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Original article

A TERTIARY HOSPITAL RESEARCH ON OVER WEIGHT/OBESE DIABETIC CONSEQUENCES. A CROSS-SECTIONAL INVESTIGATION.

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Abstract

Introduction:

The prevalence of diabetes mellitus has exhibited a notable surge in recent decades, mirroring the concerning trend observed in obesity rates. Of particular concern is the escalating incidence of type 2 diabetes mellitus among paediatric populations, which has witnessed a twofold increase.

Aim:

This study aimed to investigate the prevalence of obesity and diabetic complications among diabetic patients in India.

Methods:

A cross-sectional investigation was conducted utilising an established clinical registry within the confines of a tertiary care facility over a span of 18 months. A retrospective analysis was conducted on the medical records of adult individuals diagnosed with type 2 diabetes mellitus.

Results:

The study included 495 people with a 10.5% HbA1c. 91% (n=451) of 495 patients were obese/overweight. 37.8% (n=187) of diabetics aged 50–59, and 59% (n=292) have had diabetes for less than 10 years. 29.9% (n=148) had one additional comorbidity (hypertension or dyslipidemia), while 63.4% (n=314) had two. The prevalence of complications was 18.9% (n=94) myocardial infarction, 11.1% (n=55) stroke, and 9% (n=45) CKD. Age and hypertension were significantly associated with diabetic complications (adjusted OR=1.03; 95% CI 1.00 to 1.07; p=0.041 and OR=4.06; 95% CI 1.21 to 13.60; p=0.023).

Conclusion:

In our research, it appears that a body mass index (BMI) exceeding 23 kg/m^2, which is indicative of obesity or overweight, does not exhibit a significant correlation with the occurrence of complications. Advanced age and the presence of hypertension, conversely, demonstrate robust prognostic value in predicting the occurrence of complications.

Recommendation:

Given the current understanding of diabetes, it is advisable to promote public education targeting the affected population in order to mitigate the associated complications.

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1. Introduction:

Obesity and diabetes mellitus have emerged as significant public health concerns, both within the

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Indian population and on a global scale. Indeed, on a global scale, obesity emerges as a more substantial health crisis compared to malnutrition, and it stands as the primary etiological factor behind mortality and morbidity worldwide. Projections indicate that the burden of obesity is anticipated to escalate in the forthcoming years. The economic burden of obesity and diabetes mellitus is substantial. Diabetes mellitus, a prevalent chronic disease, has emerged as the most common ailment globally. Its prevalence has witnessed a notable increase, surging from 4.7% in 1980 to 8.5% in 2014, specifically among adults aged 18 years or older [1]. It is projected that approximately 439 million adults will be afflicted with diabetes by the year 2030, as indicated by scholarly research [2]. The anticipated surge in prevalence is projected to manifest predominantly in low- and middle-income nations, such as India [1, 2]. In the year 2010, India exhibited the highest prevalence of individuals diagnosed with diabetes, approximately 50.8 million in number. Projections indicate that this figure is anticipated to escalate to 87 million by the year 2030 [3]. Annually, approximately one million fatalities in India are ascribed to diabetes mellitus, a chronic metabolic disorder. This condition also serves as the foremost aetiology for ocular complications leading to visual impairment, renal dysfunction culminating in kidney failure, myocardial infarction, cerebrovascular accident, and lower extremity amputation [3].

Individuals with obesity incur healthcare costs that are, on average, 42% higher compared to individuals with a normal weight. In comparison to individuals without diabetes mellitus, it has been observed that individuals diagnosed with diabetes mellitus incur medical expenses that are more than double (2.3 times) the amount. According to a study conducted in 2008, the yearly financial burden of obesity in the healthcare sector was approximated to be $147 billion. Additionally, the overall additional expenses associated with the existing prevalence of overweight and obesity among adolescents were estimated to be even higher, reaching $254 billion [4]. In the year 2012, diabetes mellitus incurred an expenditure of $245 billion for the taxpayers of the United States, indicating a notable 41% surge in costs compared to the expenses recorded in 2007 [3]. The economic burden linked to diagnosed diabetes mellitus, undiagnosed diabetes mellitus, gestational diabetes mellitus, and prediabetes is significantly elevated, surpassing $322 billion in 2012. This figure indicates a substantial 48% rise compared to the corresponding value in 2007 [5]. The primary objective of this study was to examine the prevalence of obesity and diabetic complications among individuals diagnosed with diabetes in the Indian population.

2. Materials and Methods:

2.1. Study design:

This cross-sectional study incorporated data from all individuals diagnosed with type 2 diabetes who were enrolled in a tertiary care facility. The present investigation was carried out over a duration of 12 months.

2.2. Participants and criteria:

The participants diagnosed with diabetes who were enrolled in this research study were of an age greater than or equal to 18 years. A total of 495 patients were included in this study. Exclusion criteria encompassed patients with incomplete medical records, individuals below the age of 18, pregnant women, and those diagnosed with type I or gestational diabetes mellitus. A well-established clinical registry was utilised to analyse the demographic characteristics of the enrolled patients. The investigator/coordinator collected baseline and follow-up clinical data, encompassing the patient's gender, haemoglobin (Hb)A1c levels, age, body mass index (BMI), smoking history, alcohol consumption, and duration of diabetes. The presence of comorbidities, namely hypertension and dyslipidemia, was documented alongside complications related to diabetes. The aforementioned complications were recorded based on the clinical documentation obtained during the patient's initial visit to the diabetic clinic.

2.3. Statistical Analysis:

The study findings included the presentation of continuous variables as mean ± standard deviation (SD), while categorical variables were presented as counts and percentages. The duration of diabetes was categorised as either less than 10 years or greater than 10 years. In order to ascertain the correlation between independent variables and vascular complications, a series of multiple logistic regression models were constructed to calculate the adjusted odds ratios (ORs) and 95% confidence intervals (CIs). Independent variables that exhibited a p-value of ≤0.20 in simple logistic regressions were incorporated into the models. The statistical analysis was conducted using SPSS version 24.0, a software programme developed by SPSS Inc. in Chicago, IL, USA.

3. Results:

Out of a total of 1227 individuals diagnosed with diabetes, only 495 patients satisfied the predetermined inclusion criteria and actively took part in the present research investigation. Table 1 presents the demographic and clinical characteristics of the patients included in the study, categorised according to their body mass index (BMI). A majority of the participants (n=282) in the study were identified as female. The average glycated haemoglobin (HbA1c) level was measured to be 10.5%. The average age of the patients was 52.2 years, with the highest number of patients (n=187) falling within the age range of 50 to 59 years. The average body mass index (BMI) was calculated to be 31.0 kg/m^2. The majority of the participants (n=451) exhibited a higher body mass index, indicating overweight or obesity. In this study, a total of 129 individuals were classified as overweight, while 322 individuals were categorised as obese. A minority of the patients, specifically less than 10%, were documented to engage in alcohol consumption (n=42) and active smoking (n=48). The majority of the patients in the study were diagnosed with diabetes for a duration of 10 years or less (n=292) and were found to have two additional comorbidities (n=314) in their medical history.

Out of the 495 individuals encompassed within the study cohort, 94 were diagnosed with myocardial infarction (MI), 55 experienced a cerebrovascular accident (CVA), and 45 were found to have chronic kidney disease (CKD). The incidence of myocardial infarction (MI) in the subgroup of patients with normal/underweight (n=11/44) exhibited a higher prevalence compared to patients with overweight/obesity (n=83/451). Likewise, the incidence of cerebrovascular accident (CVA) was observed to be greater in the subset of individuals with normal/underweight body mass index (BMI) (n=5/44) in comparison to those in the overweight/obesity classification (n=50/451), albeit the disparity exhibited minimal significance. In contrast, chronic kidney disease (CKD) was found to have a higher prevalence in the subgroup of individuals classified as overweight or obese (n=42/451) compared to those categorised as having a normal weight or being underweight (n=3/44).

However, upon examining the subset of individuals with overweight or obesity, it was observed that the incidence of myocardial infarction (MI) was higher in patients with overweight (n=34/129) compared to patients with obesity (n=49/322). Similarly, the occurrence of cerebrovascular accidents (CVA) was also higher in patients with overweight (n=18/129) compared to patients with obesity (n=32/322). However, the prevalence of chronic kidney disease (CKD) was found to be similar between patients with overweight (n=12/129) and patients with obesity (n=30/322).

The sole determinant that exhibited a statistically significant correlation with the occurrence of cerebrovascular accident within our cohort of patients diagnosed with type 2 diabetes was the coexistence of hypertension (adjusted odds ratio = 4.03). However, it is important to note that the likelihood of developing chronic kidney disease notably rises with advancing age (adjusted odds ratio [OR]=1.03). Furthermore, there is a statistically significant elevation in the occurrence of this condition among individuals who also have coexisting hypertension (adjusted OR=4.14). Similarly, the likelihood of experiencing any of the

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Table 1: **Clinical characteristics and demographics**

Variables	Normal/Underweight	Obese/Overweight
Age		
< 30	0	14
30-39	7	52
40-49	6	96
50-59	18	169
≥ 60	13	120
Sex		
Male	25	188
Female	19	263
BMI		
< 23	44	0
23-27	0	129
≥ 27.5	0	322
Diabetes duration		
≤ 10 years	26	266
> 10 years	18	185
Dyslipidemia	33	355
Hypertension	27	361
Mean HbA1c	10.9	10.4

three complications exhibited an age-related increase (adjusted odds ratio [OR]=1.03), as well as in individuals with coexisting hypertension (adjusted OR=4.06).

4. Discussion:

The prevalence of co-occurring overweight and obesity in this study cohort with diabetes is 91%, indicating a relatively high occurrence in comparison to international reports [6-9]. Among the primary complications associated with diabetes, myocardial infarction (MI) emerges as the predominant occurrence within our study cohort. This finding stands out in contrast to other nations, such as Riyadh, Sri Lanka, and Pakistan, where chronic kidney disease has been documented as the prevailing complication [6–9]. When patients were examined according to their body mass index (BMI) classification (normal weight, overweight, and obese), the incidence of myocardial infarction (MI) consistently exhibited the highest prevalence across all categories, followed by cerebrovascular accident (CVA) and chronic kidney disease (CKD). However, the prevalence of myocardial infarction (MI) was found to be higher in the subgroup of patients with normal/underweight compared to those in the overweight/obese category. However, it should be noted that this difference is not statistically significant.

In contrast to the widely accepted premise, this study findings indicate that there was no significant association between overweight or obesity and an elevated risk of diabetic complications within our study population [10, 11]. The atypical observation may potentially be ascribed to the limited sample size and the imbalanced distribution among the body mass index (BMI) classifications within our study population. Hence, it is imperative to conduct studies with increased sample sizes that are both larger and more comparable across various body mass index (BMI) categories. This is necessary in order to gain a deeper understanding of the correlation between weight and the occurrence of diabetic complications within the Indian population. A body mass index (BMI)

of 23 kg/m^2 was chosen as the threshold for this research due to the elevated prevalence of type 2 diabetes and cardiovascular disease among Asians with lower BMI, in comparison to Caucasians [12].

In this study, it was observed that male patients exhibited an elevated likelihood of experiencing myocardial infarction (MI) in comparison to female patients. This observation aligns with the findings from the Framingham population, where men were found to have a twofold higher occurrence of coronary heart disease and associated mortality when compared to women. It is worth noting that this gender disparity diminishes with advancing age [12]. One plausible hypothesis for the observed gender disparity in the incidence of myocardial infarction (MI) is the potential influence of sex hormones on the development of atherosclerosis. Elevated concentrations of estradiol and progesterone during the premenopausal stage provide women with a cardioprotective advantage due to a more advantageous lipid profile in comparison to men [13]. This phenomenon, however, exhibits a decline as women transition into the postmenopausal period, thereby explaining the comparable occurrence rates during the subsequent stages of their lifespan.

Patients diagnosed with diabetes mellitus who have a prolonged duration of the disease exhibit an increased likelihood of developing vascular complications. This finding aligns with a scholarly investigation that documented the incidence of cardiovascular disease (CVD) rising from 6% during the period of 0 to 10 years of diabetes, to 10% and 30% during the duration of 10-20 years and over 20 years, respectively [14]. Hence, it is imperative to consistently implement interventions to maintain blood glucose levels within the designated range [14].

The prevalence of comorbidities among individuals diagnosed with diabetes mellitus is highly prevalent, and within our selected study cohort, approximately 30% exhibited the presence of at least one comorbidity, specifically hypertension or dyslipidemia. Approximately 63% of the participants reported experiencing both of these comorbidities. As anticipated, individuals diagnosed with hypertension exhibited a statistically significant elevation in the likelihood of experiencing complications related to diabetes. Significantly, the presence of hypertension was found to be correlated with a 3- to sixfold rise in the likelihood of developing chronic kidney disease (CKD) according to studies cited as references 15 and 16. This underscores the necessity for heightened awareness, comprehensive education, and optimal management within this cohort of individuals.

5. Conclusion:

In this study, it has been determined that there exists no statistically significant variance in the incidence of complications across different body mass index (BMI) classifications. Nevertheless, advanced age and the presence of hypertension appear to be robust prognostic indicators for the development of complications within this specific group.

6. Limitations:

The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population.

7. Recommendation:

Future research endeavours may aim to investigate age-specific correlations between modifiable risk factors and additional comorbidities, which could potentially serve as a more accurate prognostic indicator of their respective outcomes.

8. Acknowledgement:

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9. List of abbreviations:

CKD- chronic kidney disease
BMI- body mass index
Hb- haemoglobin
SD- standard deviation
OR- odds ratios
CI- confidence intervals
SPSS- Statistical Package for the Social Sciences
MI- myocardial infarction
CVA- cerebrovascular accident

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11. Conflict of interest:

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