ASSESSMENT OF RISK FACTORS AND COMPLICATIONS OF DIABETES MELLITUS IN DIFFERENT STAGES OF HYPERTENSION: A RETROSPECTIVE COHORT STUDY FROM A MAJOR METROPOLITAN CITY OF PAKISTAN

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ABSTRACT

Diabetes mellitus is a group of metabolic disorders clinically manifested by hyperglycemia. Diabetic patient having hypertension has more chances of heart diseases, peripheral vascular disease, nephropathy and retinopathy. The aim of the study was to evaluate the prevalence of risk factors and related complications in diabetic patients having hypertension. This retrospective observational study was conducted by enrolling 250 patients for study. Results have indicated that there was higher percentage of female diabetics (60.16%) as compared to males due to more prevalence of obesity in females. Patients in pre-hypertensive stage were having more risk factors; salt intake (66.42%), fat intake (67.8%), aerobic exercise <30 minutes (70.2%) and even 50% were not exercising. They were experiencing more symptoms and complications such as thirst (63.1%), dryness of mouth (60.33%), loss of appetite (59.2%), abdominal pain (67.1%), nausea and vomiting (56.3%), frequent urination (56.7%) and high blood sugar level (56.33%). About 92.30% patients were satisfied with the treatment and were following the instructions by the doctors. The study inferred that the risk factors and complications related to diabetes were more prevalent in pre-hypertensive stage which could progress the disease to advanced stages.

Keywords: Hypertension, Co-morbidities, Risk factors, Diabetes Mellitus, Pre-hypertension

INTRODUCTION

Diabetes mellitus is a metabolic disorder in which glucose level in the blood increases above normal. In diabetic patients, insulin is not produced in the body or its action is not proper or both resulting in abnormalities like disturbance in carbohydrate, protein and fat metabolism (Alberti and Zimmet, 1998). Type 1 diabetes mellitus is due to the destruction of beta cell which is destruction, insulin is not produced in the body. It is usually diagnosed by the presence of insulin antibodies responsible for the secretion of insulin; as a result of this (Association 2008). In some cases antibodies of own and anti GAD (glutamic acid decarboxylase), an enzyme that catalyzes the decarboxylation of glutamate to GABA immune system attack on the GAD_{67} and GAD_{65} of diabetes mellitus type 1 result in latent autoimmune called non insulin diabetes mellitus (NIDDM) (Consultation, 1999), in which cells become resistant to respond properly to the body insulin. Various factors diabetes (Erlander *et al*., 1992). Type 2 diabetes mellitus is also involved in Type 2 diabetes such as environmental and genetic but it is generally caused by the glucose intolerance caused by obesity and sedentary behavior among people (Lindström *et al*., 2001). An equal risk of type 2 diabetes mellitus may exist in person of normal body weight who is taking alcohol and smoking (Manson *et al*., 2001). As regard as the genetic factor, a gene is involved which encodes the calpain-10, belongs to calpain like cystein protease family (Oda *et al*., 2000).

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Gestational diabetes is characterized by poor carbohydrate tolerance result in high blood sugar level at start of pregnancy without any diabetic history. In obese women with poor glucose tolerance and age above 25 years have suffered from gestational diabetes more frequently than other women. Diabetes can cause various complications such as polyuria, polyphagia, polydipsia, kidney failure, numbness, weight reduction, blurred vision and end organ damage (Kumar, 2013). Diabetic ketoacidosis and hyper osmotic hyperglycemia are the serious metabolic derangements of diabetes. Probability of hyper osmotic hyperglycemia occurs mostly in Type 2 diabetes mellitus having preceding concomitant illness like infection and in acute cases this condition may cause coma leading to death (DiPiro *et al*., 2006).

The risk of coronary heart disease is much greater in diabetic patients than non-diabetic. Various factors contributing in coronary heart disease (CHD) include smoking, hypertension, higher level of LDL and triglyceride whereas lower level of HDL (Millns *et al*., 1998). CHD risk increases by 25% for every rise in 5-10mmHg systolic blood pressure (Group, 2010). Patient having essential hypertension usually also have high level of circulating blood insulin than expected and it becomes more severe when hypertension is treated by diuretics or beta blockers.

Actually high insulin level in blood promote inhibition of sodium pump, as a result, sodium is retained and sympathetic system is activated (Hamilton, 1990). Diabetic patient having hypertension has more chances of heart diseases, peripheral vascular disease, and kidney disease e.g. nephropathy, damage of retina of the eye which leads to blindness. Purpose of hypertension treatment in diabetic patient is to control blood pressure and reduce the risk of cardiac diseases (Epstein and Sowers 1992) as the risk is more in diabetic compared to hypertensive person (Yeh *et al*., 2000). This present study aimed to assess the prevalence of risk factors and complications of diabetes mellitus in different stages of hypertension.

SUBJECTS AND METHODS

Study design
A retrospective observational study of three months duration was designed to assess the prevalent risks, complications and co morbidities in diabetes patients presenting to two major tertiary hospitals of Lahore, Pakistan.

Inclusion criteria
All diabetic patients irrespective of their age, gender, concomitant disease, education and ethnic background were enrolled for the study.

Exclusion criteria
Non diabetic and little on type 1 diabetes clinical presentation.

Study center
Data were collected from the two major tertiary care hospitals of Lahore; Jinnah hospital and Mayo Hospital.

Ethical approval
Ethical approval for the study was obtained from Ethical Committee of the Punjab University College of Pharmacy, University of the Punjab, reference number (EC/UCP/092/2015) and Hospital committee of Ethics on Human Research.

Study population
A total of 250 patients were enrolled from these hospitals. As per the hospital wise patient distribution, 150 were enrolled from Jinnah hospital, 100 were enrolled from Mayo Hospital.

Instrument of measure and data collection
A comprehensive questionnaire fulfilling the study needs and objectives were designed based on basic demographics, clinical characteristics, non-pharmacological and pharmacological interventions, risks and complications. Notable parameters include co morbidities and lab values. Informed consent was obtained from all the enrolled patients.

Data analysis
The data were analyzed using the SPSS software (IBM, version 21). Descriptive statistics was performed using SPSS. Pair-wise comparison was done employing student-t test. An alpha value of 0.05 or less is considered statistically significant.

RESULTS

Demographics
Retrospective study on 247 diabetic patients was designed and assigned 3 groups (pre hypertension, stage 1, stage 2) on the basis of stages of hypertension as shown in Table I. Out of 247 diabetic patients 155 (62.7%) were pre hypertensive, 63 (25.50%) were of stage 1 and 29 (11.74%) were of stage 2 hypertension. The count of female was higher than male patients as they were 148 (60.16%) of total patients out of them 91(61.4%) were pre hypertensive, 39 (26.3%) were stage 1 and 18 (12.16) were stage 2 hypertensive. However, about 98 (39.83%) patients were male and out of them 64(65.3%) were pre hypertensive, 23(23.4%) were stage 1 and 11(11.2%) were of stage 2 hypertensive. The mean of ages of the pre hypertensive patients was 50.909±10.65 while 54.079 ± 9.76, 52.103 ± 9.03 were of stage 1 and stage 2

hypertensive respectively. Married patients were more in number that had diabetes along with hypertension. The 234 (94.7%) patients from total diabetic hypertensive patients were married, out of them 148 (63.2%) were of pre-hypertensive, 59 (25.2%) were stage 1 and 27 (11.5%) were stage 2 hypertensive. The majority of them were housewives suffering from diabetes with hypertension 84 (34.0%). From housewives mostly are of pre hypertension that are 57 (67.8) of total count. The least count in occupation was found of self-employed that was only 14 (5.66%) from total patients. While the counts of own business, salaried worker, unemployed were 29 (11.7%), 41 (16.95%) and 79 (31.98%) respectively. Data analysis showed that genetic factor was involved in majority of patients as 138 (55.87%) were having family history of diabetes. From the patients that had family history of diabetes mostly were of pre hypertension (63.04%), while least were of stage 2 (12.13%).

Table I: Basic demographics

Parameters	Pre-hypertension (N=155)	Stage 1 (N=63)	Stage 2 (N=29)	Total (N=247)
Age	50.909±10.65	54.079±9.76	52.103±9.03	51.858±10.31
Gender				
Male	64/98(65.3%)	23/98(23.4%)	11/98(11.2%)	98/246(39.83%)
Female	91/148(61.4%)	39/148(26.3%)	18/148(12.2%)	148/246(60.16%)
Weight (kg)	68.05±14.57	68.50±13.24	67.72±22.43	68.12±15.31
Height (cm)	362.73±2223.14	165.31±11.9	166.43±9.38	291.07±1773
BMI	25.93±5.64	26.39±4.49	25.57±3.91	25.99±5.14
BSR (g/dL)	252.37±94.49	257.43±115.76	267.92±148.52	255.60±107.63
Marital status				
Single	2/3(66.6%)	1/3(33.3%)	0/3(0%)	3/247 (1.21%)
Married	148/234 (63.2%)	59/23 4(25.2%)	27/234 (11.5%)	234/247 (94.7%)
Widow	5/10(50%)	3/10(30%)	2/10(20%)	10/247 (4.04%)
Occupation				
House wife	57/84 (67.8%)	20/84 (2.38%)	7/84 (8.33%)	84/247 (34.0%)
Own business	17/29 (58.6%)	7/29 (24.13%)	5/29 (24.1%)	29/247 (11.7%)
Social worker	22/41 (53.65%)	13/41 (44.8%)	6/41 (14.63%)	41/247 (16.95%)
Self employed	12/14 (85.7%)	1/14(7.14%)	1/14(7.14%)	14/247 (5.66%)
Unemployed	47/79 (59.4%)	22/79 (27.8%)	10/79 (12.65%)	79/247 (31.98%)
Ethnicity				
Pathan	3/3(100%)	0/3(0%)	0/3(0%)	3/247 (1.21%)
Punjabi	149/240 (62.0%)	62/240 (25.8%)	29/240 (12.0%)	240/247 (97.1%)
Pashto	3/4(75%)	1/4(25%)	0/4(0%)	4/247 (1.61%)
Family History	87/138(63.04%)	34/138(24.63%)	17/138(12.31%)	138/247(55.87%)

Drugs used by the patients
Figure 1 Patients data show that 106/243 (43.63%) were using sulfonylurea, 78/243(32.09%) metformin, 32/243 (13.16%) insulin and 31 (12%) were on combination therapy for Diabetes mellitus. It also shows the variation in B.P among the patients.

Dietary and other risk factors for hypertension
Table II showed that higher no. of patient were taking low sugar, their count was 141 (57.0%), out of them 81 (57.4%) were pre-hypertensive while 40 (28.3%), 20 (14.1%) were of stage 1 and stage 2 hypertension respectively. The lower count of patients was taking higher sugar 17 (6.88%). Majority of the patients were taking moderate salt in their diet, their count was 140 (56.68%) of total patients out of them 93 (66.42%) were pre hypertensive while 31 (22.14%), 16 (11.42%) were of stage 1 and 2 respectively. Total patients 143 (57.89%) were on moderate fat intake, majority of them were pre-hypertensive (67.8%), while 21.6% and 10.4% were of stage 1 and 2. The least count of patients was on high fat diet; their count was 13 (5.26%). Out of 247 patients that underwent study 84 (37.1%) walked for less than 30 min, out of them 59 (70.2%) were pre hypertensive, 22 (26.1%), 3 (3.5%) were of stage 1 and 2. The count of patients that did exercise for greater than 30 minutes were 47 (70.1%), 13 (19.4%), 7 (10.44%) were of pre-hypertension, stage 1 and stage 2 respectively. The 47
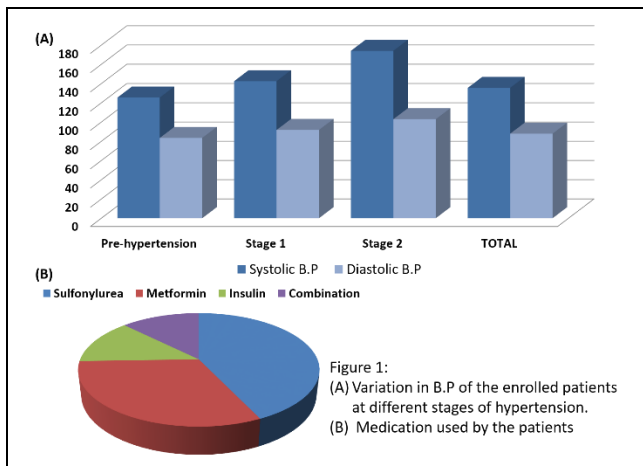
Figure 1:
(A) Variation in B.P of the enrolled patients at different stages of hypertension.
(B) Medication used by the patients

Figure1: Variation in BP and types of drugs used by the enrolled patients

(70.1%), 13 (19.4%), 7 (10.44%) were of pre-hypertension, stage 1 and stage 2 respectively. The count of patients that didn't exercise was 50 (20.24%) from them 25 (50%), 15 (30%) and 10 (20%) were of pre-hypertensive, stage 1 and stage 2 respectively. However, 196 (79.35%) patients were nonsmokers out of which 122 (62.24%) were of pre-hypertension, while 51 (26.02%) and 23 (11.73%) were of Stage 1 and 2 respectively and smokers were 51/247(20.64%). Obese feelings were among the 65 (26.31%) patients belonging to 40 (61.53%) were pre-hypertensive 14 (21.52%), 11 (16.92%) were of Stage 1 and 2. 167 (67.31%) patients did not consider themselves to be obese. There were only 24 (9.71%) patients who did not have any idea about being obese. These all risk factors were more in pre-hypertensive patients which can affect the progression and complication of the HTN to stage 1 and 2.

Table II: Dietary and other risk factors for Hypertension

Parameters	Pre-hypertension	Stage 1	Stage 2	Total
Sugar intake				
High	11/17(64.7%)	4/17(23.5%)	2/17(11.7%)	17/247(6.88%)
Low	81/141(57.4%)	40/141(28.3%)	20/141(14.1%)	141/247(57.08%)
Moderate	63/89(70.7%)	19/89(21.3%)	7/89(7.8%)	89/247(36.03%)
Salt intake				
High	8/17(47.0%)	7/17(41.1%)	2/17(11.7%)	17/247(6.88%)
Low	54/90(60%)	25/90(27.7%)	11/90(12.2%)	90/247(36.43%)
Moderate	93/140(66.42%)	31/140(22.14%)	16/140(11.43%)	140/247(56.68%)
Fat intake				
High	7/13(53.8%)	6/13(46.1%)	0/13(0%)	13/247(5.26%)
Low	51/91(56.0%)	26/91(28.5%)	14/91(15.3%)	91/247(36.84%)
Moderate	97/143(67.8%)	31/143(21.6%)	15/143(10.4%)	143/247(57.89%)
Diet				
Beans	2/3(66.6%)	1/3(33.3%)	0(0%)	3/247 (1.21%)
Cereals	26/37(70.2%)	5/37(13.5%)	6/37(16.2%)	37/247(14.97%)
Cereals ,beans	8/14(57.1%)	5/14(35.7%)	1/14(7.14%)	14/247(5.66%)
Rice ,pasta	3/13(23.0%)	0(0%)	0(0%)	13/247(5.26%)
Cereals ,rice	45/90(50%)	33/90(36.6%)	12/90(13.3%)	90/247(36.43%)
Cereals, rice, beans	38/47(80.8%)	3/47(6.3%)	6/47(12.7%)	47/247(19.02%)
Pasta, cereals	1/1(100%)	0(0%)	0(0%)	1/247(0.40%)
Rice, beans	19/26(73.0%)	5/26(19.2%)	2/26(7.6%)	26/247(10.52%)
Smocking	33/51(64.7%)	12/51(23.52%)	6/51(11.74%)	51/247(20.64%)
Feeling obese	40/65(61.53%)	14/65(21.52%)	11/65(16.92%)	65/247 (26.31%)

Signs, symptoms and complications of diabetes

Table III shows that 190 (76.92%) patients complained of increased thirst, out of which, 120 (63.1%), 48 (25.2%), 22 (11.57%) patients were pre-hypertensive, stage 1 and 2. Majority of patients 179 (72.46%) were found to face dryness of mouth out of which 108 (60.33%) were pre-hypertensive, 49 (27.37%), 22 (12.29%) were of Stage 1 and 2. Of total patients 103 (41.70%) patients experience an increase in appetite out of which 61 (59.2%) were pre-hypertensive, and 30 (29.1%), 12 (11.65%) were of stage 1 and 2. abdominal pain was present in 70 (28.34%) patients out of which 47 (67.1%), 14 (20%), 9 (12.8%) were pre-hypertensive, stage 1 and stage 2. Only 87 (35.22%) patients were found to experience nausea and vomiting out of which 49 (56.3%) were pre-hypertensive, 25 (28.7%), 13(14.9%) were of stage 1 and 2.

A total of 162 (65.5%) patients were found facing frequent urination out of which 92 (56.7%) were pre-hypertensive, and 46 (28.3%), 24 (15%) were of stage 1 and 2. About 142 (59.91%) patients were suffering from high blood sugar, out of them 80 (56.33%) were pre hypertensive, 40 (28.1%), 22 (15.4%) were stage 1 and stage 2 hypertensive patients. Complain of morning headache was present in 104 (42.1%), out of them 55 (52.8%), 33 (31.7%) and 16 (15.3%) were of pre hypertension stage 1 and stage 2. About 141(57.08%) patients had their own glucometer, on the other hand 106 (42.91%) did not have glucometer. Data analysis showed that mostly diabetic patients had problem in hearing and seeing as 128 (51.82%) patients found to suffer from this problem. Out of them 76 (59.37%) patients were pre hypertensive, 33 (25.78%), 19 (14.84%) were of stage 1 and 2 respectively while 119 (48.17%) patients did not experience these problems.

Most of them were of pre hypertension (66.38%). A total of 103 (41.0%) patients had retinopathy and nephropathy. From them 62 (60.19%) were pre hypertensive, while 25

(24.27%), 16 (15.53%) were of stage 1 and 2. Numbness in feet was major problem of diabetic patients. 101 (58.72%) were pre-hypertensive, 45 (26.16%) were of stage 1 and 26 (15.11%) were 0f stage 2 that had this problem. Heart problem was also seen in mostly diabetic patients 143 (57.89%), 65 (45.45%) were pre hypertensive, 54 (37.7%) and 24 (16.78%) were of stage 1 and 2 respectively. Mostly patients were stressed due to diabetes.157 (63.56%) out of 247 went through this situation in which 97 (61.78%) were pre-hypertensive, 38 (24.20%), 22 (14.01%) were of stage 1 and 2.90 (36.43%) remained normal. Diabetics had different feeling about their disease. Some were had angry, frustrated, while some were stressed. 90 (36.43%) patients were frustrated out of which 50 (55.5%) were of pre hypertension, 25 (27.7%), 15 (16.66%) were of stage 1 and stage 2 respectively. 48 (19.43%) patients were angry while 1 (0.40%), 11 (4.45%) were guilty and stressed. Associated with the above risk factors symptoms and complications are more prominently present in pre-hypertensive category as compare to stage 1 and 2.

Table III: Symptoms and complications of diabetes

Parameters	Pre-hypertension	Stage 1	Stage 2	Total
Increased thirst	120/190(63.1%)	48/190(25.2%)	22/190(11.57%)	190/247(76.92%)
Dry mouth	108/179(60.33%)	49/179(27.37%)	22/179(12.29%)	179/247(72.46%)
Increased appetite	61/103(59.2%)	30/103(29.1%)	12/103(11.65%)	103/247(41.70%)
Abdominal pain	47/70(67.1%)	14/70(20%)	9/70(12.8%)	70/247 (28.34%)
Nausea/vomiting	49/87(56.3%)	25/87(28.7%)	13/87 (14.9%)	87/247 (35.22%)
Frequent urination	92/162 (56.7%)	46/162(28.3%)	24/162(15%)	162/247 (65.5%)
Urination at night	63(40.6%)	40(25.8%)	23(14.8%)	155/247(62.75%)
High sugar level	80(56.33%)	40(28.1%)	22(15.4%)	142/237(59.91%)
Headache	55(52.8%)	33(31.7%)	16(15.3%)	104/247 (42.1%)
Glucometer	82/141	42/141(29.7%)	17/141(12.0%)	141/247(57.08%)
Hearing & seeing problem	76/128 (59.37%)	33/128 (25.78%)	19/128 (14.84%)	128/247(51.82%)
Food allergy	9/17(52.94)	8/17(47.05%)	0	17/247(6.88%)
Eyes/kidney problem	62/103(60.19%)	25/103(24.27%)	16/103(15.53%)	103/247(41.0%)
Numbness in feet	101/172(58.72%)	45/172(26.16%)	26/172(15.11%)	172/247(69.63%)
B.P/heart problem	65/143(45.45%)	54/143(37.76%)	24/143(16.78%)	143/247(7.89%)
Other aspects	88/148(59.45%)	41/148(27.70%)	19/148(12.83%)	148/247(59.91%)
Stress	97/157(61.78%)	38/157(24.20%)	22/157(14.01%)	157/247(63.56%)

Patient compliance and counseling

Table IV shows that 228 (92.30%) patients were found to be satisfied with the prescribed medication out of which, 144 (63.15%) were pre-hypertensive, 59 (25.87%), 25 (10.96%) were of stage 1 and 2. About 236 (95.54%) patients regularly followed Doctor's prescription out of which 151 (63.98%) were of pre hypertension, 58(24.57%), 27 (11.44%) were of Stage 1 and 2. About

195 (78.94%) patients claimed that the medication did not affect their finances of which 119 (61.02%) patients were pre hypertensive 56 (28.71%), 20 (10.25%) patients were of Stage 1 and 2. Those patients whose finances were affected by treatment were 52 (21.05%). Patients whose disease presented Family Issues were 109 (44.12%) meanwhile 138 (55.87%) did not have any disease related family issues. To 178 (72.06%) patients, medicine was not

dispensed by pharmacist of those, 113 (63.48%) were pre-hypertensive 45 (25.28%), 20 (11.23%) patients were of stage 1 and 2. Only 69 (27.93%) patients were those whose medicine was dispensed by pharmacist. A total of 197 (79.75%) patients were those who never got information regarding their drug from pharmacist of which 129 (65.48%), 48 (24.66%), 20 (10.15%) were of pre-hypertension stage 1 and 2 respectively. Only 50 (20.24%) were those patients who used to take information about their drugs from pharmacists. Only A minority of patients 20 (8.09%) enquired about possible drug interactions while a majority of 227 (91.90%) patients did not enquire about possible drug interactions. Only 23 (9.31%) patients asked for a cheaper substitute of drugs prescribed while 224 (90.68%) did not ask for cheaper substitute of drug. These parameters were more satisfactory in pre-hypertensive stage than that of stage 1 and 2.

Table IV: Patient Compliance and counseling by Pharmacist by the enrolled patients

Parameters	Pre-hypertension	Stage 1	Stage 2	Total
Satisfied with medicine	144/228 (63.15)	59/228 (25.87%)	25/228 (10.96)	228/247(92.30%)
Follow the prescription	151/236 (63.98)	58/236 (24.57%)	27/236 (11.44%)	236/247(95.54%)
Satisfied with consultation	147/234(62.82%)	59/234 (25.21%)	28/234 (11.96%)	234/247(94.73%)
Treatment affected by finance	36/52 (69.23%)	7/52 (13.46%)	9/52 (17.30%)	52/247 (21.05%)
Family issues	73/109 (66.97%)	21/109 (19.26%)	15/10 (13.76%)	109/247(44.12%)
Ever dispensed by pharmacist	42/69 (60.86%)	18/69 (26.08%)	9/69(13.04%)	69/247 (27.93%)
Ever counseled from pharmacist	26/50 (52%)	15/50 (30%)	9/50 (18%)	50/247(20.24%)
Ever asked about ADRs	21/38 (55.26%)	11/38(28.94%)	6/38(15.78%)	38/247 (15.38%)
Ever asked about interactions	10/20(50%)	6/20(30%)	4/20(20%)	20/247 (8.09%)
Ever asked about substitution	11/23 (47.82%)	6/23(26.08%)	6/23(26.08%)	23/247 (9.31%)

DISCUSSION

A retrospective cross sectional study was conducted. According to that there was higher percentage of female diabetics as compared to males. Obesity, an important contributor of diabetes mellitus, was more prevalent in females. Probably the reason is that females have less physical activity as compared to men so obesity will be more prevalent in females (Mobarhan *et al*., 2008). Similarly diabetes was majorly seen in housewives because they spend most of their time in sedentary behavior. Diabetics should do exercise regularly and should participate in other physical activities in order to achieve glycemic control (Haddad *et al*., 2001). However, according to study most of the patients do not exercise or do less than half an hour. Our results have shown that majority of patients has family history of diabetes mellitus because it is a hereditary disease that can be transferred from one generation to another. Diabetes is a major risk factor for cardiovascular events. According to the results mentioned in the above table majority of diabetic patients has heart problem, difficulty in hearing and complication of retinopathy, which is due to prolonged hyperglycemia leading to damage of small blood vessels of retina of eye. Retinopathy leads to blindness if left untreated, chances of this complication increase with the increasing age of patients also with the uncontrolled sugar level and hypertension. Numbness in feet is the major problem in diabetics because of development of neuropathy. This occurs with the passage of time and also because of poor glycemic control (Said, 2007). Results have shown polyphagia, polydipsia, polyuria and complain of thirst again and again in patients due to high glucose level, the body try to remedy the situation by removing glucose from the blood through the kidneys. When this happens, the kidney will filter more water and patient urinates more than frequently. Complain of stress, frustrated behavior among patients under study is due to release of mediators (Wellen and Hotamisligil, 2005).

The prevalence of stressful behavior and its symptoms are more in diabetes mellitus. The factors related to symptoms of depression include obesity enhancing health behavior and activation of neuro-endocrine and inflammatory response. These factors result in increased mediators can cause insulin resistance and development of Type 2 diabetes (Lazo *et al*., 2008). The results show that prevalence of hypertension among diabetic patients is high as compared to non-diabetic patients. According to Bedford survey, the recently detected diabetic patients and those that has borderline diabetes have significantly high level of systolic blood pressure than those patients whose blood sugar level is normalized. So the blood sugar level must be controlled.

CONCLUSION

It is concluded that diabetic patients are more susceptible to hypertension. The risk factors and complications related to diabetes were more prevalent in pre-hypertensive stage leading the patient to stage 1 and 2.

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