Sex Differences in Cardiovascular Risk Factors among People with Diabetes in South India

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Abstract

Objective: To assess the sex differences in the prevalence of cardiovascular risk factors among patients with type 2 diabetes, visiting the hospital between March–December 2012.

Methods: A cross-sectional study was performed among the type 2 diabetes patients attending M.V. Hospital for Diabetes, a tertiary centre specialized in diabetes care, Chennai, South India. We collected information on obesity (body mass index ≥25 kg/m²), hypertension, dyslipidemia, smoking, alcohol consumption and glycemic control (HbA1c >8% considered poor control).

Results: Risk factors (prevalence) among 6113 (58% males; mean age 54 years) patients were obesity (68.4%), poor glycemic control (51.4%), hypertension (37.9%), dyslipidemia (34.7%), smoking (9.6%) and consumption of alcohol (10.3%), respectively. Women had a higher prevalence of obesity (75.7 vs 63.2%) and poor glycemic control while men had higher prevalence of smoking and alcohol consumption. There were no sex differences in prevalence of hypertension and dyslipidemia. Cardiovascular risk factors were not associated with duration of diabetes.

Conclusion: Cardiovascular risk factors were highly prevalent among patients with type 2 diabetes attending a tertiary care centre in South India, with different risk profiles among men and women. We recommend a gender-sensitive approach in planning interventions (counseling and treatment) to reduce the risk of cardiovascular disease.

Introduction

The burden of diabetes mellitus (DM) and cardiovascular disease (CVD) is on the rise in all developing countries. India has the highest number of people living with DM¹,² and the risk of developing CVD is 2–4 times higher among people with diabetes as compared to people without diabetes.³ Mortality due to CVDs account for 65–75% of all deaths among diabetes patients.³ There is evidence that South Asians have a high prevalence of CVD risk factors and are more susceptible to CVD.⁴ Globally, several studies have examined gender-based differences in the distribution of cardiovascular risk factors and risk of CVD among patients with diabetes, which indicate excess risk factor clustering among females, thus rendering them at an increased risk of CVD and CVD mortality as compared to men.⁷–⁹ These studies were conducted in varied settings and ethnic groups, outside India. There is limited information from India about the prevalence of CVD risk factors in patients on long-term diabetes care in specialized tertiary care hospital settings. A recent study from Orissa, India, describes the prevalence of CVD risk factors among type 2 DM patients attending a tertiary care centre. But it did not provide any information, disaggregated by sex and was limited by small sample size.¹⁰ In this cross-sectional study, we report on the sex differences in the prevalence of cardiovascular risk factors in a large cohort of DM patients attending a tertiary care centre.
care centre for diabetes in Chennai, India.

**Methods**

**Design:** This was a cross-sectional study involving a large cohort of DM patients.

**Setting:** The study was conducted at the M.V. Hospital for Diabetes, a 100-bed tertiary care hospital for DM in the state of Tamil Nadu, South India. More than 2,00,000 DM patients have been registered in care at the hospital since its opening, and 100–200 patients visit the hospital every day on an out-patient basis. Standard care is provided to all DM patients, including patient education, counseling, advice on lifestyle modification and treatment. Nearly 50% of all registered patients visit the hospital regularly for checkup including assessment of their glycemic status.

**Study Population and Study Period**

All adult patients (aged ≥15 years) with type 2 DM who attended the M.V. Hospital for Diabetes, Chennai, India, during the period March–December 2012 were included in this study. Subjects with established CVD and pregnant and lactating women were excluded. The study was conducted during the period February – November 2013.

**Data Collection Procedure, Variables**

After obtaining informed consent, a structured questionnaire was used to collect information on sex, age, residence, duration of diabetes, family history of diabetes, education status, current medication for diabetes (diet only, oral medication only, insulin only, oral plus insulin), personal habits such as current smoking (defined as a history of smoking in the last 3 months) and alcohol consumption (defined as consumption of average daily consumption of 60 ml of alcohol). Occupation was classified as skilled (carpenter, painter, electrician, plumber, etc.) and unskilled (farmer, labourer), businessmen, and ‘others’ for categories such as retired people, homemakers, and unemployed. Socioeconomic status was classified as low income (family income <US$200/month), middle income (family income US$200–400/month) and high income (family income >US$400/month).

Anthropometric measurements, including height and weight were measured for calculation of body mass index (BMI). Obesity was defined as BMI ≥25 kg/m². Biochemical parameters such as fasting and postprandial glucose levels and glycosylated haemoglobin (HbA1c) levels were recorded. Plasma glucose was estimated using glucose oxidase peroxidase method and HbA1c was estimated using high performance liquid chromatography method with Bio-Rad Variant Turbo equipment (Bio-Rad Laboratories, Hercules, CA, USA).

Patients were assessed for poor glycemic control (HbA1c >8%) and presence of other comorbidities such as hypertension and dyslipidaemia. Hypertension was defined as history of hypertension and receiving anti-hypertensive drugs or systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg. Dyslipidaemia was defined as history of receiving any lipid-lowering drug or the presence of any one lipid abnormality, i.e., total cholesterol ≥5.18 mmol/L (200 mg/dl) or triglycerides ≥1.69 mmol/L (150 mg/dl) or LDL cholesterol ≥2.59 mmol/L (100 mg/dl) or HDL cholesterol <1.04 mmol/L (40 mg/dl) in men and <1.3 mmol/L (50 mg/dl) in women.

**Data Entry and Analysis**

Data were captured electronically into the hospital information system by trained staff. This was then exported to and analysed using SPSS, version 16.0 (SPSS Inc., Chicago, IL). Data were expressed as mean and standard deviations and proportions. Continuous variables such as BMI and duration of DM were converted to categorical variables. Differences between men and women were assessed for statistical significance using the two-tailed t-test and Chi-square test, as appropriate. A p value of <0.05 was considered as statistically significant.

**Ethics Approval**

The study protocol was reviewed and approved by the institutional ethics committee and Ethics Advisory Group of The International Union Against Tuberculosis and Lung Disease, Paris, France.

**Results**

There were a total of 6113 patients with type 2 DM who attended the hospital during the study period. Of them, 3544 (58%) were males and mean (SD) age was 54 (11.3) years. The socio-demographic factors and clinical details of the patients, disaggregated by sex, are shown in Table 1. Mean age was similar in both men and women. Majority of women were from urban location as compared to men (63.5% vs 49.4%). Women were less likely to have attended school than men and half of the women came from lower socioeconomic status as compared to 14% of men. Nearly three-fourths of the study subjects had a positive family history of diabetes. Approximately 40% of the subjects were on a combination of oral hypoglycemic drugs and insulin therapy. Sex-wise clinical characteristics and other CVD risk factors are described in Table 2. The mean duration of DM care was about 5.9 years and was similar among both sexes. The most prevalent CVD risk factor was obesity (68.4%) with higher prevalence among women as compared to men (75.7 vs 63.2%), followed by uncontrolled glycemic status (51.4%), hypertension (37.9%) and dyslipidaemia (34.7%). Smoking and consumption of alcohol was highly prevalent in men (around
17%), while almost non-existent in women (0.3%). Women had significantly higher mean HbA1c levels as compared to men. There was no statistically significant sex difference in the presence of hypertension and dyslipidaemia. No significant difference was noted in the presence of these CVD risk factors when the study subjects were stratified by the duration of diabetes (data not shown).

### Discussion

Our study revealed that a large proportion of people with type 2 diabetes attending a tertiary care centre had CVD risk factors despite receiving standard diabetes care for a long duration. There was a gender-wise difference noted in the cardiovascular risk profile with obesity and HbA1c levels being higher in women, smoking and alcohol consumption being lower and no difference noted in the levels of hypertension and dyslipidaemia.

Obesity, particularly central obesity, has been shown in other studies to be an independent risk factor for cardiovascular diseases, even in the absence of diabetes.\(^{14}\) The observed high rate of obesity, particularly among women, may be due to their sedentary lifestyle and lack of physical activity. It is a limitation of our study that we could not systematically document the level of physical activity, diet intake and presence of central obesity.

Mean HbA1c levels were significantly higher in women as compared to men. Good glycemic control remains a vital component of preventing CVD. Poor glycaemic control could be a reason for two-fifths of our patients with diabetes requiring combination therapy. But, in the absence of information on other factors that are responsible for poor glycaemic control such as compliance with diet, physical exercise, intercurrent illness and ingestion of other drugs, it would be inappropriate to speculate on the reasons of this finding. This, however implies the need for more sustained intervention to reduce the risk of prolonged metabolic disturbance.

It is expected that individuals of Indian ethnicity will account for between 40–60% of global CVD burden within the next 10–15 years.\(^{15}\) Several studies report that CVD risk factors vary substantially between sexes\(^{4,6}\) and the CVD risk was considerably higher in women than in men in a 10-year follow-up study.\(^{7}\) These data necessitate aggressive treatment of CVD risk factors in women with type 2 diabetes. Similar results were observed in a recently published cross-sectional study conducted by Joni et al in South Carolina,
USA. The authors reported that women with type 2 diabetes had significantly lower composite control of CVD risk factors (i.e., HbA1c, blood pressure, and LDL cholesterol levels were not under control) compared with men with type 2 diabetes. Another study reported a high prevalence of CVD and risk factors for CVD in Iranian patients with diabetes that underscores the importance of better detection and treatment of metabolic risk factors of CVD in those patients.

All the DM patients attending the tertiary care centre were routinely offered counseling services on lifestyle modifications, specific education and advice. But the study findings revealed high prevalence of CVD risk factors irrespective of duration of DM. This could probably indicate that the current efforts taken to educate patients are not sufficient and innovative interventions are required to effect lifestyle changes. Moreover, men had a higher prevalence of smoking and alcohol consumption. So, there is a need to provide individualized, systematic and comprehensive care and effective counseling to effect behavioral change. The approach also needs to gender-sensitive, given distinct risk factor clustering between the sexes. A recent study conducted in a tertiary care centre in Orissa also implied a need for counseling and changes in lifestyle among patients with diabetes.

Hypertension is known to coexist in a significant proportion of people with diabetes. About one-third of patients in the study had hypertension and dyslipidaemia. Identification of individual risk factors and their aggressive management is important to reduce these risk factors in DM patients.

The strengths of this study are that it reports on a large cohort of DM patients attending a tertiary care centre and could be representative of DM patients attending specialized, tertiary care settings across India. STROBE guidelines were followed to report the findings of this study.

The study had a few limitations. One was that some of the key risk factors of CVD such as waist circumference were not measured, and details on physical activity, dietary pattern, knowledge of care in diabetes and so on were also not evaluated. Another limitation was that it was not aimed at looking at the outcome of CVD events after controlling the identified risk factors, which could have given a better correlation pattern. Another limitation to this study was that we have not assessed the gender differences with regard to microalbumin, hypothyroidism and inflammatory markers which could have identified the risk factors that would help in planning strategies to prevent CVD.

**Conclusion**

Cardiovascular risk factors are highly prevalent among patients with type 2 diabetes attending a tertiary care centre in South India. There is a distinct gender-based risk clustering with higher levels of obesity and poor glycemic control among women, lower levels of smoking and alcohol consumption and no difference in levels of hypertension and dyslipidemia. Gender-based approach to manage DM patients for preventing the risk of future CVD, innovative means of counseling to effect behavioral change, including support to quit smoking and alcohol consumption and more aggressive management of glycemic control and comorbidities such as dyslipidaemia and hypertension are essential.

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**Conflict of interest**

None declared.

**References**


