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Medicine

Orthostatic Hypertension in Patients with Type 2 Diabetes

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ABSTRACT

Objective: to compare the frequency of orthostatic hypertension in type 2 diabetic and non diabetic patients.
Study Design: A cross sectional comparative study
Place and Duration of Study: This study was conducted in a private tertiary care hospital of Karachi in 2011.
Materials and Methods: The patients suffering with type 2 diabetics were taken as cases and non diabetic patients as control with age and sex matched in a ratio of 2:1. After taking inform consent socio demographic data of the participants were recorded on a pre structured questionnaire. The findings of SBP and DBP were taken in sitting, supine and standing position. Blood samples were taken with fasting to test HbA1c, total cholesterol, HDL cholesterol, triglyceride and creatinine.
Results: Over all 250 diabetic types 2 patients and 125 non diabetic patients were included in the study. The orthostatic hypertension was higher in normotensive type 2 diabetic patients as compared to non-diabetics (16.9% vs. 2.8%, $p<0.01$). However it was not found statistically significant in hypertensive cases of both the groups. Orthostatic induces a mean increase in SBP and DBP in type 2 diabetic as compared to non diabetics. Serum triglyceride level was also found higher in OHT diabetic patients as compared to non diabetic patients.
Conclusion: Orthostatic hypertension is a complication in normotensive diabetic patients as compared to non diabetic patients and it may associate with early stage of neuropathy. It can cause sustained hypertension and other complications. So physicians treating type 2 diabetic patients should take care of it.
Key Words: orthostatic hypertension, type 2 diabetic co morbidity, hypertension,**:**

INTRODUCTION

Diabetic is called the mother of all co-morbid conditions. Orthostatic Hypertension (OHD) is one of them which are mostly ignored by the physicians. It was firstly discovered by Dr. David HB Streeten. Orthostatic hypertension or Postural hypertension is a condition, when sudden change occurs in blood pressure of a person from sitting position to standing position[1]. It is diagnosed if the systolic blood pressure (SBP) rose by 20 mmHg or more from sitting position to standing position [2, 3]. It is not proved till now that why it is being happened but it is alpha energic activities of a person which may be the major patho-physiological mechanism of orthostatic hypertension especially in elderly hypertensive cases[4]. According to a study[5], its prevalence was found just 1.1% in the population. However it was determined that its risk may increased with age and in a study it was 16.3% in older hypertensive patients[6]. It causes gravitation shift in circulating blood thus reduces venous return for heart. Due to this, a fall in stroke volume reduces the pulse pressure [7, 8]. But in type 2 diabetic patients, it is shown occasionally disturbance of parasympathetic autonomic regulation which proceeding overt automatic neuropathy. Thus orthostatic hypertension may develop into sustained hypertension which develops vascular complications in long term poor control of blood glucose level [9, 10].

As the importance of orthostatic hypertension has not yet been reported clinically, so this study was develop to establish through comparison the frequency of it in type 2 diabetic and non-diabetic patients.

MATERIALS AND METHODS

A cross section comparative study was conducted in 2011in a private tertiary care hospital of Karachi. The patients (cases and controls) were selected from the OPD of the hospital. According to the prevalence of the disease, we have selected type 2 diabetic cases and non diabetic controls with age and sex matched in a ratio of 2:1. Patients taking any hypertencive medication were not included in the study. Orthostatic hypertension (OHT) was taken if increase in systolic blood pressure (SBP) from <140 to ≥140mmHg and diastolic blood pressure (DBP) from <90 to ≥90 mmHg after standing from supine position. A pre structured, pre tested questionnaire was used to collect the data which record information regarding socio-demographic, clinical findings, X-ray chest and cardiograms result and laboratory findings. BMI was calculated by taking height and weight. The measurement of blood pressure was taking by applying the apparatus on the arm in sitting, spine and standing positions. Supine blood pressure was measured 3-5 minutes after lying on bed and remeasured one minute after standing. Two reading were taking for each one and average was noted. The collected data was analyzed through computer using

SPSS version 16.0. Mean and standard deviation was calculated for each quantitative variables like age, pulse rate SBP, DBP, BMI and other lab findings. Independent T-test was applied to assess the significance of the variables. Frequencies and percentages were calculated for qualitative variables.

RESULTS

Over all 375 persons were included in the study that fulfills our inclusion criteria. Out of these 250 were type 2 diabetic patients and 125 were age and sex matched non diabetic patients. The patients were selected from the OPD. The mean age was 49.6 ± 7.2 years and 45.2 ± 9.3 years in diabetic and non diabetic cases. The family history of hypertension was found more than double in diabetic patients as compared to non- diabetic patients. The duration of diabetic was 4.7± 3.9 years. In both the groups, smokers were nearly equal but BMI was higher in diabetic patients as compared to non-diabetic cases. (Table I)

Table No.1: Comparison of basic information of the participants in type 2 diabetic and non diabetic.

S.no	Basic information	Diabetic cases	Non diabetic cases
1.	Age	49.6 ± 7.2	45.2 ± 9.3
2.	Family history of hypertension	26.2%	12.9%
3.	Duration of diabetic (in years)	4.7± 3.9	---
4.	Smokers	44.2%	45.9%
5.	BMI (Kg/m^2)	27.3 ± 2.9	21.7± 1.6

Table No.2: Comparison of OHT in diabetic and non diabetic patients

S.no	Group	Orthostatic hypertensive	Orthostatic hypotensive	Orthostatic normotensive
1.	Diabetic patients (250) 100% a) Hypertensive (84) 100% b) Normotensive (166) 100%	41 (16.4%) 13 (15.5%) 28 (16.9%)	23 (9.2%) 6 (7.1%) 17 (10.2%)	186(74.4%) 65 (77.4%) 121(72.9%)
2.	Diabetic patients (125) 100% a) Hypertensive (17) 100% b)Normotensive (108) 100%	6 (4.8 %) 3 (17.7%) 3 (2.8%)	7 (5.6%) 4 (23.5%) 3 (2.8%)	112(89.6%) 10(58.8%) 102 (94.4%)

P< 0.001 diabetic normotensive v/s non diabetic normotensive

Table No.3: Comparison of mean with standard deviation of clinical findings between diabetic and non diabetic cases.

	Diabetic OHT	Diabetic Hyper/ hypotensive without OHT	Diabetic normotensive	Non diabetic OHT	Diabetic Hyper/ hypotensive without OHT	Diabetic normotensive
SBP	128 ± 9	136 ± 8	120 ± 12	120± 7	123± 9	115 ± 8
DBP	84±8	89±9	76±6	76±4	80±3	72±10
Pulse Rate	74±11	75±8	72±5	73±8	76±5	73±9

Table No.4: Comparison of mean laboratory findings with standard deviation in type 2 diabetic and non diabetic patients.

	Diabetic OHT	Diabetic Hyper/ hypotensive without OHT	Diabetic normotensive	Non diabetic OHT	Diabetic Hyper/ hypotensive without OHT	Diabetic normotensive
HbA1c	7.6 ± 1.7	7.5± 1.4	7.3 ±1.1	5.2± 1.1	5.1± 0.9	4.9± 1.2
Total cholesterol	5.6±1.1	5.8±1.2	5.2±0.9	4.7±0.9	4.8±0.6	4.7±0.8
HDL cholesterol	1.3±0.3	1.4±0.4	1.3±0.2	1.4±0.6	1.5±0.9	1.3±0.8
Triglyceride	2.7±1.7	2.8±2.1	2.2±0.9	1.6±1.1	1.5±0.9	1.3±0.8
Creatinine	0.7±0.2	0.7±0.3	0.6±0.1	0.8±0.1	0.8±0.2	0.7±0.1

The prevalence of OHT was found significantly higher in diabetic hypertensive, and normotensive and non diabetic hypertensive (15.5%, 16.9% and 17.7%) as compared to only 2.8% in non diabetic normotensive cases. In diabetic cases, 84 (33.6%) were hypertensive as compared to 17 (13.6%) in non diabetics. In diabetics' patients, overall 41 patients were found OHT patients out of which majority 28 were from normotensive cases. Against this in non diabetic cases only 6 were found OHT patients and it found in equal

number (3 in each) in hypertensive and normotensive cases. The results were found statistically significant at P<0.001 as compared to normative cases of both the groups (Table 2)

According to the analysis of the clinical findings, the mean SBP, DBP and Pulse rate were found almost higher in diabetic as compared to non diabetics (Table 3).

Regarding laboratory findings, HbA1c was higher in OHT diabetic cases. Createnine was found almost equal in both groups. However total cholesterol and triglyceride was higher in diabetic cases (Table 4).

DISCUSSION

Orthostatic hypertension (OHT) is an indicating problem of sudden high blood pressure. In a study 8 it was reported that the prevalence of OHT in normotensive non diabetic cases was only 4.2% in 2000 aviators. Although it is more than the results of our study where it was found only 2.8%. However the major finding of the present study was the high prevalence of OHT in diabetic patients (six fold) compared with in non diabetic subjects. In particular, the prevalence of OHT in normotensive diabetic patients was higher than in normotensive non diabetic subjects. [8].

In a study conducted by Kario and others, [12] it is reported that among 110 asymptomatic elderly hypertensive patients without treatment, 7.2% had OHT. In another study[13] conducted on 1800 patients suffering with hypertension the prevalence of OHT was found around 10%. Therefore, it could be concluded that OHT is relatively common phenomenon in hypertensive patients. In our study, the prevalence of OHT in hypertensive cases was high not only in diabetic patients but also in non diabetic subjects. In contrast, in normotensive cases, the prevalence of OHT was high in diabetic patients with normal sitting blood pressure.

In western countries only a few studies have been conducted to investigate the pathogenesis of OHT[13, 14, 15]. It is known that the likely mechanisms of OHT include not only excessive venous pooling, with an initial drop in cardiac output followed by overcompensation with an excessive release of catecholamines[13]; but nephroptosis, with orthostatic activation of the renin-angiotensin system[14] and vascular adrenergic hypersensitivity [15]. However none of the diabetic patients with OHT had microalbuminuria suggestive of nephroptosis. They had a reduced mean time of vibration perception as compared to those without OHT, suggesting the presence of neuropathy. The levels of serum triglycerides remains on high level in patients with OHT but it was similar to those in hypertensive patients without OHT. Hyper triglyceridemia is a hallmark of the insulin resistance syndrome [16-18], which is associated with overstimulation of sympathetic nervous system activity[19]. In this regard, treatment of autonomic neuropathy in diabetic patients with tolrestat, an aldose reductase inhibitor, is reported to reduce orthostatic elevation of blood pressure[20]. With the result, the hypersensitivity of the cardiopulmonary baroreflex and sympathetic nervous system may contribute to the pathogenesis of OHT in the diabetic state.

In a report of Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure[10], the high prevalence of OHT supports the importance of high normal blood pressure as a risk for coronary heart disease in diabetic patients. In another study,conducted by Payen and others, [21, 22] reported that OHT may be a determining factor for development of sustained hypertension. Although the prognosis of OHT is not well defined, the increased mean CTR in patients with OHT to a level similar to that in hypertensive patients implies that OHT may accelerate vascular injury.

CONCLUSION

Orthostatic hypertension is a complication in normotensive diabetic patients as compared to non diabetic patients and it may associate with early stage of neuropathy. It can cause sustained hypertension and other complications. So physicians treating type 2 diabetic patients should take care of it.

REFERENCES

1. Fessel J, Robertson D. "Orthostatic hypertension: When pressor reflexes overcompensate". Nature Clinical Practice Nephrol 2006;**2** (8):424–431.
2. Bell, David S. Lyndonville News 2000;2(3).
3. Streeten DHP. Orthostatic Disorders of the Circulation. New York: Plenum Medical; 1987.p.116.
4. Kario K, Eguchi K, Hoshide S, Hoshide Y, Umeda Y, Mitsuhashi T, et al. "U-curve relationship between orthostatic blood pressure change and silent cerebrovascular disease in elderly hypertensives: Orthostatic hypertension as a new cardiovascular risk factor". J Am College of Cardiol 200240 (1): 133–141.
5. Wu JS, Yang YC, Lu FH, Wu CH, Chang CJ. "Population-Based Study on the Prevalence and Correlates of Orthostatic Hypotension/ Hypertension and Orthostatic Dizziness". Hypertension Research 2008;31(5):897–904.
6. Fan XH, Sun K, Zhou XL, Zhang HM, Wu HY, Hui RT. "Association of orthostatic hypertension and hypotension with target organ damage in

middle and old-aged hypertensive patients". Zhonghua yi xue za zhi 2011;91(4): 220–224.
7. Moses AM, Weinstock RS. "In memoriam: David H. P. Streeten". J Clin Endocrinol and Metabolism 2001;**86** (2).
8. Schneider EC, Truesdell D. A statistical study of the pulse rate and the arterial blood pressures in recumbency, standing and after a standard exercise. Am J Physiol 1922;61:429–474.
9. Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. I. Diagnosis and classification of diabetes mellitus: provisional report of a WHO consultation. Diabet Med 1998;15:539–553.
10. The sixth report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Arch Intern Med 1997;157:2413–2446.
11. Pfeifer MA, Cook D, Brodsky J, Tice D, Reenan A, Swedine S, et al. Quantitative evaluation of cardiac parasympathetic activity in normal and diabetic man. Diabetes 1982;31:339–345.
12. Kario K, Eguchi K, Nakagawa Y, Motai K, Shimada K: Relationship between extreme dippers and orthostatic hypertension in elderly hypertensive patients. Hypertension 1998;31: 77–82.
13. Streeten DH, Auchincloss JH, Anderson GH, Richardson RL, Thomas FD, Miller JW. Orthostatic hypertension: pathogenetic studies. Hypertension 1985;7:196–203.
14. Takada Y, Shimizu H, Kazatani Y, Azechi H, Hiwada K, Kokubu T: Orthostatic hypertension with nephroptosis and aortic disease. Arch Intern Med 1984;144:152–154.
15. Benowitz NL, Zevin S, Carlsen S, Wright J, Schambelan M, Cheitlin M: Orthostatic hypertension due to vascular adrenergic hypersensitivity. Hypertension 1996;28:42–46.
16. Pagani S, Malfatto G, Pierini S, Casati R, Masu Am, Poli M, et al. Spectral analysis of heart rate variability in the assessment of autonomic diabetic neuropathy. J Auton Nerv Syst 1988;23:143–153.
17. Gottsater A, Ahmed M, Fernlund P, Sundkvist G: Autonomic neuropathy in type 2 diabetic patients is associated with hyperinsulinaemia and hypertriglyceridaemia. Diabet Med 1999;16:49–54.
18. Howard BV: Insulin resistance and lipid metabolism (Review). Am J Cardiol 1999;84: 28J–32J.
19. Peles E, Goldstein DS, Akselrod S, Nitzan H, Azaria M, Almog S, et al. Interrelationships among measures of autonomic activity and cardiovascular risk factors during orthostasis and the oral glucose tolerance test. Clin Auton Res 1995;5:271–278.
20. Giugliano D, Acampora R, Marfella R, Maro GD, Rosa ND, Misso L, et al. Tolrestat in the primary prevention of diabetic neuropathy. Diabetes Care 1995;18:536–541.
21. Payen DM, Safar ME, Levenson JA, Totomokouo JA, Weiss YA: Prospective study of predictive factors determining borderline hypertensive individuals who develop sustained hypertension: prognostic value of increased diastolic orthostatic blood pressure. Am Heart J 1982;103:379–384.
22. Kageyama S: Autonomic function test using R-R interval variation in ECG. No to Shinkei 1984;36:433–439.

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