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Research Article

Prevalence of pre-diabetes and diabetic status in hypertensive patients

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ABSTRACT

Background: Diabetes and hypertension are known to coexist in patients. The prevalence of hypertension is 1.5-2.0 times more in those with diabetes than in those without diabetes, whereas almost one-third of the patients with hypertension develop diabetes later. In this study, pre-diabetes and diabetes in hypertensive patients and on coexisting risk factors were studied.
Methods: After institutional ethics committee approval diagnosed hypertension cases on treatment who gave written informed consent were studied for duration of disease, drug therapy, family history, manifestations of co-morbidities and investigated for fasting and post-prandial blood sugar, oral glucose tolerance, lipid profile, serum creatinine, uric acid and SGPT.
Results: Out of 100 recruited hypertensive patients 52 were females and 48 were males. 43% were diagnosed pre-diabetics where as 16% were diabetics.
Conclusions: Prediabetes and diabetes are highly prevalent among individuals with known cases of hypertension.

Keywords: Pre-diabetes, Impaired glucose tolerance, Impaired fasting glucose, Diabetes, Hypertension

INTRODUCTION

Hypertension and diabetes, two of the major global risks for mortality, are on a rapid rise in developing nations.[1] In India, as per the 2011 estimates reported by the Indian council of medical research-India diabetes study, 62.4 and 77.2 million people have diabetes mellitus (DM) and pre-diabetes (PD), respectively.[2] It is predicted that by 2030, India's diabetes burden will be almost 87 million people.[3] Additionally, there is an increasing prevalence of hypertension in the Indian population, especially in the urban areas.[4] Elevated blood pressure has been linked to ischemic heart disease, peripheral vascular diseases, stroke, myocardial infarction, and renal failure.[5] Hypertension and diabetes are important risk factors for cardiovascular disease. Given the increasing rates of coronary artery disease among Indians, especially at a younger age, understanding and successfully managing hypertension and diabetes may hold the key to reducing cardiovascular mortality in India.[6]

Diabetes and hypertension are also known to coexist in patients. The prevalence of hypertension is 1.5-2.0 times more in those with diabetes than in those without diabetes, whereas almost one-third of the patients with hypertension develop diabetes later.[7] This coexistence presents an increased risk and can accelerate vascular complications.[8,9] Diabetes and hypertension are manageable health conditions and can be controlled by medicinal intervention, exercise, and diet. Moreover, detection of progenitors pre-diabetes and pre-hypertension-through periodic surveillance can allow for early intervention and delay disease progression. Although studies have been carried out over the past few decades to estimate the prevalence of diabetes and hypertension, they were often small-scale and regional or

carried out in a particular subset of the diverse Indian population.

In this study, we present the findings on prevalence of new cases of pre-diabetes and diabetes, diabetes in hypertensive patients and on coexisting risk factors.

The objectives of the study were following.

- To determine the prevalence of pre-diabetes and diabetic status in hypertensive patients and its early detection;
- To study correlation of duration of hypertension leading to pre-diabetes and diabetic status;
- To study the correlation of impaired plasma glucose levels with lipid profile, serum uric acid, SGPT and co-morbidities.

METHODS

This study is a cross sectional study of patients attending medicine OPD in a post-graduate institute situated at Mumbai city in the state of Maharashtra in Western India. After obtaining permissions from the institutional ethics committee (IEC) and institutional authorities for conducting the study, known hypertensive patients who satisfied the inclusion criteria and those who gave written informed consent were selected for this study (n=100).

Inclusion criteria

Patients more than 40 years of age who are diagnosed cases of hypertension and are taking treatment for the same.

Exclusion criteria

Patients less than 40 years of age, known cases of DM and secondary hypertension, pregnant ladies and patients on thiazide diuretics or beta blockers.

Demographic details of patients, history of hypertension, drug therapy, family history and history of co-morbidities were noted. Patients were investigated for fasting and post-prandial plasma glucose, lipid profile, serum uric acid, serum glutamate pyruvate transaminase (SGPT) and serum creatinine levels. In addition to this patients were subjected to oral glucose tolerance test (OGTT).

Definitions

A patient whose diabetic status was not known and had OGTT (2 hours) levels between 140 mg/dl and less than 200 mg/dl or fasting plasma glucose levels between 100 and 125 mg/dl was defined as having ‘‘prediabetes.’

Patients without previously reported diabetes who had OGTT (2 hours) levels more than 200 mg/dl were considered as new cases of diabetes mellitus (DM).

Statistical analysis

Categorical data were presented as percentages and continuous data as mean and standard deviations. Significance of difference in parameters was calculated by Karl Pearson’s Chi Square test at 95% confidence interval ($p<0.05$). EpiInfo version 7.0 (public domain software package from centers for disease control and prevention, Atlanta, GA, USA) was used for calculating the Chi Square test (with Yates’ correction where applicable).

RESULTS

Out of 100 recruited hypertensive patients 52 were females and 48 were male patients. When these patients were screened for pre-diabetes and diabetes, 43% were diagnosed as prediabetics where as 16% were diabetics. Amongst those who were detected to be prediabetic, 58% were females and 42% were male. In diabetic patients 44% were female and 56% were male. The demographic details of demography and investigations of patients are given in Table 1. The details of diabetics are in Table 2 and those of prediabetics in Table 3.

Table 1: Hypertensives - demographic profile and blood parameters.

		Duration of hypertension (years)		
		<1 year	1-5 year	>5 year
Age	21-40	11	2	1
	41-60	22	27	17
	>60	4	7	9
Gender	Female	20	18	14
	Male	17	18	13
Family history of hypertension	No	34	33	26
	Yes	3	3	1
Serum Triglycerides	Normal	18	23	16
	Increased	19	13	11
Serum cholesterol	Normal	25	24	21
	Increased	12	12	6
Serum LDL	Normal	30	25	19
	Increased	7	11	8
Serum creatinine	Normal	34	33	25
	Increased	3	3	2
Serum uric acid	Normal	32	27	19
	Increased	5	9	8

Table 2: Serum parameters normal and raised fasting plasma glucose.

		Fasting plasma glucose (mg/dl)		
		<100	<125	>125
Family history of diabetes mellitus	No	50	29	15
	Yes	2	4	0
Serum creatinine	Normal	49	29	14
	Increased	3	4	1
Serum LDL	Normal	39	25	10
	Increased	13	8	5
Serum cholesterol	Normal	36	22	12
	Increased	16	11	3
Serum triglycerides	Normal	33	16	8
	Increased	19	17	7
Serum uric acid	Normal	39	25	14
	Increased	13	8	1

Table 3: Serum parameters -normal and raised plasma glucose after 2 hour OGTT.

		2 hours OGTT plasma glucose (mg/dl)		
		<140	<200	>200
Serum LDL	Normal	39	26	9
	Increased	13	8	5
Serum creatinine	Normal	48	33	11
	Increased	4	1	3
Serum cholesterol	Normal	37	22	11
	Increased	15	12	3
Serum triglycerides	Normal	29	20	8
	Increased	23	14	6
Serum uric acid	Normal	36	29	13
	Increased	16	5	1

DISCUSSION

The prevalence of pre-diabetic (PD) status among the high BP patients of the UNTH was 25%. This is within the range of 25-47% reported by Giovindarajan et al.[2] Shrestha et al reported a prevalence of 43% among hypertensive patients in urban Nepal.[4] Mills and Grant stated that 25% of the population was in state of relative insulin resistance which preceded type 2 DM.[6] A prevalence of 3.5% was reported among primary health care patients with illness in Canada, and 40% of women with polycystic ovarian syndrome.[13] Although 25% of US adults were known to have prediabetes, only an estimated 4% were aware of this.[14,15] Awareness was not assessed in this study. However, lack of the knowledge of the existence of prediabetes in an individual makes screening for the condition in the general population necessary. Impaired fasting glucose (IFG) was more prevalent among the patients 15%, than impaired glucose tolerance (IGT) (5%). This is contrary to the report of Shobha et al who recorded a prevalence of 9.7% for IFG and 15.6% for IGT in US adult aged 40-74 years. Among overweight subjects aged 45-74 years, the prevalence of combined IFG and IGT in Penghu Islets of Taiwan was found to be 14.7% and 30.7% among the women and men within the age ranges of 40-49 years and 50-59 years respectively.[16]

IGT was said to be more sensitive in detecting early dysregulation than IFG. It reflects hepatic gluconeogenesis and slower uptake to glucose from blood into skeletal muscles and adipose tissue following a meal.[17] It is also independently associated with traditional microvascular complications of diabetes. IGT patients, however, will not always progress to diabetes since it is a dynamic and reversible state. Some will revert to normoglycaemia while a greater percentage may continue as such.[17] Six patients (6%) had both IFG and IGT impaired. Eleven patients, therefore, had IGT in this study (5 IGT alone and 6 IGT plus IFG), and are at increased risk of progressing to type 2 DM and developing cardiovascular disorders. A large number of the patients (14%) had unreported DM. This underscores the necessity for regular screening of hypertensive patients for DM. The mean HOMA-IR (homeostasis model assessment for insulin resistance) of the patients, (5.1+4.5) is in the upper range of values reported for PD (4.3-5.2) with some definitely in the DM range, 8.3-9.5, due to the presence of the unreported DM subjects. The HOMA-IR of the control subjects was outside the range of values reported for White Americans, 2.1-2.7.[17] The prevalence of PD among the patients did not exceed reported value range but the percentage of unreported DM was high. The reasons may include ignorance and lack of affordable health services. The lack of correlation between the anthropometric parameters and the laboratory parameters indicates that it may not be possible to predict PD from knowledge of the former parameters. The patients did not differ significantly from the control in their body mass index (BMI) but not in elevated waist circumference and waist to hip ratio. The differences in the later parameters reflect in significantly elevated fasting and 2-hour post prandial plasma glucose of the patients. This shows that BMI is not a good index of obesity in this group of patients. Normal fasting insulin levels in the hypertensive patients reflect the fact that most of the patients could secret enough insulin to keep them in normoglycaemic state in the absence of insulin resistance as shown by normal index of insulin resistance.

The study has highlighted the importance of screening for PD especially among hypertensive patients of the study locality.

CONCLUSION

Prediabetes and diabetes are highly prevalent among individuals with known cases of hypertension. The risk of both diabetes and prediabetes increased in long standing hypertension. The study has highlighted the importance of screening for prediabetes and diabetes especially among hypertensive patients of the study locality so that

treatment measures can be started early in these patients and further complications can be prevented.

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