

## Study the Prevalence of Hypertension in Type-2 Diabetes Mellitus: A study in Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh

Md. Zahidul Islam<sup>1\*</sup>, A. S. M Shamim-Al-Azad<sup>2</sup>, Farid-Al-Hasan<sup>3</sup>

<sup>1</sup>Medical Officer, Medical Department, Power Development Board, Bangladesh

<sup>2</sup>Junior Consultant, Cardiology, 250 Bed Sadar Hospital, Patuakhali, Bangladesh

<sup>3</sup>Resident Surgeon, Department of ENT, Mymensingh Medical College, Bangladesh

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\*Corresponding author: Md. Zahidul Islam

### Abstract

### Original Research Article

**Introduction:** Diabetes mellitus is a common and a serious disease with chronic complications and constitutes a substantial burden for both patient and health care system. The prevalence of coexisting hypertension and diabetes appears to be increasing in industrialized nations because populations are aging and both hypertension and non-insulin dependant diabetes mellitus incidence increases with age. **Objective:** To study the prevalence of hypertension in Type-2 diabetic patients. **Materials and Methods:** A total of 250 diabetic patients coming to Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh during from January to March 2019 were studied and evaluated for blood pressure (BP), and macrovascular and microvascular complication. **Study Design:** A cross-sectional study. Sample Size: 250. **Results:** Prevalence of hypertension noted in 64 (25.6%) patients. BP was normal in 55 (22%), 131 (52.4%) patients were prehypertensive, 45 (18%) patients were in stage-1 hypertension, and 19 (7.6%) had stage-2 hypertension. Macrovascular complications noted in 120 (48%) and microvascular complications noted in 60 (24%) patients. **Conclusion:** From the above study, we would like to conclude that, the prevalence of hypertension is increasing in patients with diabetes mellitus due to increased insulin resistance. The presence of hypertension along with diabetes mellitus increases the complications and twofold rises in cardiovascular diseases related mortality.

**Keywords:** Hypertension, insulin resistance, macrovascular.

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## INTRODUCTION

Diabetes mellitus is a common and a serious disease with chronic complications and constitutes a substantial burden for both patient and health care system. Bangladesh increasing day by day diabetes related hypertension patients. According to the International Diabetes Federation (IDF) Diabetes Atlas 2011, the number of people living with diabetes is expected to rise from 366 million in 2011 to 552 million by 2030 if preventive programs are not put in place [1]. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030 [2]. Type-2 diabetes mellitus (T2DM) is the predominant form of diabetes worldwide, accounting for 90% of cases globally [3]. Sex, age, and ethnic background are important factors in determining the risk of developing T2DM [4]. A disturbing trend has become apparent in which the prevalence of obesity and T2DM in children is raising dramatically [5]. Cardiovascular disease is the major cause of morbidity

and mortality among diabetic patients, accounting for 75% of hospitalizations and 70-80% of deaths [6, 7]. In fact, coronary heart disease (CHD) is the leading cause of death among diabetic patients, who have a two- to fourfold higher risk of CHD mortality and incidence of nonfatal CHD events compared with patients without diabetes [8]. Diabetes mellitus and hypertension are inter-related diseases that strongly predispose an individual to atherosclerotic cardiovascular disease [9, 10]. Hypertension is about twice as frequent in individuals with diabetes as in those without [10]. The prevalence of coexisting hypertension and diabetes appears to be increasing in industrialized nations because populations are aging and both hypertension and non-insulin dependent diabetes mellitus incidence increases with age [9, 10]. Indeed, an estimated 35-75% of diabetic cardiovascular and renal complications can be attributed to hypertension [9, 10]. Hypertension also contributes to diabetic retinopathy, which is the leading cause of newly diagnosed blindness [10]. For all these

reasons, hypertension and diabetes should be recognized and treated early and aggressively. Chen *et al.*, [11] stated that hypertension to account for 30% of deaths in diabetes patients and for 25% of cardiovascular events in diabetes patients. In contrast, when hypertension and diabetes mellitus were regarded as independent, the population-attributable risk from diabetes mellitus was only 7% for all-cause mortality and 9% for any major atherosclerotic cardiovascular event.

## MATERIALS AND METHODS

It was a cross-sectional study in patients with Type-2 diabetes mellitus patients, who visited medicine outpatient department Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh during from January to March 2019. The patients were included in the study according to inclusion criteria. Samples were drawn randomly; there was no cut-off age or body mass index (BMI). The duration of the study was 3 months and for an individual patient, duration of the study was 1 day. There were no study-specific visit and the data was recorded during their routine visit to the outpatient department. Detailed history of all the patients regarding the duration of diabetes, mode of diagnosis was asked. Detailed history regarding personal habits like smoking, alcoholism, tobacco-chewing was noted. Information about family history of diabetes was recorded. General and systemic examination was done for each study subject. Physical examination was undertaken after the interview was over. It included height, weight, and blood pressure. For recording blood pressure, students were individually called in a room and were allowed to be seated quietly for 5-10 minutes to alley anxiety and restlessness. Blood pressure (BP) was recorded in sitting position in right arm, using a standard mercury sphygmomanometer with appropriate cuff size. Systolic blood pressure (SBP) was determined by the onset of the “tapping” Korotkoff sounds (K1) and fifth Korotkoff sound (K5), or the disappearance of Korotkoff sounds, was recorded as diastolic blood pressure (DBP). Hypertension was defined as average of two readings recorded 3 minutes apart on two separate occasions that are greater than or equal to SBP 140 and/or DBP 90 mm of Hg. Data was collected and entered in master sheet and statistically analysed using statistics software Statistical package for social service.

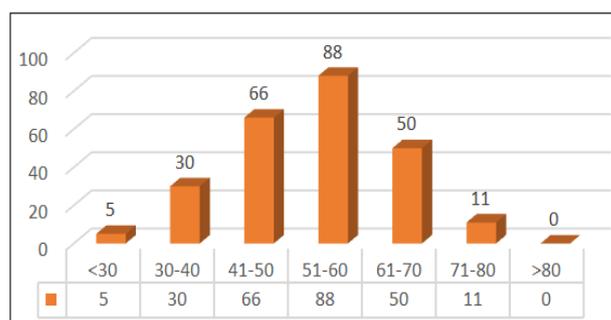
## RESULTS

A total of 250 patients were included in the study among which, 139 (55.6%) were males, 111 (44.4%) were females with male to female ratio of 1:1.256.

**Table-1: Frequency of diabetic complications (N=250)**

Complications (n=180/250)	Frequency (72%)
Macrovascular (n=120)	
CAD	76 (38)
CVD	12 (6)
PVD	47 (23.5)
Microvascular (n=60)	
Neuropathy	22 (11)
Nephropathy	88 (44)
Retinopathy	30 (15)

CAD: Coronary artery disease, CVD: Cerebrovascular disease, PVD: Peripheral vascular disease

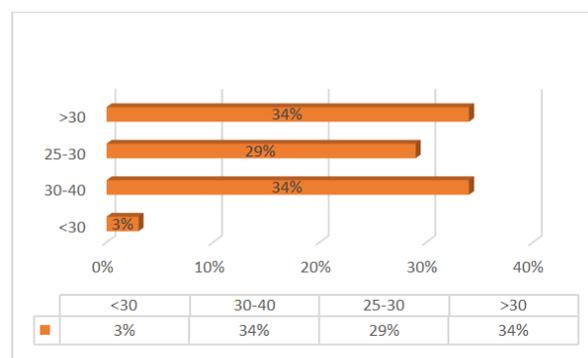


**Fig-1: Age wise distribution of patients**

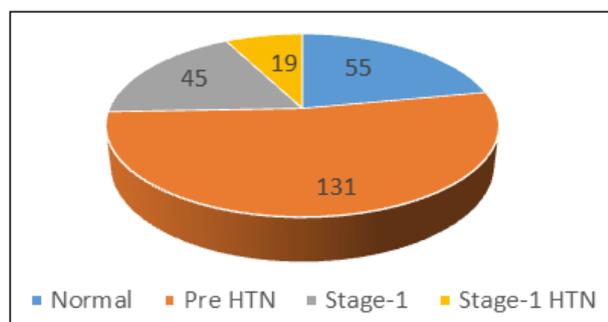
154 (61.6%) patients were in the age-group of 41-60 years with mean age of years (Figure-1). Eighty-six (34.4%) were of normal BMI, 73 (29.2%) were overweight, and 85 (34%) are obese (Figure-2). Prevalence of hypertension noted in 64 (25.6%) patients. Hypertension was present in 36 (56.25%) females and 28 (43.75%) males. BP was normal in 55 (22%), 131 (52.4%) patients were prehypertensive, 45 (18%) patients were in stage-1 hypertension, and 19 (7.6%) had stage-2 hypertension (Figure-3).

**Table-2: Prevalence of hypertension according to the duration of diabetes (N=250)**

Duration of diabetes (years)	No	Percentage
1-5	8	12.5
5-10	17	26.56
10-15	16	25
>15	23	35.9



**Fig-2: Body mass index (BMI) of patients**



**Fig-3: Blood pressure distribution among patients**

Of 250 patients, 180 (72%) patients had various microvascular- and macrovascular-related complications. Macrovascular complications noted in 120 (48%) and microvascular complications noted in 60 (24%) patients. Frequency of complications is given in (Table-1). Prevalence of hypertension according to the duration of diabetes is given in (Table-2).

## DISCUSSION

In our study, prevalence of hypertension was noted in 64 (25.6%) patients. Priya *et al.*, [12] observed hypertension in 42.7% of the patients. In a study by Ramachandran *et al.*, [13] 38% study subjects were hypertensive. Hypertension was present in 36 (56.25%) females and 28 (43.75%) males. Nephropathy was present in 88 (44%) patients. In that, 50 (56.18%) patients had hypertension. Essential hypertension accounts for the majority of hypertension in individuals with diabetes, particularly those with Type-2 diabetes, who constitute more than 90% of people with a dual diagnosis of diabetes and hypertension [9, 10]. Hypertension in insulin resistance states is generally attributed to hyperinsulinemia, with resulting increases in renal sodium retention and/or sympathetic nervous system activity. Hyperinsulinemia induces hypertension through increased renal tubular reabsorption of sodium and water, increased sympathetic nervous system activity, proliferation of vascular smooth muscle cells, and alterations of transmembrane cation transport. At physiological concentrations, insulin decreases urinary sodium excretion, an action mediated by binding to specific high-affinity receptors [14]. However, recent data suggest that cellular insulin resistance, rather than hyperinsulinemia *per se*, may lead to hypertension [15]. Recent observations suggest that impaired cellular response to insulin predisposes to increased vascular smooth muscle (VSM) tone (the hallmark of hypertension in the diabetic state). For example, recently reported studies from laboratory demonstrate that insulin in physiological doses attenuates the vascular contractile response to phenylephrine, serotonin, and potassium chloride. Thus, insulin appears to normally modulate (attenuate) VSM contractile responses to vasoactive factors, and insulin resistance should accordingly be associated with enhanced vascular reactivity [15]. Abnormal VSM cell calcium [ $Ca^{2+}$  +  $I_i$ ] homeostasis may be the nexus between insulin

resistance and increased VSM tone. Insulin stimulates membrane Ca-ATPase, blocks  $Ca^{2+}$  currents, and  $Ca^{2+}$ -driven action potentials. Thus, an insulin-resistant state as exists in the Zucker rat may be associated with increased  $Ca^{2+}$  influx through voltage-dependent sarcolemma  $Ca^{2+}$  channels and/or decreased production or activation of the VSM cell Ca-ATPase pump. The resulting sustained rise in VSM [ $Ca^{2+}$ ]; could then account, in part, for increased VSM tone characteristic of hypertension associated with non-insulin-dependent diabetes mellitus [15]. The overabundance of oxidants is mechanistically connected with the multifactorial etiology of insulin resistance, primarily in skeletal muscle tissue, and the subsequent development of Type-2 diabetes. Two important mechanisms for this oxidant excess are 1) the mitochondrial overproduction of hydrogen peroxide and superoxide ion in conditions of energy surplus and 2) the enhanced activation of cellular nicotinamide adenine dinucleotide phosphate-oxidase via angiotensin II (AT1) receptors. Several recent studies are reviewed that support the concept that direct exposure of mammalian skeletal muscle to an oxidant stress (including hydrogen peroxide) results in stimulation of the serine kinase p38 mitogen-activated protein kinase (p38 MAPK), and that the engagement of this stress-activated p38 MAPK signaling is mechanistically associated with diminished insulin-dependent stimulation of insulin signaling elements and glucose transport activity. The beneficial interactions between the antioxidant  $\alpha$ -lipoic acid and the advanced glycation end product inhibitor pyridoxamine to ameliorate oxidant stress-associated defects in whole-body and skeletal muscle insulin action in the obese Zucker rat, a model of pre-diabetes, are also addressed. It emphasizes the importance of oxidative stress in the development of insulin resistance in mammalian skeletal muscle tissue, at least in part via a p38 MAPK-dependent mechanism, and indicates that interventions that reduce this oxidative stress and oxidative damage can improve insulin action in insulin-resistant animal models. Strategies to prevent and ameliorate oxidative stress remain important in the overall treatment of insulin resistance and Type-2 diabetes [16]. Hypertension often antedates and likely contributes to the development of nephropathy in many diabetic individuals [17, 18]. Diabetic nephropathy, which occurs after 15 years of diabetes in one-third of people with insulin dependent diabetes mellitus (Type-1 diabetes) and 20% of those with NIDDM, is an important contributing factor to the development of hypertension in the diabetic individual [9]. The high BP associated with diabetic nephropathy is usually characterized by sodium and fluid retention and increased peripheral vascular resistance [10]. Isolated systolic hypertension is considerably more common in diabetics, and supine hypertension with orthostatic hypotension is not uncommon in diabetic individuals with autonomic neuropathy [9]. Although hypertension and diabetes mellitus are both independent risk factors

for ischemic heart disease, insulin resistance, and hyperinsulinemia associated with hypertension and NIDDM also likely contribute to accelerated atherogenesis [19-21]. Hypertension is acknowledged to be a major risk factor in the progression of diabetic renal disease [10]. Diabetic nephropathy, defined as the appearance of proteinuria, elevated arterial BP, and diminished glomerular filtration rate, will develop in as many as 40% of IDDM patients [10].

## CONCLUSION

From the above study, we would like to conclude that, the prevalence of hypertension is increasing in patients with diabetes mellitus due to increased insulin resistance. The presence of hypertension along with diabetes mellitus increases the complications and twofold rises in cardiovascular diseases related mortality. The complications of diabetes increases in the presence of hypertension. Early evaluation for hypertension and periodic evaluation of patient with pre hypertension, applying life style modifications and prompt treatment of hypertension and hyperglycemia will favours the good outcome.

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