Prevalence of Hypertension, Obesity and Its Influence on Achievement of Therapeutic Goals in Indian Type 2 Diabetes Patients: A retrospective observational study at tertiary diabetes care centre in Bihar

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Abstract
Aim: The present study was conducted to observe the prevalence of hypertension, obesity and its Influence on Achievement of Therapeutic Goals in Type 2 Diabetes Patients who were attending diabetes care centre in Bihar.

Method: The observational study was undertaken at Prakash diabetes care hospital at Patna city in Bihar. A total sample of 1400 type 2 diabetes patients attending the medical outdoor patient department were studied to assess the prevalence hypertension, obesity and its influence on achievement of therapeutic goals. Anthropometric data was collected by using standard questionnaire by measuring body weight, height, waist circumference and hip circumference. A mercury sphygmomanometer (Diamond Deluxe Blood Pressure apparatus, Pune, India) was used to determine the sitting blood pressure of right arm. Glycated haemoglobin (HbA1c) test was performed at hospital laboratory to determine glycemic level.

Result: There were 42.6% subjects who were overweight and 18.2% type 2 diabetes patients were obese. Prevalence of hypertension was 79.8% in this category of subjects. Among this subjects target goals were achieved by 12.6% of subjects who were overweight and 9.6% of subjects who were obese. The subjects who were having normal BMI among both over weight and obese were less likely to achieve target glycemic goal. It was also observed that prevalence of hypertension, obesity was quite high in type 2 diabetic patients of Patna city. Subjects who had abdominal obesity with hypertension were unable to achieve target glycemic control than those without abdominal obesity and hypertension.

Conclusion: Hypertension and obesity were associated with poor glycemic control in Indian type 2 diabetes patients mainly residing at Bihar. To manage the situation a proper clinical awareness and management of obesity and hypertension is essential with lifestyle modification and strict exercise to achieve target glycemic control among type 2 diabetes subjects.

Keywords: Hypertension, Obesity, Diabetes, BMI, waist circumference.

Introduction
In 21st centuries one of the largest global health emergencies is diabetes. A recent publication[1] already confirmed that prevalence of diabetes varied from 4·3% in Bihar (95% CI 3·7–5·0) to 10·0% (8·7–11·2) and was higher in urban areas (11·2%, 10·6–11·8) than in rural areas (5·2%, 4·9–5·4; p<0·0001) and higher in mainland states (8·3%, 7·9–8·7) than in the northeast (5·9%, 5·5–6·2; p<0·0001). The risk of developing type 2 diabetes is higher among people who are overweight or obese[2]. Approximately 85% of
people with diabetes are overweight or obese\textsuperscript{[3]}. Incidence of increasing global prevalence of type 2 diabetes (T2DM) principally driven by obesity epidemic which is now become well established and accepted\textsuperscript{[4]}. As by improvement in standards of living\textsuperscript{[5]} there was a rapid increase in aging and urbanizing\textsuperscript{[6]} among Indian population which is lead to increase in obesity and its associated cardiovascular disease (CVD) risk factors, including diabetes and hypertension. Geldsetzer P et al,\textsuperscript{[7]} has already confirmed that diabetes and hypertension prevalence is high in middle and old age across all geographical areas and sociodemographic groups in India, and hypertension prevalence among young adults is higher than previously thought. Sharma et al, has observed that, there is a 2-3 folds increase in prevalence of T2DM among obese patients, among moderately obese it increases up to 5 folds and it reaches maximum of 10 folds to severely obese patients\textsuperscript{[8]}. Excess body weight was attributed to approximately 90% of T2DM patients which has been estimated by Hossain et al\textsuperscript{[9]}. Arner et al\textsuperscript{[10]} even confirmed that excess weight is more common in newly diagnosed T2DM compare to non-diabetic subjects.

It is of paramount importance to determine the prevalence of major risk factors like obesity and hypertension and its influence on achievement of therapeutic goals in Type 2 Diabetes patients who were attending diabetes care centre in Bihar, which was never done here earlier.

**Methods**

The observational study was undertaken at Prakash diabetes care hospital at Patna city in Bihar from 02 Jan 2017 to November 2018. Prakash Diabetes Speciality Hospital is a specialty care diabetes Centre with state-of-the-art technology and providing sophisticated and specialized medical services at affordable costs in Diabetes and its related specialties in Patna city. A total sample of 1400 type 2 diabetes patients attending the medical outdoor patient department were studied to assess the prevalence
Diagnosis of T2DM was based on American Diabetes Association (ADA) recommendation i.e., in subjects whose glycated haemoglobin HbA1C ≥6.5% (48 mmol/mol)\(^{[12]}\). Obesity was defined by International Diabetes Federation (IDF) criteria as the presence of any one or more of the following parameters i.e., BMI>23 Kg/m\(^2\), WC : >90cm (Male) and WC : >80cm (Female)\(^{[13]}\).

**Inclusion Criteria:** The study included patients who were attended the diabetes and medicine outdoor patient department of Prakash diabetes care hospital and having type 2 diabetes and non-diabetic between the age group of 20-70 years.

**Exclusion criteria:** Patient with existing vascular complication, with any previous CV event, pregnancy or lactating woman.

**Statistical Analysis:** The whole data was entered into computer using MS-Excel program. The data was analysed using Statistical Software for Social Sciences for Windows version 16.0 (SPSS Inc., Chicago, IL). The students “t”- test and “chi” square tests were used to find out the statistical significance of the results.

**Result**

899 subjects were belongs to age group of 40-60 which is maximum out of 1400 subjects. 869 subjects were female and 531 were male.

Prevalence of obesity was 63% as per the BMI criteria (≥25)

Prevalence of hypertension was 53 %.(Table 1)

![Table 1: Association of BMI with hypertension among T2DM subjects](image)

| BMI | Hypertensive | Normotensive | Significance |
|-----|--------------|--------------|--------------|
| ≥25 | 470          | 411          | \(X^2_{cal}=6.29,\) d.f. =1, \(p<0.05\) |
| <25 | 138          | 381          |              |
| Total | 608        | 792          |              |

Out of 531, 263 male subjects were hypertensive of which 211 had WC of 90 or more, the association of hypertension and obesity (central) was not statistically significant. Out of 339 hypertensive female subjects, 317 had WC of 80 or more obese (central), the association of central obesity with hypertension in female is statistically significant.

![Table 2: Association of waist circumference and hypertension among T2DM subjects](image)

| Waist circumference | Blood pressure | Significance |
|---------------------|----------------|--------------|
|                     | Hypertensive   | Normotensive |
| Males(n=531)        |                |              |
| ≥90                 | 211            | 80           | \(X^2_{cal}=1.9\), p>0.05 |
| <90                 | 70             | 170          |              |
| Females(n=869)      |                |              |
| ≥80                 | 267            | 133          | \(X^2_{cal}=10.65\), p>0.05 |
| <80                 | 60             | 409          |              |

The demographic and clinical characteristics of the 1,400 patients with type 2 diabetes were stratified by BMI and WC and are shown in Table 3. Patients were having long duration of diabetes with comorbid condition. Sedentary lifestyle and Alcohol consumption were more common in obese than in normal-weight patients. Centrally obese patients were also more likely to be smokers or alcohol drinkers (P<0.001).
Table 3: Demographic and clinical characteristics of diabetes patients stratified by BMI and WC

| Total (n=1400) | BMI (kg/m²) | BMI ≥25 kg/m² | P Value | Normal WC (n=190) | Central obesity (n=691) | P Value |
|----------------|-------------|---------------|---------|-------------------|-------------------------|---------|
| Age, years (mean±SD) | 52.5±11.3 | 53.5±11.6 | 52.2±11.5 | <0.001 | 53.1±11.2 | 52.8±11.8 | <0.001 |
| <40 | 112 (8%) | 31 (6%) | 81 (9.1%) | <0.001 | 15 (7.8%) | 66 (9.5%) | <0.001 |
| 40–60 | 899 (64.2%) | 353 (68%) | 546 (61.9%) | <0.001 | 123 (64.7%) | 423 (61.2%) | <0.001 |
| >60 | 389 (27.8%) | 112 (21.57%) | 277 (31.4%) | <0.001 | 52 (30.1%) | 225 (32.56%) | <0.001 |
| Male | 531 | 196 | 335 | <0.001 | 72 | 263 | <0.001 |
| Diabetes duration, years | 4.1±1.6 | 4.2±1.8 | 4±1.2 | <0.001 | 4±1.3 | 3.8±1.1 | <0.001 |
| <1 | 118 (8.4%) | 40 (7.7%) | 78 (8.8%) | <0.001 | 19 (10%) | 59 (8.5%) | <0.001 |
| 1–5 | 984 (70.3%) | 381 (73.4%) | 603 (68%) | <0.001 | 142 (74.7%) | 461 (66.7%) | <0.001 |
| >5 | 298 (21.3%) | 121 (23%) | 177 (20.1%) | <0.001 | 49 (25.8%) | 128 (18.5%) | <0.001 |
| Dyslipidemia | 381 (27.2%) | 29 (5.6%) | 352 (40%) | <0.001 | 51 (26.8%) | 301 (43.6%) | <0.001 |
| Dyslipidemia and hypertension | 308 (22%) | 18 (3.5%) | 290 (32.9%) | <0.001 | 44 (23.15%) | 246 (35.6%) | <0.001 |
| Smoking | 231(16.5%) | 86 (16.6%) | 145 (16.5%) | <0.001 | 32 (16.8%) | 113 (16.4%) | <0.001 |
| Alcohol consumption | 112 (8%) | 37 (7.1%) | 75 (8.5%) | <0.001 | 17 (8.94%) | 58 (8.4%) | <0.001 |
| Sedentary lifestyle | 521 (37.2%) | 188 (36.2%) | 333 (37.8%) | <0.001 | 69 (36.3%) | 264 (38.2%) | <0.001 |

Data are shown as mean±SD or n (%).

Table 4: Profiles and goal attainment rates of diabetes patients stratified by BMI and WC.

| Total (n=1400) | BMI (kg/m²) | BMI ≥25 kg/m² | P Value | Normal WC (n=190) | Central obesity (n=691) | P Value |
|----------------|-------------|---------------|---------|-------------------|-------------------------|---------|
| HbA1c <7.0% | 641 (45.8%) | 440 (84.7%) | 201 (22.8%) | <0.001 | 144 (75.8%) | 57 (8.2%) | 0.001 |
| BP <140/90 mmHg | 593 (42.4%) | 414 (79.8%) | 179 (30.3%) | <0.001 | 97 (51%) | 82 (11.8%) | 0.149 |
| LDL-C <100 mg/dl | 607 (43.4%) | 414 (79.8%) | 193 (21.9%) | 0.052 | 107 (56.3%) | 86 (12.4%) | 0.893 |
| Achieve all above Targets | 267 (19%) | 180 (34.7%) | 87 (9.9%) | <0.001 | 51 (26.8%) | 36 (5.2%) | 0.014 |

Data are shown as n (%).

Discussion
Diabetes Mellitus is a major public health problem which has become the leading cause of mortality and morbidity worldwide. Its prevalence is rising in the developing countries especially in India, in response to increasing prosperity and sedentary lifestyles.
Over weight and obesity are major two consequence of Type 2 Diabetes. Even though it is recommended by all most all diabetes guideline recommend to achieve integrated glycemic, blood pressure and lipid goal, but in reality obese subjects fails to achieve it than normal weight subjects. It was also observed that subjects with central obesity fails in much higher rate to active integrated glycemic, blood pressure and lipid goal. Prevalence of obesity was 63% as per the BMI criteria (≥25) were observed in this study. In a study, prevalence of obesity (BMI ≥30kg/m2) was 54.8% and combined prevalence of overweight and obesity (BMI ≥25kg/m2) was 85.2%, conducted among US population[14].

Evidence from some prospective studies in Asia suggests that obesity is directly related to the incidence of diseases such as hypertension, type 2 diabetes, and hypercholesterolemia[14, 16, 17, 18]. As per majority of trial reports, waist circumference or waist-to-hip ratio might be more appropriate indices of obesity for Asian people[19, 20].

In our study only 19% subjects were able to achieve their target goal of diabetes, hypertension and dyslipidemia. This trial conducted at Prakash diabetes Hospital OPD confirms the negative effect of obesity and overweight for achieving target therapeutic goal[21,22]. In addition to obesity and overweight, there were another risk factor which influence the achievement of target therapeutic goal of type 2 diabetes and hypertension was like style. Sedentary lifestyle and Alcohol consumption were more common in obese than in normal-weight patients. Centrally obese patients were also more likely to be smokers or alcohol drinkers (P<0.001). Several trial has confirm that, increase insulin sensitivity, oxidation of free fatty acids and glucose disposal may because of decrease in physical activity[23,24].

Drinking alcohol and smoking, in this study has appeared to be independent risk factor and prevent an individual to achieve primary target goal. Frequent exercise and restriction of smoking and drinking habits with exercise regimen and healthy lifestyle may help obese and overweight people to achieve their target goal.

Conclusion
Hypertension and obesity were associated with poor glycemic control in Indian type 2 diabetes patients at Bihar. To manage the situation a proper clinical awareness and management of obesity and hypertension is essential to achieve target glycemic control among type 2 diabetes subjects.

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