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Original Research Article

Cardio vascular risk profile among diabetic patients attending a tertiary care hospital in Odisha, India

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ABSTRACT

Background: Diabetes is associated with reduced quality of life and wide range of complications including CVD which vary geographically. The likely causes for the dramatic increase in the CVD rates include lifestyle changes associated with urbanization and the epidemiologic as well as nutritional transitions that are associated with economic development. This study aims to identify the CVD risk factors that exists among the diabetes patients of Odisha.
Methods: The study was conducted in KIMS during July-December 2016. A total of 300 diabetic and 300 non-diabetic patients were included in the study. Medical history and lifestyle data were collected using a pretested structured format and a separate checklist for laboratory results. Patient interview, physical examination and laboratory analysis were performed. Chi-square test was performed to identify significance of difference between prevalence of risk factors between diabetic and non-diabetic groups. Multiple logistic regression analyses (forward stepwise addition) were performed to identify the variables significantly associated with CVD risk factors. Significance level of 5% was considered.
Results: Total 376 males and 224 females were enrolled in the study with higher proportion of male participants in both diabetic and non-diabetic groups. Overall mean age of study subjects was 47.5±10.4 years. No significant difference was observed for demographic distribution between both groups. Prevalence of dyslipidaemia among diabetic patients was 86%, while prevalence of hypertension and dyslipidaemia were 71% and 62.3% respectively.
Conclusions: Overall prevalence of CVD risk factors observed in this study among population of Odisha, is higher compared to reported prevalence for other regions of India.

Keywords: Cardiovascular, Dyslipidaemia, Diabetes, Hypertension

INTRODUCTION

Prevalence of diabetes is increasing throughout the world as the populations in most countries age. According to the Diabetes Atlas 2015 published by the International Diabetes Federation, the number of people with diabetes in India was 69.2 million in 2014 and it is expected to rise to 123.5 million by 2040 unless urgent preventive steps are taken. Cardiovascular diseases, i.e. Coronary heart diseases, stroke, and peripheral vascular diseases tend to be the cause for the majority of deaths in diabetic patients. Diabetes mellitus, hypertension, cigarette smoking, dyslipidemia, obesity and physical inactivity are established risk factors for cardiovascular diseases (CVD).[1]

These risk factors are said to be the traditional or conventional CVD risk factors. The conventional cardiovascular risk factors have more adverse effects on diabetic patients than non diabetics.

Diabetes is associated with reduced quality of life and a wide range of long-term complications, including both microvascular and macrovascular diseases resulting in significant morbidity and mortality.[2] In India, considering diversity in regional culture and lifestyle, it is difficult to generalise complete data of one region to other.[3]

Several studies among diabetic population have been conducted which reveals cardiovascular risk factors and impact of them on daily life, however so far no such data are available for Odisha state in India. Considering lack of local population data for cardio vascular disease (CVD) risk factors in diabetic patients for Odisha, this study was designed to identify the same.

METHODS

This cross-sectional study was conducted at the diabetic follow-up clinic of Kalinga Institute of Medical Sciences (KIMS) Bhubaneswar during Jul-2016 to Dec-2016. The study population was all adult (≥18 years) diabetic and non-diabetic patients who were on follow-up at medicine OPD, KIMS. Patients with established cardio-vascular diseases, pregnancy and acute illness were excluded from the study. A total of 300 diabetic and equal number of non-diabetic patients were included considering sample size calculation with expected 50% prevalence of CVD risk factors, 95% confidence level and margin of error of 5%.

Data were collected using a pretested structured format and a separate checklist for laboratory results. The format and checklist were linked by unique identification code. The data collection format had four parts. The first section was concerning socio-demographic characteristics. The second section was about habits including chewable tobacco, cigarette smoking, alcohol consumption, exercise and diet. The third part was for clinical data including medical history of diabetes, hypertension and treatment. In the final part laboratory investigations including glycemic and lipid parameters were recorded. Weight was measured in kilograms (kg) using the WHO weighing scale (Health-O-Meter, USA) at a precision of 0.1kg with the study subjects minimally dressed. Height was measured in centimetre (cm) in erect position at a precision of 0.1cm with shoes removed. Waist circumference was measured in cm at the midpoint of the line between the lowest border of the thoracic cage and anterior superior iliac spine. Blood pressure was measured using a mercury sphygmomanometer with a cuff deflation rate of 2mmHg. Measurements in each arm after 10min in sitting position were averaged to be recorded.

For laboratory measurements, blood was taken at the clinic after an overnight fasting of 10-14 hours. The patients attending the clinic were advised to come after an overnight fasting for the determination of FBG and lipid profiles. Urine samples were also obtained. FBG, serum total cholesterol, HDL-C and triglyceride were determined using the hemanalyzer machine (Human, USA) and appropriate reagents. LDL-C was calculated using the Freidwald formula.[4,5] Urine dipstick was done for presence of albuminuria. Macroalbuminuria was defined as detection of albumin in the spot urine specimen.[4]

The interview, chart review and physical measurement were carried out by trained medical interns. Laboratory samples were collected by an experienced technician at the laboratory, KIMS. Laboratory analyses were carried out by a laboratory technician. Principal investigator supervised the data collection process at the clinic. The laboratory data collection and analysis were supervised by senior laboratory technologist.

To ensure quality, training was given to data collectors and supervisors on the data collection process and the collected data were checked for completeness and consistency on the day of collection. The collected data were entered in to computer and analysed using SPSS for windows version 20. Descriptive analysis was considered for socio-demographic characteristics. Chi-square test was performed to identify significance of difference between prevalence of risk factors between diabetic and non-diabetic groups. Multiple logistic regression analyses (forward stepwise addition) were performed to identify the variables significantly associated with CVD risk factors. Significance level of 5% was considered.

Hypertension was defined as systolic blood pressure (SBP) ≥140mmHg or diastolic blood pressure ≥90mmHg or being on treatment for a physician diagnosed hypertension. Obesity was defined as BMI ≥30kg/m^2 or waist circumference ≥102cm for men and ≥88cm for women. A patient was considered to have Dyslipidemia in the presence of at least 1 of the following: high plasma total cholesterol (≥200mg/dl), high LDL-C (≥130mg/dl), low HDL-C (<40mg/dl in men or <50mg/dl in women), high triglyceride level (≥150mg/dl).[6,7] A person who reports regular aerobic exercise (walking, jogging) of at least 30min for every 5 days or its equivalent; or whose occupation requires physical exertion daily was considered to be physically active.[7] A person who smokes any quantity of cigarette in the last 12 months was considered as current smoker.[8]

RESULTS

Total 600 patients participate in the study which included two groups of 300 subjects, diabetic and non-diabetic groups. Overall 376 males and 224 females included in the study with higher proportion of male participants in both groups. Overall mean age of study subjects was 47.5±10.4 years. No significant difference was observed for demographic distribution between both groups. The distribution and characteristics of demographic variables among two groups and overall are summarized in Tables 1.

Table 1: Socio-demographic characteristics of study population.

Characteristics		Diabetic	Non-diabetic	Overall
		N (%)	N (%)	N (%)
Total subjects		300 (100)	300 (100)	600 (100)
Age (years)	<35	18 (6.0)	54 (18)	72 (12.0)
	35-49	111 (37.0)	112 (37.3)	223 (37.2)
	50-65	163 (54.3)	131 (43.7)	294 (49.0)
	>65	8 (2.7)	3 (1.0)	11 (1.8)
Gender	Female	108 (36.0)	116 (38.7)	224 (37.3)
	Male	192 (64.0)	184 (61.3)	376 (62.7)
Educational status	Illiterate	22 (7.3)	5 (1.7)	27 (4.5)
	Upto primary level	30 (10.0)	50 (16.7)	80 (13.3)
	Upto middle	39 (13.0)	46 (15.3)	85 (14.2)
	Upto highschool	41 (13.7)	56 (18.7)	97 (16.2)
	Upto intermediate	55 (18.3)	46 (15.3)	101 (16.8)
	Graduate and above	113 (37.7)	97 (32.3)	210 (35.0)
Occupation	Currently working	181 (60.3)	192 (64)	373 (62.2)
	Housewife	90 (30.0)	94 (31.3)	184 (30.7)
	Others	0 (0.0)	6 (2.0)	6 (1.0)
	Retired	29 (9.7)	8 (2.7)	37 (6.2)
Family income	<10000	75 (25.0)	39 (13.0)	114 (1900)
(rs/month)	10000-20000	90 (30.0)	169 (56.3)	259 (4320)
	>20000	135 (45.0)	92 (30.7)	227 (3780)
Physical exercise	Regular exercise and strenous work	13 (4.3)	12 (4.0)	25 (4.2)
	Regular exercise or strenous work	82 (27.3)	80 (26.7)	162 (27.0)
	No exercise and sedentary work	205 (68.3)	208 (69.3)	413 (68.8)
Chewable tobacco use	No	173 (57.7)	222 (74.0)	395 (65.8)
	Yes	127 (42.3)	78 (26.0)	205 (34.2)
Smoker	No	240 (80.0)	273 (91.0)	513 (85.5)
	Yes	60 (20.0)	27 (9.0)	87 (14.5)
Alcoholic	No	255 (85.0)	290 (96.7)	545 (90.8)
	Yes	45 (15.0)	10 (3.3)	55 (9.2)

Table 2: Prevalence of CVD risk factors among study patients.

CVD Risk Factors	Diabetic	Non-diabetic	Overall	p-value
	n (%)	n (%)	n (%)	(diabetic vs non-diabetic)
Hypertension	213 (71.0)	103 (34.3)	316 (52.7)	<0.001
Obesity	53 (17.7)	37 (12.3)	90 (15.0)	0.067
Dyslipidemia	258 (86.0)	235 (78.3)	493 (82.2)	0.014
Smoking	59 (19.7)	27 (9.0)	86 (14.3)	<0.001
Physical inactivity	187 (62.3)	203 (67.7)	390 (65.0)	0.170

Prevalence of hypertension among study patients was overall 52.7%, which was significantly higher among diabetic patients (71.0%) compared to non-diabetic patients (34.3%).

Similarly, prevalence of dyslipidemia and smoking were significantly higher among diabetic patients, while no significant difference was observed for prevalence of obesity and physical inactivity among two groups. Prevalence of risk factors for CVD among two groups and overall are summarized in Tables 2.

Total number of CVD risk factors for each patient was analysed and 81.5% patients were having at least 2 risk factors. Proportion of patients having three or more risk factors was higher among diabetic patients (54.3%) compared to non-diabetic patients (28.3%) (Table 3).

Age 50-65 years and family history of hypertension of either parents or both parents were found to be strong independent predicator for hypertension among diabetic patients with OR of 5.75, 7.63 and 7.11 respectively. Similarly, female gender, housewife occupation and

family history of diabetes of both parents were found to be predicators for obesity with OR of 4.63, 3.81 and 3.28 respectively among diabetic patients. No independent predictor was identified for dyslipidemia among diabetic patients (Table 4).

Table 3: Number of CVD risk factors among study patients.

Number of CVD risk factors	Diabetic	Non-diabetic	Overall
	n (%)	n (%)	n (%)
0	2 (0.7)	21 (7)	23 (3.8)
1	32 (10.7)	56 (18.7)	88 (14.7)
2	103 (34.3)	138 (46.0)	241 (40.2)
3	124 (41.3)	68 (22.7)	192 (32.0)
4	35 (11.7)	16 (5.3)	51 (8.5)
5	4 (1.3)	1 (0.3)	5 (0.8)

Table 4: Association between selected characteristics and CVD risk factors among diabetic patients.

Characteristics		Hypertension	Obesity	Dyslipidemia
		OR (95% CI)	OR (95% CI)	OR (95% CI)
Age	<35	1	1	1
	35-49	2.9 (1.04-8.08)	3.97 (0.5-31.5)	1.65 (0.42-6.54)
	50-65	5.75 (2.07-15.92)	3.99 (0.51-31.15)	1.05 (0.28-3.9)
	>65	4.71 (0.73-30.28)	-	1.4 (0.12-15.97)
Gender	Female	0.89 (0.53-1.49)	4.63 (2.47-8.71)	1.7 (0.82-3.53)
	Male	1	1	1
Educational Status	Illiterate	1	1	1
	Upto primary level	1.2 (0.39-3.7)	1.58 (0.35-7.17)	1.4 (0.18-10.79)
	Upto middle	0.9 (0.31-2.59)	2.49 (0.61-10.12)	0.55 (0.1-2.99)
	Upto highschool	2.46 (0.8-7.59)	2.04 (0.5-8.38)	1.27 (0.2-8.21)
	Upto intermediate	1.55 (0.56-4.31)	0.78 (0.18-3.42)	0.29 (0.06-1.41)
	Graduate and above	2.57 (0.98-6.72)	1.12 (0.3-4.21)	0.65 (0.14-3.08)
Occupation	Currently working	1	1	1
	Housewife	0.99 (0.57-1.72)	3.81 (2.03-7.16)	1.53 (0.71-3.29)
	Retired	1.63 (0.63-4.23)	0.56 (0.13-2.55)	1.65 (0.47-5.83)
Family Income	<10000	0.34 (0.18-0.64)	1.04 (0.52-2.07)	2.43 (0.87-6.78)
(Rs/month)	10000-20000	0.41 (0.22-0.76)	0.42 (0.19-0.95)	0.75 (0.37-1.52)
	>20000	1	1	1
Physical Exercise	Regular exercise and strenous work	1.35 (0.36-5.07)	2.09 (0.61-7.15)	NA
	Regular exercise or strenous work	0.92 (0.53-1.61)	0.88 (0.44-1.77)	0.87 (0.43-1.78)
	No exercise and sedentary work	1	1	1
Chewable tobacco use	No	1	1	1
	Yes	0.87 (0.52-1.43)	0.79 (0.43-1.46)	1.09 (0.56-2.12)
Smoker	No	1	1	1
	Yes	1.16 (0.61-2.18)	0.67 (0.3-1.5)	1.59 (0.64-3.96)
Alcoholic	No	1	1	1
	Yes	1.31 (0.63-2.73)	1.01 (0.44-2.31)	1.36 (0.5-3.66)
Family History of Diabetes	No	1	1	1
	Either Parent	1.28 (0.75-2.17)	1.91 (0.99-3.7)	1.39 (0.7-2.76)
	Both Parents	1.01 (0.43-2.39)	3.28 (1.29-8.37)	1.69 (0.47-6.05)
Family History of Hypertension	No	1	1	1
	Either Parent	7.63 (4.26-13.68)	1.75 (0.84-3.65)	0.65 (0.3-1.42)
	Both Parents	7.11 (2.69-18.74)	2.45 (0.92-6.56)	0.76 (0.24-2.39)

DISCUSSION

Diabetes, due to its prevalence and complications makes a significant impact to overall morbidity and burden related to treatment. This study evaluated prevalence of cardio vascular risk factors among diabetic patients attending a tertiary care hospital in eastern part of Odisha.

Improper intake of food and its metabolism is hampered in diabetes mellitus; due to high sugar levels, metabolism and catabolism at cellular level is not up to the mark. Hence retention of catabolic products and incomplete metabolic products in blood stream is observed. Some of them may conjugate with lipids and proteins and accumulate in several parts of organ systems.

In a sixteen-year follow up study in Framingham, where it was found that diabetics in general show an increased morbidity and mortality from all cardiovascular causes. Insulin-treated diabetic women showed the greatest relative mortality from coronary heart disease. Diabetics were found to have higher lipid values, more hypertension and more obesity, even prior to diagnosis. Diabetes mellitus magnifies the risk of cardiovascular morbidity and mortality. The abnormal metabolic state that accompanies diabetes causes arterial dysfunction. The relevant abnormalities include chronic hyperglycemia, dyslipidaemia, and insulin resistance. Numerous epidemiological studies have shown a link between diabetic dyslipidaemia, which is further, characterized by hypertriglyceridemia; lower levels of HDL cholesterol and associated co-morbid risks. High risk of retention of low density lipoproteins is known to occur around the blood vessels and capillaries; which lead to high incidence of cardiac diseases. Raised levels of triglycerides were detected in diabetic patients which is highly predisposing to cardiac disease.

Glucose reduction with lifestyle modification and drugs in people with diabetes, especially if started early, can delay progression to microvascular complications. Although evidence is mixed from trials on the macrovascular benefits of intensive glucose lowering, long-term glycemic control and lowering blood pressure and serum cholesterol to reduce the risk of adverse cardiovascular outcomes. However, the effectiveness of these interventions at the population level has been slight, both because many diabetes cases remain undiagnosed and because adherence to treatment is typically lower in general populations than in those enrolled in clinical trials. In patients with poorer glycemic control, levels of TG rich lipoproteins are higher.

Dyslipidemia was most common risk factor observed among study population with prevalence of 86% in diabetes patients, which is much higher than reported 64.1% by Yadav et al. in a cross sectional study at Gwalior, however it is lower than reported 91.2% by Parikh et al. in a hospital based observational study at Jaipur.[9,10] Prevalence of hypertension among diabetic patients was 71% which was higher than reported 49% by Yadav et al.[9] Proportion of all five CVD risk factors were observed to be higher among diabetic patients compared to non-diabetic patients in this study. Moreover, differences for dyslipidemia, hypertension and smoking were statistically significant ($p<0.05$).

This study observed association of 50-65 years of age and family history of hypertension as independent predictors for hypertension among diabetic patients. Similarly, female gender, housewife occupation and family history of both parents for obesity were independent predictors for obesity among diabetic patients. No similar studies have been conducted for this region before, however association of female gender and obesity among diabetics is consistent with other studies.[11-14] No specific independent predictor for dyslipidemia was observed among this study population.

Overall prevalence of CVD risk factors is higher among population of Odisha, compared to reported prevalence for other regions of India. Also, among study population, large proportions of diabetic patients were having multiple risk factors which attribute higher risk for cardio vascular diseases. It is important to identify and control such risk factor with intensive and early intervention. Cross-sectional single site study design was limitation for establishing causal effect relation among CVD risk factors and diabetes. However, observed higher prevalence of risk factors indicates necessity of periodic assessment of diabetic patients. Larger population based multi-centric studies with follow up visits are suggested to develop therapeutic guidelines for early intervention.

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