Numerous illnesses and other health issues have been demonstrated to be more likely to occur in those who are obese. Overweight and obesity impact around 30 to 65 percent of adult Indian urban population, making obesity a major worldwide health issue.1

It has been shown that type 2 diabetes mellitus (DM) and obesity are closely related. As independent risk factors for cardiovascular diseases based on previously published data, type 2 diabetes mellitus

and obesity are both significant contributors to mortality and morbidities from atherogenic microvascular and macrovascular disorders.[2]

Not all individuals with type 2 diabetes mellitus, however, are typically overweight or obese. The most practical way to assess obesity is via body mass index, or BMI. Additionally, a correlation has been shown between elevated BMI and heightened endothelial dysfunction, a significant contributor to the development of thrombosis and atheroma plaque.3 Little is known about the relationship between obesity and microvascular complications of diabetes, and there is a paucity of available information. Four Therefore, the current study sought to evaluate the macrovascular and microvascular consequences in participants with type 2 diabetes mellitus who were overweight and non-obese as well as those who were overweight and obese.

MATERIALS AND METHODS

The objective of the current observational cross-sectional study was to evaluate the macrovascular and microvascular consequences in individuals with type 2 diabetes mellitus who were overweight and non-obese as well as overweight and obese. The study subjects were from the Outpatient Department of the Institute. Prior to participation, all individuals gave their written and verbal informed permission.

According to American Diabetes Association (ADA) guidelines5, the study evaluated participants who were 20 years of age or older, attended the Institute during the designated study period, and had a verified diagnosis of type 2 diabetes mellitus. Subjects under the age of twenty who refused to take part in the study were excluded.

Following the research participants' final inclusion, information was collected using a standardized proforma, including each subject's height and weight, which was then used to determine their body mass index, or BMI. Standing back straight, feet near to one another, and arms at the side, a typical stadiometer was used to measure height in cm. On the other hand, standing weight was measured in kilos using a typical analog weighing equipment.

The calculation of BMI included dividing an individual's weight in kilograms by the square of their height in meters (kg/m2). The BMI of adults over 20 is classified as follows: normal, overweight, and obese at 18–22.9 kg/m2, 23-24.9 kg/m2, and >25 kg/m2. Every participant's level of glycemic control was evaluated. The American Diabetes Association's criteria for diabetes management were 80–130 mg/dL, postprandial glucose <180 mg/dL, and HbA1C <7.0.

Additionally, in accordance with ADA standards, microvascular and macrovascular problems were examined. Neuropathy was classified as autonomic, motor, and sensory neuropathy in microvascular complications. Macular edema and retinopathy were evaluated by ophthalmologists who were specialists in the subject.

Distal symmetric sensory polyneuropathy was evaluated using a thorough medical history, as well as measures of small-fiber function (pinprick and temperature feeling), large-fiber function (vibration perception and 10-g monofilament), and protective sense (10-g monofilament). Four out of ten stimulations across the bilateral soles were not detected by monofilament, which was seen as positive.

The diagnosis of diabetic autonomic neuropathy was made when the patient experienced erectile dysfunction, constipation, gastroparesis, orthostatic hypotension, resting tachycardia, fecal incontinence, neurogenic bladder, sudomotor dysfunction with either increased or reduced sweating, and hypoglycemia unawareness.

The diagnosis of nephropathy was based on the presence of albuminuria and/or a decreased estimated glomerular filtration rate (eGFR) in the absence of any indications of other major causes of kidney damage.

Based on plasma creatinine, age, race, and gender, eGFR was computed using the CKD-EPI creatinine equation (2021) with the aid of a mobile application. 6 ERBA TransAsia machines, which are fully and semi-autoanalyzers, were used to measure serum creatinine and blood sugar levels using spectrophotometric techniques and the corresponding kits.

Changes in the electrocardiogram (ECG), clinical evaluation, and history were used to evaluate coronary heart illnesses, whereas non-contrast computed tomography brain, clinical evaluation, and history were used to evaluate cerebrovascular disorders for macrovascular consequences.

Utilizing SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk, NY, USA), the collected data was statistically examined using the Student t-test, ANOVA (analysis of variance), Turkey post hoc analysis, Chi-square test, and descriptive measure evaluation.

Pearson correlation coefficient was used to assess correlation in various parameters. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered.

RESULTS

The objective of the current observational cross-sectional study was to evaluate the macrovascular and microvascular consequences in individuals with type 2 diabetes mellitus who were overweight and non-obese as well as overweight and obese. In this study, 168 individuals with type 2 diabetes mellitus who visited the Institute throughout the designated study period were evaluated. The current study included 90 female participants and 78 male participants. 53.85% of the 78 male respondents were between the ages of 40 and 60, whereas 12.82% of the participants were older than 60 Years. Of the 90 women who participated in the study, the majority were over 60, with 35.6% of them being between 40 and 60. The percentage of females under 40 with diabetes was 11%.

The study found that, out of 168 patients evaluated, 33.3% (n=56) were non-obese and 66.6% (n=112) were overweight related to macrovascular and microvascular problems. A statistically significant difference of 0.03 was observed. With p=0.04, the mean age of the research participants was similar for the non-obesity and obese overweight people. Males were present in 53.57% (n=30) and 42.86% (n=48) of the non-obese overweight and obese overweight individuals (p=0.07), and in 46.43% (n=26) and 57.14% (n=64) of the obese overweight and obese overweight subjects (p=0.08) (Table 2).

In comparison to obese overweight patients, the mean creatinine of non-obesity overweight subjects was considerably lower (1.2 and 2.10, respectively; p=0.001), according to the study's findings.

Among non-obese overweight and obese overweight participants, retinopathy, mean GFR, nephropathy, neuropathy, CVA, and ischemic heart disease were statistically similar (p=0.06, 0.06, 0.2, 0.6, 0.5, and 0.05). The mean duration of microvascular problems was 5.54 years for non-obese overweight participants and 5.72 years for obese overweight subjects. These differences were not statistically significant (p=0.4). For both non-obesity overweight and obese overweight participants, the average duration of macrovascular problems was 8.54 and 6.46 years, respectively, with p=0.04 (Table 2).

According to an evaluation of the glycemic control in study participants with type 2 diabetes mellitus, 74% of non-obese overweight patients and 60% of obese/overweight people had macrovascular problems. 72% of overweight participants who were not obese and 65% of obese/overweight subjects had microvascular problems (Table 2).

DISCUSSION

In the current investigation, 168 individuals with type 2 diabetes mellitus who visited the institute throughout the designated study period were evaluated. Ninety females and 78 males participated in the current investigation. Of the 78 male participants, 53.85% were between the ages of 40 and 60, while 12.82% were older than 60. Of the 90 women who participated in the study, the majority were over 60, with 35.6% of them being between 40 and 60. Of the females under 40 years of age, 11% had diabetes. These findings were similar to those of earlier research by Poirier P et al.7 and Tomic M et al.8, whose authors evaluated respondents with demographic information similar to the current study in their study participants who had diabetes and were overweight.

In the research, 168 patients were evaluated for macrovascular and microvascular problems; 33.3% (n=56) of the subjects were non-obese, and 66.6% (n=112) were overweight. The difference was 0.03 and statistically significant. The mean age of the research participants was similar for the overweight and non-obese patients (p=0.04). Of the non-obese overweight and obese overweight participants, there were 53.57% (n=30) and 42.86% (n=48) men with p=0.07, and 46.43% (n=26) and 57.14% (n=64) guys with p=0.08 who were obese overweight and obese overweight. These findings were in line with research by De Block CE et al. (2005) and Nag T et al. (2013), who also reported macrovascular and microvascular complications in obese/overweight and non-obese overweight subjects that were comparable to the current study.

With mean creatinine levels of 1.2 and 2.10, respectively, non-obese overweight participants had substantially lower mean creatinine levels than obese overweight subjects (p=0.001). Both non-obese overweight and obese overweight participants had statistically similar levels of retinopathy, mean GFR, nephropathy, neuropathy, CVA, and ischemic heart disease (p=0.06, 0.06, 0.2, 0.6, 0.5, and 0.05). The mean duration of microvascular problems was 5.54 years for non-obese overweight participants and 5.72 years for obese overweight subjects. These differences were not statistically significant [p=0.4]. The mean duration of macrovascular problems was 6.46 years for obese overweight patients and 8.54 years for non-obese overweight subjects [p=0.04]. As shown in the current investigation, these results were consistent with those of Agarwal AK et al.11 and Agarwal AK et al.12, who likewise revealed non-significant variations in laboratory parameters between obese and non-obese overweight diabetics.

74% of non-obese overweight patients and 60% of obese/overweight persons experienced macrovascular problems. 72% of overweight participants who were not obese and 65% of obese/overweight persons had microvascular problems. These findings were in line with those of Duby JJ et al. (2013) and Chawla A et al. (2016), who also reported similar results to the current study in their investigations on the relationship between microvascular and macrovascular complications and glycemic control in study participants with type-2 diabetes mellitus.

CONCLUSION

The findings indicate that being overweight or obese increases the likelihood of problems in participants, especially retinopathy and ischemic heart disease. In individuals with diabetes who are

overweight or obese, glycemic control is poor. Microvascular problems manifest early in people with diabetes who are overweight or obese.

REFERENCES

1. Berrios X, Koponen T, Huiguang T, Khaltaev N, Puska P, Nissinen A. Distribution and prevalence of major risk factors of noncommunicable diseases in selected countries: The WHO Inter-health Programme. *Bull World Health Organ*. 1997;75:99-108.
2. Seidell JC, Verschuren WM, vanLeer EM, Kromhout D. Overweight, underweight, and mortality. A prospective study of 48,287 men and women. *Arch Intern Med*. 1996;156:958-63.
3. Misra A, Chowbey P, Makkar BM, Vikram NK, Wasir JS, Chadha D, et al. Consensus statement for diagnosis of obesity, abdominal obesity, and the metabolic syndrome for Asian Indians and recommendations for physical activity, medical and surgical management. *J Assoc Physicians India*. 2009;57:163-70.
4. Misra A, Khurana L. Obesity and the metabolic syndrome in developing countries. *J Clin Endocrinol Metab*. 2008;93:S9-30.
5. Pach LF. Standards of Medical Care in Diabetes-2018. Available from: https://www.academia.edu/35718960/standards_of_medical_care_in_diabetes_2018 [Last accessed on 2023 Jul 22]
6. Levey AS, Stevens LA. Estimating GFR using the CKD Epidemiology Collaboration (CKD-EPI) creatinine equation: More accurate GFR estimates, lower CKD prevalence estimates, and better risk predictions. *Am J Kidney Dis*. 2010;55:622-7.
7. Poirier P, Giles TD, Bray GA, Hong Y, Stern JS, Pi-Sunyer FX, et al. Obesity and cardiovascular disease: Pathophysiology, evaluation, and effect of weight loss: An update of the 1997 American Heart Association Scientific Statement on Obesity and Heart Disease from the Obesity Committee of the Council on Nutrition, Physical Activity, and Metabolism. *Circulation*. 2006;113:898-918.
8. Tomic M, Poljicanin T, Pavlic-Renar I, Metelko Ž. Obesity risk factor for microvascular and neuropathic complications in diabetes? *Diabetol Croat*. 2003;32:73-8.
9. De Block CE, De Leeuw IH, Van Gaal LF. Impact of overweight on chronic microvascular complications in Type 1 diabetic patients. *Diabetes Care*. 2005;28:1649-55.
10. Nag T, Ghosh A. Cardiovascular disease risk factors in Asian Indian population: A systematic review. *J Cardiovasc Dis Res*. 2013;4:222-8.
11. Masood CT, Afzal W. Long-term complications of diabetes and co-morbidities contributing to atherosclerosis in the diabetic population of Mirpur, Azad Kashmir. *J Pak Med Assoc*. 2013;63:1383-6.
12. Agarwal AK, Singla S, Singla S, Singla R, Lal A, Wardhan H, et al. Prevalence of coronary risk factors in Type 2 diabetics without manifestations of overt coronary heart disease. *J Assoc Physicians India*. 2009;57:135-42.
13. Duby JJ, Campbell RK, Setter SM, White JR, Rasmussen KA. Diabetic neuropathy: An intensive review. *Am J Health Syst Pharm*. 2004;61:160-73.
14. Chawla A, Chawla R, Jaggi S. Microvascular and macrovascular complications in diabetes mellitus: Distinct or continuum? *Indian J Endocrinol Metab*. 2015;20:546-51.

S. No	Category	Non-obese overweight		Obese overweight		Total	p-value
		n	%	n	%		
1.	**Total n (%)**	56	33.3	112	66.6	168	**0.03**
2.	**Mean age**	54.62		57.21		-	0.4
3.	**Gender**						
a)	Males	30	53.57	48	42.86	78	0.07
b)	Females	26	46.43	64	57.14	90	0.08
4.	**Mean creatinine**	1.2		2.10		-	**0.001**
5.	**Retinopathy**	6	10.71	30	26.79	36	0.06
6.	**Mean GFR**	69.55		57.89		-	0.06
7.	**Nephropathy**	20	35.71	52	46.43	72	0.2
8.	**Neuropathy**	30	53.27	58	51.79	88	0.6
9.	**CVA**	8	14.28	14	12.5	22	0.5
10	**Ischemic heart disease**	16	28.57	52	46.42	68	0.05
11	**Microvascular complications mean duration**	5.54		5.72		-	0.4
12	**Macrovascular complications mean duration**	8.54		6.46		-	0.04

Table 1: Microvascular and macrovascular complications in obese/overweight and non-obese overweight subjects in the study

S. No	Poor glycemic control in diabetics with complications	Obese/overweight	Non-obese/overweight
1.	**Macrovascular complications**	60%	74%
2.	**Microvascular complications**	65%	72%

Table 2: Glycemic control in study subjects with type 2 diabetes mellitus