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DIABETES MELLITUS TYPE 2;
COMPLICATIONS IN MEDICAL WARD LAHORE GENERAL HOSPITAL.

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ABSTRACT… Objectives: The objective to identify prevalence of different types of type 2 Diabetes in our population and relate them with the Gender and Duration of disease. **Study Design:** Retrospective study. **Period**: January 2014 to December 2015, 2 years. **Setting:** Lahore General Hospital, Lahore. **Method:** On admitted record of 269 patients (171 Men and 98 females), known to have complications during ward stay. Data was analyzed on SPSS 20 and results calculated. **Results:** 232 patients (86.2%) showed one or more complications. Most common was diabetic nephropathy 117 (43.5% patients), followed by diabetic foot 94 (34.9%), and then others. A comparison between genders exposed, an equal distribution of complications. 233 patients had poor blood sugar control, with 107 having hypertension. When duration was considered as a variable over a period of 10 years, maximum complication was of diabetic foot (66), followed by renal failure (64). Main reason identified was non-compliance to medication and infrequent follow-ups. When a less duration of 5 years was put as variable, there were very few complications, with their total number reduced to 24. **Conclusion:** Type 2 Diabetes causes higher number of complications. Frequency among different genders was similar. They were associated with high prevalence of risk factors, such as poor blood sugar control, concomitant hypertension and poor compliance to medication. Duration of disease has impact on the complications.

Key words: Diabetes mellitus type 2, complications, risk factors.

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INTRODUCTION

Diabetes mellitus is growing quickly, and is one of most exponentially spreading disease worldwide, which is well documented in recent literature. The sixth edition of the International Diabetes Federation (IDF) World Diabetes Atlas points to the statistic, that the count will rise from 382 million today to 592 million in 2035.[1] Currently, the WHO literature is suggesting a figure of 8.6% in Pakistan, with a further division of 11.1% and 13.9% in the provinces of NWFP and Sindh.[2,3] Globally, diabetes is a killer. 4.6 million people lost life because of this disease in 2013 alone.[4] More than 77% of morbidity and 88 % of mortality is documented in low and middle income countries, and is ever increasing suggested from previous literature.[5,6] Studies from United States (U.S) and United Kingdom (U.K)predict annual medical expense of $176 billion and £10 billion, effecting both genders and all ages.[7,8] As a leading cause of morbidity and mortality, diabetes causes a variety of both micro and macro-vascular complications, including retinopathy, nephropathy, neuropathy, stroke and myocardial infarction.[9,10,11]

Non-insulin-dependent diabetes mellitus (NIDDM) was the leading cause in 85-90% of diabetic population in the U.S.[12]High blood sugar was present in both insulin-dependent diabetes mellitus (IDDM) and NIDDM patients. The two types were different however, different totally when age of onset, physique, ancestral and cultural occurrence rates, and primary pathophysiology were considered. Epidemiology of Diabetes Interventions and Complications (EDIC) study and other similar trials have shown that diabetes exerts powerful effect on complications, with alarming effects of physiological control of blood sugar on micro and macro-vascular complications of the disease. All these pathophysiological

changes were estimated to bring change in the clinical progression of T1DM.[13,14]

Trials have revealed that rigorous sugar control in patients with diabetes diminishes the progression of micro-vascular disease. However, the outcome on macro-vascular complications remains indeterminate. In epidemiologic studies, the link between glucose control and cardiovascular disease has not been consistent.[15-17] Short-term trials have put forward either advantage or opposing effects of this control. The Diabetes Control and Complications Trial (DCCT) disclosed that intensive glycemic control, very close to normal range, decreased the complications rate of clinical neuropathy by 60– 69%, and a similar drops was noted for other clinical and investigational complications.[18]

The aim of this study was to determine frequency of complications in type 2 diabetes in our population, in correlation with the gender and duration of diabetes, which will help to guide medical authorities in further accelerating efforts for better control of disease. It will decrease the economic burden and improve quality of life of our patients, distressed with diabetes mellitus.

MATERIAL AND METHODS

A cross sectional study was conducted in Medicine department of Lahore General Hospital, from January to December 2015, who were admitted during this period. Total of 500 patients suffering from type 2 diabetes mellitus were included. Patient age ranged from 40-70 years in both genders. It was noted that every diabetic had a duration of more than 5 years. Previous glycemic control was assessed by measuring glycosylated hemoglobin (HbA1c) by DiaSTAT. Blood glucose was assessed with fasting plasma glucose (FPG), by glucose oxidase method. Enzymatic methods (GPO-PAP and CHOD-PAP) were used for total cholesterol, which was also used for high density lipoproteins, Low density Lipoproteins and triglycerides. Body mass index (BMI) was considered with the standard formula and obesity was measured at BMI more than 30 kg/m2, overweight between 25.1 to 30 kg/m2 and less than 25 kg/m^2 value was reflected as normal. Funds was examined using routine ophthalmoscope. Nephropathy was demarcated by way of protein more than 1+on dipstick (Combur 10, Rouche Diagnostics) and with no other abnormal findings on routine urine examination. Peripheral neuropathy was taken as absent touch or vibratory feelings in feet, using 10 Gm monofilament and Neurotheisiometer, respectively. Patients with established coronary artery disease and stroke were considered having proven macro-vascular complication. In patients with absent dorsalis pedis or posterior tibial pulses, whether history of intermittent claudication was present or not, we considered them as having established peripheral vascular disease (PVD). Data was analyzed on SPSS version 20. To evaluate the statistical significance of the sample mean with standard cutoff value, one-sample t-test was used. To measure association of chronic complications with age and gender, patients were categorized into respective groups. Frequency of chronic complications in young and old subjects with male and female patients, were calculated. Chi-square test was used to assess the statistical significance of these differences.

RESULTS

Minimum age of the patients in our study was 42 years, maximum 68, and mean of 56, with STD + 6.13 years. Minimum duration of diabetes was 8 years, maximum 18, and mean 14.48 years with STD + 2.18 years. Minimum HbA_1c level was 6.3, maximum 8.8, mean 7.69, and STD + 0.71721. Minimum and maximum cholesterol level were 157 mg/dl and 264 mg/dl, mean was 220 mg/dl and STD + 30 mg/dl. For triglyceride, minimum and maximum were 127 and 178 mg/dl, and mean 154.08 mg/dl with STD + 14.698 mg/dl. For LDL, minimum and maximum values were 115 and 153 mg/dl and mean 133 mg/dl, with STD of + 10.43mg/dl. BMI level normal was minimum and maximum 25 and 36, and mean 30 with STD of + 3.25. Fasting blood sugar level was minimum and maximum 76 and 212 mg/dl, mean 139 mg/dl with STD + 27.449. Random blood sugar level was minimum 145 mg/dl, maximum 274 mg/dl and mean 209 mg/dl with STD + 33.89mg/dl. Minimum and maximum systolic blood pressure was 117 and 164 mm Hg, mean 136.28 mm Hg

with STD + 9.974. The diastolic blood pressure was minimum and maximum 74 98 mm Hg and mean 88.18 mm Hg with STD + 5.95. (Table-I, Figure-1)

	Minimum	Maximum	Mean	Std. Deviation
Age of patients	42.00	68.00	56.3800	6.13418
Duration of Diabetes (years)	8.00	18.00	14.4800	2.18753
HbA_1C level %	6.30	8.80	7.6900	.71721
Cholesterol Level (mg/dl)	157.00	264.00	220.1000	30.11695
Triglyceride level (mg/dl)	127.00	178.00	154.0800	14.69810
LDL level (mg/dl)	115.00	153.00	133.4200	10.43364
BMI Level (mg/dl)	25.00	36.00	30.2600	3.25018
Fasting Blood Sugar level (mg/dl)	76.00	212.00	139.0600	27.44970
Random Blood Sugar level (mg/dl)	145.00	274.00	209.3600	33.89224
Systolic Blood Pressure (mm of Hg)	117.00	164.00	136.2800	9.97352
Diastolic Blood Pressure (mm of Hg)	74.00	98.00	88.1800	5.95113

Table-I. Descriptive statistics of sample population

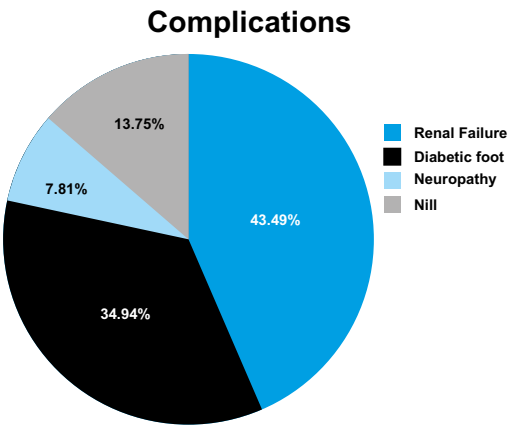

Figure-1. Complications of diabetes distribution

In this study, there were 322 (64.4%) males and 178 (35.6%) female patients. 91(18 %) had normal range HbA_1C, 132 (26%) had controlled cholesterol, 194(39%) had normal range triglyceride, 228(46%) were having controlled LDL, 164(33%) had normal BSF and 152 (30%) with normal BSR. (Table-II & III)

There were 112 (22%) patients in normal BMI category. However, 123 (25%) were overweight and 265(53%) in obese category. There were 293 (59%) patients with retinopathy, 268(54%) had nephropathy, 60(12%) had diabetic foot, 224(45%) had hypertension, 242(48%) were suffering from ischemic heart disease, 48(10%) have had already suffered from stroke and 132(26%) had PVD in one or other or both feet. (Table-IV,V & Figure-2)

	Number of Patients	Percentage
Male	322	64.4%
Female	178	35.6%

Table-II. Frequency statistics of gender in sample population

	Yes	No
HbA_1C	91 (18.2%)	409 (88.8%)
Cholesterol	132 (26.4%)	368 (73.6%)
Triglyceride	194 (38.8%)	306 (61.2%)
LDL	228 (45.6%)	272 (54.4%)
BSF	164 (32.8%)	336 (67.2%)
BSR	152 (30.4%)	348 (69.6%)

Table-III. Frequency statistics of control of hba_1c, cholesterol, triglycerides, LDL, BSF and BSR

	Number of Patients	Percentage
Normal	112	22.4%
Overweight	123	24.6%
Obese	265	53%

Table-IV. Frequency statistics of BMI category in sample population

	Yes	No
Retinopathy	293 (58.6%)	207 (41.4%)
Nephropathy	268 (53.6%)	232 (46.4%)
Diabetic Foot	60 (12%)	440 (88%)
Hypertension	224 (44.8%)	276 (55.2%)
Ischemic Heart Disease	242 (48.4%)	258 (51.6%)
Stroke	48 (9.6%)	452 (90.4%)
Peripheral Vascular Disease	132 (26.4%)	368 (73.6%)

Table-V. Frequency statistics of presence of retinopathy, nephropathy, diabetic foot, hypertension, IHD, stroke and peripheral vascular disease

The statistics on uncontrolled patients were different in every complication. Out of 91(18%) patients of HbA_1C; 72 (14%) were males, and 19 (4%) females. Of 132(26%) cholesterol patients, 112 (23%) were males and 20 (4%) females. From 194(39%) patients of triglyceride, 102 (23%) were males and 92 (18%) females. From 228 (46%) patients of LDL, 178 (36%) were males and 50 (10%) females. In 164 (33%) patients of BSF, 102 (21%) were males and 60 (12%) females. Out of 152 (30%) patients of BSR, 108 (22%) were males and 44 (9%) females. Out of 60 (12%) patients of diabetic foot; 32 (7%) were males and 28 (6%) females. In 224 (45%) patients of hypertension; 132 (26%) were males and 92 (18%) females. In 242(48%) patients of ischemic heart attack; 202 (40%) were males, 40 (8%) females. In 48(10%) patients of stroke; 14 (3%) were males and 34 (7%) females. The P-Value was insignificant in all of these categories of uncontrolled patients. From 293(59%) patients of retinopathy, 252 (50%) were males and 41 (8%) females. From 268 (54%) patients of nephropathy; 213 (43%) were males and 55 (11%) females. From 132(26%) patients of peripheral vascular disease; 128 (26%) were males, 4 (1%) females. Important differentiating part was that P-value was significant in these groups. (Table-VI, Figure-3)

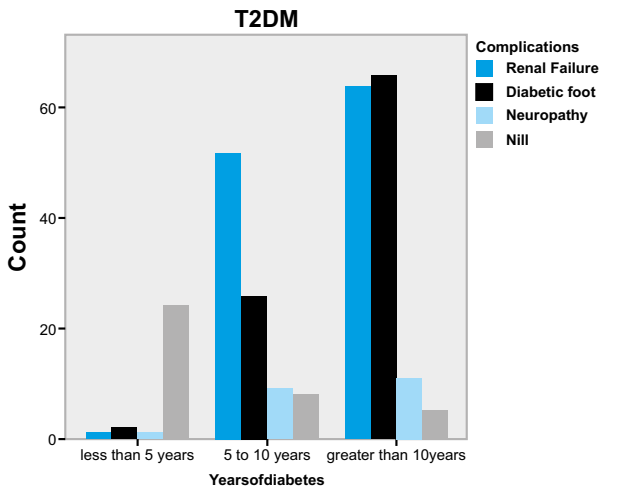

Figure-2. Complications according to duration of diabetes

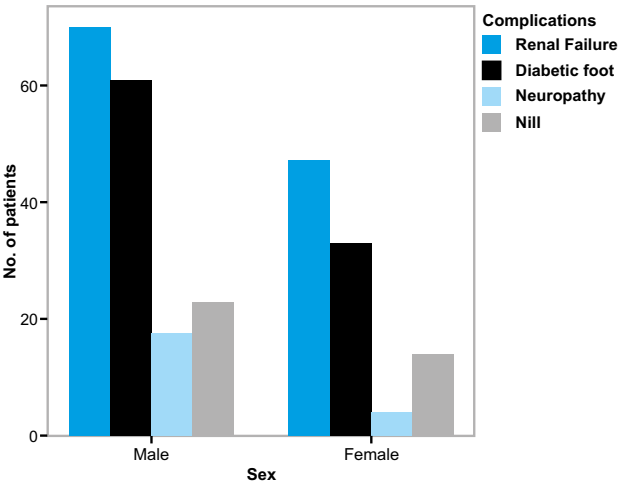

Figure-3. Complications according to sex distribution

	Total	Male	Female	P- Value
HbA_1C	91 (18.2%)	72 (14.4%)	19 (3.8%)	0.432
Cholesterol	132 (26.4%)	112 (22.8%)	20 (4%)	0.072
Triglyceride	194 (38.8%)	102 (20.4%)	92 (18.4%)	0.190
LDL	228 (45.6%)	178 (35.6%)	50 (10%)	0.050
BSF	164 (32.8%)	104 (20.8%)	60 (12%)	0.880
BSR	152 (30.4%)	108 (21.6%)	44 (8.8%)	0.368
Retinopathy	293 (58.6%)	252 (50.4%)	41 (8.2%)	0.000
Nephropathy	268 (53.6%)	213 (42.6%)	55 (11%)	0.028
Diabetic Foot	60 (12%)	32 (6.4%)	28 (5.6%)	0.446
Hypertension	224 (44.8%)	132 (26.4%)	92 (18.4%)	0.522
Ischemic Heart Disease	242 (48.4%)	202 (40.4%)	40 (8%)	0.006
Stroke	48 (9.6%)	14 (2.8%)	34 (6.8%)	0.446
Peripheral Vascular Disease	132 (26.4%)	128 (25.6%)	04 (0.8%)	0.002

Table-VI. Stratification statistics of complications of diabetes on basis of gender of patients

	Total	40-49 years	50-59 years	60-69 years	P- Value
HbA_1C	91 (18.2%)	22 (4.4%)	23 (4.6%)	46 (9.2%)	0.029
Cholesterol	132 (26.4%)	12 (2.4%)	72 (14.4%)	48 (9.6%)	0.270
Triglyceride	194 (38.8%)	53 (10.6%)	102 (20.2%)	39 (7.8%)	0.487
LDL	228 (45.6%)	42 (8.4%)	132 (26.4%)	54 (10.8%)	0.950
BSF	164 (32.8%)	42 (8.4%)	81 (16.2%)	41 (8.2%)	0.634
BSR	152 (30.4%)	44 (8.8%)	78 (15.6%)	30 (6%)	0.489
Retinopathy	293 (58.6%)	63 (12.6%)	143 (28.6%)	90 (18%)	0.243
Nephropathy	268 (53.6%)	58 (11.6%)	162 (32.4%)	48 (9.6%)	0.950
Diabetic Foot	60 (12%)	12 (2.4%)	36 (7.2%)	12 (2.4%)	0.883
Hypertension	224 (44.8%)	44 (8.8%)	122 (24.4%)	58 (11.6%)	0.879
Ischemic Heart Disease	242 (48.4%)	64 (12.8%)	108 (21.6%)	70 (14%)	0.229
Stroke	48 (9.6%)	01 (0.2%)	33 (6.6%)	14 (2.8%)	0.200
Peripheral Vascular Disease	132 (26.4%)	54 (10.8%)	38 (7.6%)	40 (8%)	0.036

Table-VII. Stratification statistics of complications of diabetes on basis of age of patients

DISCUSSION

The observations made by us in this study were not radically different from other comparable studies in terms of relative extent of various complications, but the incidences were relatively different, though comparable. In our study mean age was 56.38 + 6.134 years. In a study done in Karachi, which is the largest cosmopolitan city of Pakistan, mean age in the diabetics was 52 years for males and 51 for females, which is less than in our study. We cannot comment on the cause for this difference, but the number of patients included in their study, were greater and included patients from different ethnic groups. In a survey carried out in Sindh Province, ages were 51 and 48 years separately, which supports this conclusion.[19]

When we compared our patients with other widely accepted and followed studies like ACCORD and ADVANCE, the mean age of patients in the ACCORD was 62 years, and the period of diabetes was 10 years, with 35% of patients were started on insulin in the beginning of treatment. The ADVANCE study had a more mature population (mean, 66 years) with a relatively smaller disease duration of 8 years.[20,21] This means that our study population was younger in terms of presentation with complication. This also means, that we should not ignore younger age groups while screening for complications and refer them to specialty centers. While comparing our findings with ADVANCE and ACCORD, HbA1c level was 7.2% in the ADVANCE study, 8.1% in the ACCORD study, and 9.4% in our study at the initial stage when readings were recorded. This makes our values much higher at presentation. After intensive therapy, HbA1c was 6.4% in the ACCORD and ADVANCE, and 6.9% in our study.[20,21] Information about overall glycemic control in type 2 diabetics in Pakistan is lacking. With a higher initial HbA1c at the time of presentation documented in our study, it reflects existing practices from all stake holders in the population, for the control of diabetes. Bringing it down and as close to normal, suggests that similar vigorous checking and guidance can help our patients.

When we compared our study findings with other studies in Southeast Asia, we found conflicting results. The mean values of HbA_1c in our study was 7.69, which was less than those detected in a study in Bangladesh (8.01), but they were closer to those found in India (8.6) and DIABCARE-ASIA study carried out in India (8.9).[22,23] the differences included that three-fourth of their subjects had poor glycemic control, when they first visited the institute, and 40% of them had diabetes for more than 10 years. However the similarity was seen in lipid profile, showing higher triglycerides and low a HDL, which was a characteristic feature of diabetic dyslipidemia, and was also seen in the study of Diab Care India.[24] It suggests that there may be a regional tendency for dyslipidemia in South East Asian countries, demanding further study into this matter.

Various studies have shown prevalence

of retinopathy around 16%, which is also documented in our study. There are some studies showing very different and higher prevalence.[25-27] It suggests that our selected patient group was not different from majority of world population, for this complication. In the macro-vascular complications, CAD 15.1%, stroke 5.5% and PVD 4.4%, were similar in pattern again to that documented in literature from India (CAD was 11.4%, Stroke 0.9% and PVD 4%). It can be seen clearly that the incidence of stroke in our population was higher, which can be due to the reason that our institute is more renowned for neurology and neuro-surgery, and considered as the tertiary care center for this specialty in whole province of Punjab.[28] Ramachandran et al documented in a study with 3010 subjects, that the male to female ratio was 1.69 to 1 (M:F 1892:1118), and the mean age was 52 +/- 9.7 years, in patients presenting to their diabetic clinic. This study sample was similar to our study in anthropometry, age and socioeconomic factors. All patients similarly underwent tests for retinopathy, nephropathy, neuropathy, peripheral vascular disease (PVD) and cardiovascular disease. Retinopathy was diagnosed in 23.7% (background 20.0% and proliferative 3.7%), trace proteinuria was documented in 19.7% and persistent overt proteinuria was documented above 500 mg/dl, and appreciated in 5.5% of these patients. CHD was traced in 11.4% and PVD was existing in 4.0%. Of the total 119 cases of PVD, 18 had gangrene due to vascular insufficiency and 21 suffered limb loss because of it. Peripheral neuropathy was also one of the common complications in their study, but less common than our study, and documented in 27.5%. Stroke was stated in 26 cases (0.9%), much less than our study population. Hypertension was documented in 38% of the cases.[29] This study was similar in some respects with our findings, but different in some also. This further supports that complication characteristics in South East Asia may be similar, and we can derive inference from their studies. However, we should increase documenting from our personal population studies that that what is the exact situation in our population. However, till sufficient studies are published, we can deduce from studies in this region.

In another study of 3000 diabetic patients from Pakistan, Khan AJ et al documented that 780 patients were diagnosed to have retinopathy. The presence of this complication was much higher in the age group of 51 years and above, and it amplified disturbingly with the prolongation of the duration of diabetes (76.7%).[30] It was close to our deduction of results. There was a likelihood of increasing complications with continuing increase in the duration of diabetes. In Primary care centers of WAH in district Rawalpindi, cross sectional population based study of a total of 805 known diabetics, there were 380 males and 425 females, with a ratio of female predominance, very different from our study and in the same country. In this study, relevant history, thorough physician examination and ECG were done to evaluate for the presence of ischemic heart disease, stroke and diabetic foot complications. Their diabetic control was assessed through estimation of plasma glucose, and previous control by and glycosylated hemoglobin, which were all similar to what we did in this study. The final results showed a prevalence of macro-vascular like Ischemic heart disease at 19.8% (female 4.7%, males 7.8%), Stroke at 6.2% (females 4.7%, males 22.1%) and diabetic foot complications 2.1%.[31] This was significantly different from our study, and there can be many reasons for this alteration. We know that literacy rate in that region of the country is high. It is a possibility that it led to this variation, with good education at baseline. Another reason could be the dietary and exercise practices. There can also be a difference in awareness of patients and doctors. It should be researched further, to adopt similar practices and bring change in our population.

CONCLUSION

Diabetes Mellitus is a major endocrine disease causing morbidity and mortality all over the world. It has resulted in a major economic load on health budget, and planning on preventive measures all over the world due to multi organ involvement associated with it, especially cardiovascular, renal, eye and vascular systems. It's time to identify factors, especially modifiable risk factors, with efforts in augmenting awareness in general population, doctors and other stake holders in

the society like funders and families of patients, to help improve patient health and reduce relative risk for complications related with complications of diabetes mellitus. More studies should be planned at larger scale to recognize practices and modifiable issues to help control the diabetic complications among our population.

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Conflict Of Interest:

There is no conflict of interest to declare in this study.

REFERENCES

1. **International Diabetes Federation: IDF Diabetes.** 6th ed Belgium: International Diabetes Federation, 2013.
2. Shera AS, Rafique G, Khawaja IA, Baqai S, Khan IA, King H. **Pakistan national diabetes survey prevalence of glucose intolerance and associated factors in North West Frontier Province (NWFP) of Pakistan.** J Pak Med Assoc 1999; 49: 206-11.
3. Shera AS, Rafique G, Khawaja IA, Baqai S, King H. **Pakistan national diabetes Survey: prevalence of glucose intolerance and associated factors in Baluchistan province.** Diabetes Res Clin Pract 1999; 44: 49-58.
4. Aschner P, Beck-Nielsen H, Bennett P, Boulton A, Colagiuri R. **Diabetes and impaired glucose tolerance.** 5. Brussels: IDF Diabetes Atlas; 2012.
5. IDF. **Diabetes and impaired glucose tolerance.** 6th ed. Brussels: Diabetes Atlas; 2013.
6. Mathers CD, Loncar D. **Projections of global mortality and burden of disease from 2002 to 2030.** PLoS Med. 2006; 3(11):e442.
7. American Diabetes Association. **Diagnosis and classification of diabetes mellitus.** Diabetes Care 2012; 35(Suppl 1):S64–71.
8. Hex N, Bartlett C, Wright D et al. **Estimating the current and future costs of type 1 and type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs.** Diabet Med 2012; 29:855–62.
9. Struijs JN, Baan CA, Schellevis FG et al. **Co-morbidity in patients with diabetes mellitus: impact on medical health care utilization.** BMC Health Serv Res 2006; 6:84.
10. von Ferber L, Köster I, Hauner H. **Medical costs of diabetic complications total costs and excess costs by age and type of treatment results of the German CoDiM Study.** Exp Clin Endocrinol Diabetes 2007; 115:97–104.
11. Mulnier HE, Seaman HE, Raleigh VS et al. **Risk of stroke in people with type 2 diabetes in the UK: a study using the general practice research database.** Diabetologia 2006; 49:2859–65.
12. **National Diabetes Data Group: *Diabetes in America*.** Bethesda, MD, NIDDK, NationalInstitutes of Health, 1985, p. II-2.
13. **Writing Team for the Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Research Group. Sustained effect of intensive treatment of type 1 diabetes mellitus on development and progression of diabetic nephropathy: the Epidemiology of Diabetes Interventions and Complications (EDIC) study.** JAMA 2003; 290(16):2159–2167.
14. Nathan DM, Cleary PA, Backlund JY, et al. **Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (DCCT/EDIC) Study Research Group. Intensive diabetes treatment and cardiovascular disease in type 1 diabetes mellitus.** N Engl J Med 2005; 353(25):2643–2653.
15. Stettler C, Allemann S, Jüni P, et al. **Glycemic control and macrovascular disease in types 1 and 2 diabetes mellitus: meta-analysis of randomized trials.** Am Heart J 2006; 152:27-38.
16. Kirkman MS, McCarren M, Shah J, Duckworth W, Abraira C. **The association between metabolic control and prevalent macrovascular disease in Type 2 diabetes: the VA Cooperative Study in diabetes.** J Diabetes Complications 2006; 20:75-80.
17. Shichiri M, Ohkubo Y, Kishikawa H, Wake N. **Long term results of the Kumamoto Study on optimal diabetes control in type 2 diabetic patients.** Diabetes Care 2000; 23:Suppl 2:B21-B29.
18. **Diabetes Control and Complications Trial Research Group: The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus.** *N Engl J Med* 329:977–986, 1993.
19. Shera AS, Rafique G, Khwaja IA, Ara J, Baqai S, King H. **Pakistan national diabetes survey: prevalence of glucose intolerance and associated factors in**

Shikarpur, Sindh province. Diabet med 1995; 12: 1116-21.

20. **The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus.** N Engl J Med 1993; 329:977-986.

21. Nathan DM, Cleary PA, Backlund JY, et al. **Intensive diabetes treatment and cardiovascular disease in patients with type 1 diabetes.** N Engl J Med 2005; 353:2643-2653.

22. Raheja Bs, Kapur A, Bhoraskar A, Sathe SR, Jorgensen LN, Moorthi SR, et al. **Diab Care Asia-India Study: diabetes care in India-current status.** J Assoc Physicians India 2001; 49:17-22.

23. Hussain Ms, Haque SS Farzana A, Mahtab H, KibriyaMG. **Long-term vascular complications in type II diabetes, BIRDEM DCCS. Diabetes in Asia 2001.** Compendium of Abstracts 2001 (18th-19th Feb): 182-3.

24. Ramachandran A, Snehalatha C, Satyavani K, Latha E, Sasikatl R, Vijay V, **Prevalence of vascular complications and their risk factors in type II diabetes.** J Assoc Physicians India 1999; 47: 1152-56.

25. **Khan AJ Prevalence of diabetic retinopathy in Pakistani subjects: a pilot study.** J Pak med Assoc 1991; 41: 49-50.

26. Raheja Bs, Kapur A, Bhoraskar A, Sathe SR, Jorgensen LN, Moorthi SR, et al. **Diab Care Asia-India Study: diabetes care in India-current status.** J Assoc Physicians India 2001; 49:17-22.

27. Ramachandran A, Snehalatha C, Satyavani K, Latha E, Sasikatl R, Vijay V, **Prevalence of vascular complications and their risk factors in type II diabetes.** J Assoc Physicians India 1999; 47: 1152-6.

28. WeerasuriyaN, Sirikbaddana S, Dissanayake A. **Long-term complications in newly diagnosed Sir Lanka patients with type-II diabetes mellitus.** QJ Med 1998; 91: 439-43.

29. Ramachandran A, Chamukuttan S, Kumpatla S, Viswanathan V. **Prevalence of Vascular Complications and Their Risk Factors in Type 2 Diabetes.** Journal of the Association of Physicians of India. 2000; 47(12):1152-6.

30. Khan AJ. **Prevalence of diabetic retinopathy in Pakistani subjects. A pilot study. Journal of the Pakistan Medical Association.** 1991; 41(3):49-50.

31. Hashim R. **Prevalence of macro vascular complications in diabetics of WAH, District Rawalpindi.** Journal of the Pakistan Medical Association. 1999; 49(1):8-11.

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
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3	Ibtesaam Amjad	Stratistical analysis, Write up.	
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