Original article

Micro-vascular complications in diabetic patient's of type -2 diabetes mellitus

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Background: A hospital based prosopective study conducted in 11000 beded teaching hospital of a metropolitan city Islamabad, Pakistan, two group of patients having diabetes for < 5 years and > 5 years were evaluated and investigated for micro-vascular complications from January to December of 2006.

Material and Methods: A total of 100 patients were included in the study.

Result: Among them 72% patients of diabetes < 5 years and 76% patients of diabetes>5 years are overweight, most of them were having very high glycosylated haemoglobin and 48% has had neuropathy, 66% has had nephropathy and 72% has had retinopathy respectively.

Conclusion: This study once again proved that increasing age, overweight, uncontrolled blood sugar, and high level of glycosylated haemoglobin all contributes to higher rates of micro-vascular complications. Similar types of study if conducted in Nepal will be more useful for health professionals and researcher in future.

Introduction

Diabetes Mellitus is etiologically and clinically heterogeneous group of hyperglycemic disorder due to relative or absolute deficiency of insulin or excess of glucagons, affecting metabolism of carbohydrate, fat and proteins leading to persistent hyperglycemia, acid-base, electrolyte and water imbalance, ketoacidosis and structural as well as functional damage of vital organs.[1]

It is one of the most common chronic diseases with an overall prevalence in white Caucasians of approximately 2%. Vast majority is DM Type-2 and at least 4% of people in their sixties have Diabetes.[2] Moreover DM Type-2 is more common among Asians where it appears earlier. Type 1, DM is common in Caucasian population whereas Type-2 is more common in the Indian subcontinent. However, Type-2 prevalence varies among various ethnic groups, 1% of Japanese, 34% in Micronesians, 40% in Pima Indians[3]. Family studies show that familial aggregation of Type-2 is very common. 38% of siblings and 1/3rd of the offspring of those with Type-2 exhibit diabetes or abnormal GTT.[4]

Type-1 DM is immune-mediated in 90% cases and 95% patients posses either MLA-DR3 or MAL-DR4, some of them has islet cell antibody and anti GAD to cause low insulin production leading to hyperglycemia and needs exogenous insulin as treatment while in case of Type-2 DM 90% patient has circulating endogenous insulin is sufficient to prevent ketoacidosis but is in adequate to prevent hyperglycemia, clinical condition due to beta cell failure or insulin resistance leading to tissue in sensitivity to insulin and can be treated by insulin secretogogus (Sulfonylurea), insulin sensitizer (Biguanides) and alpha-glucosidase inhibitor (acarbose).[5]

If untreated DM causes much morbidity and mortality due to its devastating late complications involving micro-vascular and macro-vascular structures.[6] In the form of micro-vascular complications like neuropathy, retinopathy nephropathy have become subjects of extensive diabetic research.[7]

Autonomic neuropathy has become very important in the natural history of diabetes mellitus and is found to be present even at diagnosis in Type 2 DM cases at an early stage, but progresses slowly over many years.[8] It has been found to leave many consequences like sudden death which

may be due to prolongation of QTc causing fatal ventricular arrythmias, altered bronchomotor tone causing sudden respiratory failure in anaesthetized patients, decreased myocardial function secondary to denervation, gastroperesis, pupillomotor abnormalities and neuroendocrinal abnormalities.[71] It also includes morbid complications like foot ulcers and charcots joints[9], which are the outcomes of altered blood flow due to autonomic neuropathy and arthrosclerotic changes of small vessels secondary to dyslipidemia.

The micro vascular complications are associated with altered microcirculations including pericyte loss, micro-aneurysms and thickened basement membranes.[10] The diabetic complications are attributed to hyperglycemia leading to non-enzymatic glycation, oxidative-reductive stress, increased polyol pathway activity, intracellular myo-ionositol depletion, diacylglycerol synthesis and protein kinase C-activity causing endothelial and capillary dysfunction.[11] The frequency of complication varies on both type of diabetes i.e. Type-1 can develop end stage renal disease up to 40% compared to less than 20% patient of Type-2 DM of to the same duration[12, 17] Major cause of death in Type-2 DM is recorded was renal failure, while among Type-2 it was acute myocardial infarction and stroke in another study.[13] Since the last two to three decades autonomic neuropathy has been increasingly recognized as a significant micro vascular complication of diabetes.[4] It has also been postulated that the altered micro-circulation may be due to Diabetic Autonomic Neuropathy (DAN) which leads to thickened basement membrane, opening A-V shunts and eventually end organ damage associated with micro-vascular complications.[8] Hence neuropathy, retinopathy and nephropathy may be the spectrum of same disease process and may coexist.[5, 11] Thus knowing the proportion prevalence of autonomic neuropathy and its association with other micro-vascular complications in any diabetic population is always mandatory.

As for diabetic neuropathy they are heterogeneous group of neuropathic disorder causing considerable morbidity. According to PJ Watkins about 50% of diabetics eventually develop one or the other types of neuropathy.[9]

Diabetic autonomic neuropathy has a prevalence of 20% to 40% in various studies with one showing prevalence as high as 75%.[9, 12]

Diabetic neuropathy is one of the commonest complications with myriad presentation. The anatomical and functional abnormalities correlates with degree and duration of hyperglycemia.[14] Chronic hyperglycemia causes loss of myelinated and unmyelinated fibers, Wallerian degeneration and blunted nerve fiber reproduction. Because of metabolic derangement (flux through polyol pathway, a deficiency of myo-inositol or sodium potassium-adenosine triphosphatase or excessive glycation of proteins) may be responsible.[6, 11] There is also considerable evidence of structural alterations of micro-vessels and local hypoxia. In some cases of proximal asymmetric neuropathy multifocal fiber degeneration was attributed to ischemia and co-existing inflammation which is peri-vascular with lymphocytic infiltration).[14] These pathological changes involve small and large vessels, cranial and peripheral nerves, the skin and the lens of eye leading to hypertension, ischemic heart disease, renal failure, blindness, cardiovascular accident, amputations of lower extremities, autonomic and peripheral neuropathy.[11, 15]

Aims and objectives

- To determine the prevalence of complications of diabetes among Type-2 diabetic patients of different duration (< 5 years and > 5 years) attending OPDs and different wards of Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan.
- To determine the association of diabetic complications; retinopathy, nephropathy and neuropathy with each other.

Study design

The prospective cross sectional study was conducted among Type-2 DM patients having history of diabetes less than 5 years (100 patient) and more than 5 years (100 patient) in each group attending medical OPD's and admitted to different wards of Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan between Jan 2006 to Dec 2006.

Review of literature

Diabetes Mellitus (DM) is etiologically and clinically a heterogeneous group of hyperglycemic disorders. The increased glycemia is the result of relative or absolute deficiency of insulin in the presence of relative or absolute excess of glucagon.[1,17]

Diagnosis of DM: According to the expert committee on the diagnosis and classification of diabetes mellitus 1997,[18] diabetes mellitus is diagnosed clinically if there is polyuria, polydypsia or polyphagia accompanied by increased weight loss. Fasting Plasma Glucose > 126 mg/dl or higher after overnight fast on more than one occasion or plasma glucose > 200 mg/dl in more than two occasion is diagnostic to diagnose DM. If the fasting blood glucose is not elevated, it can be diagnosed by oral glucose tolerance test (OGTT).[17]

Criteria for diagnosis of Diabetes According to National Diabetes Data Group

1. Fasting plasma glucose more than or equal to 7.0 mmol/l (126 mg/dl) on at least two occasions.
2. Oral glucose tolerance test: 1.7 g/kg of glucose with maximum 75g given after over night fast.
   a. Diabetes mellitus is said to be present if plasma glucose level more than or equal to 11.1 mmol/l (200 mg/dl) at 2 hours and one other point in the test.
   b. Impaired glucose tolerance is said to be present if plasma glucose is between 7.8 - 11.1 mmol/l (140 - 200 mg/dl) at 2 hours and 11.1 mmol/l (200 mg/dl) at any time between 0 hour and 2 hours.

However, an expert committee on the Diagnosis and Classification of Diabetes mellitus 2000 has recommended a change in the diagnostic criteria for the various forms of the disease.[18, 19] A random plasma glucose concentration of 11.1 mmol/l (200 mg/dl) in a patient with symptoms is enough to confirm the diagnosis. The report also adds that the terms 'insulin' and 'non insulin dependent' are no longer acceptable and suggests type 1 and type 2 as a more preferable terms to denote conditions where there is insulin deficiency and insulin resistance respectively.

Prevalence of microvascular complications

Diabetic Nephropathy

Diabetic nephropathy functionally may remain silent for long period, 10-15 years and nephropathy start with increased glomerular filtration rate up to 40%, followed by microalbuminurea (30-300 mg/day) then overt proteinuria, (> 300 mg/day) azotemia and/or hypoalbuminemia and CRF.[21] Microalbuminuria predicts cardiovascular mortality [31] and nephropathy is common in those ethnic groups with whom Type-2 DM appears earlier and Type 1 DM patient diagnosed before puberty.[33] Advance nephropathy as defined by urinary albumin excretion of 300 mg or more/24 hours and rate of creatinine clearance below 70 ml/min/1.73 m^2 of body surface area. 40% North American diabetic requiring hemodialysis are 30-45% Type 1 DM and 20% Type 2 DM and finally develops ERDS. In DCCT study intensive therapy of DM has reduced microalbuminuria 43%, Albuminuria 56% and so as ESRD.[34]

Diabetic Retinopathy

It was estimated that 5000 patients with diabetes in the United States and 30,000 to 40,000 worldwide became blind each year from retinopathy.[22] Risk of developing the retinopathy is 50% more in type 1 compared to type 2 patients who were followed for 20 years.[23] Most informative cross sectional study "Framingham Heart Study" shows the prevalence of retinopathy in diabetes mellitus as 5% those with duration < 5 years, 30% with DM of 5-9 years 45% with 10-14 years and 65% who has history of Diabetes Mellitus > 15 years.[31] In one study the cumulative incidence of retinopathy in the intensive therapy group was approximately 50% less than in conventional therapy group.[35]

Diabetic Neuropathy

Diabetic neuropathy is an umbrella term encompassing two distinct groups of disorders, focal and diffuse neuropathies.[30]

Focal neuropathies can be divided into ischemic and entrapment neuropathies. Examples of focal ischemic neuropathies are mononeuropathies, femoral neuropathies, radiculopathies, plexopathies, and cranial neuropathies.[36]

The most common types of neuropathy attributed to diabetic complications are the diffuse poly-neuropathies, which have been the focus of most clinical trials because of their increased prevalence and long term impact on morbidity and mortality. They have an insidious onset and present with a symmetrical distribution, right and left sides, upper and lower extremities, and motor sensory and autonomic nerves tend to correlate within an individual.[36,37.]

An understanding of the complex etiology and progressive nature of distal symmetrical poly-neuropathy is important when considering the future direction of clinical trials. It is hypothesized that there are at least three different mechanisms (insulin deficiency, abnormal vasa nervosum and autoimmunity) each of which initiates a cascade of biochemical alterations that in turn leads to structural changes.[11,36]

Study Protocol

Type of study **-** It was a prospective cross sectional study

Place of study **-** Study was conducted at Pakistan Institute of Medical Sciences (PIMS) Islamabad Pakistan.

Study period **-** One year (Jan 2006 -Dec 2006)

Inclusion criteria - 100 patients havingType-2 DM for less than or equal to 5 years and another group of 100 patient of Type-2 DM having more than or equal to 10 years diabetes were included in the study with prior written consent of patient.

Exclusion criteria -

- The following patients were excluded for this study purpose:-

a) The patient having DKA and acute other illnesses.

b) The patient having gestational diabetes and secondary diabetes

- The patients having following diseases were also excluded:-

Amyloidosis, AIDS, spinal cord injury, heart block, arrythmias, CCF, chronic pancreatitis, hypothyroidism, hyperthyroidism, Addison's disease, Fanconi's syndrome, pregnancy, tabes dorsalis, Parkinsonism, multiple sclerosis, leprosy, Guillian-barre syndrome.

- The patients receiving the following drugs will also be excluded.

  Thiazide diuretics
  Niacin
  Vincristine
  High dose steroid

Outcome of study

Increased duration of disease is associated with increased frequency of complications. As in Type-1 DM frequency of DAN increased sharply after five years of follow-up. However, in Type-2 DM patients a few studies[62] have failed to establish significant correlation of complication with duration. Though the DCCT has stated that strict glycemic control stops progression of disease.[8,34]

Frequency of micro-vascular complication among the patients having DM < 5 years and > 5 years are statistically significant and correlate with poor adherence with diet, high BMI, high HbA_{IC} level and prolonged duration of diabetes.

The presence (proportion prevalence) of complication of diabetes were examined in 100 patients coming to different OPD's and admitted in different departments of Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan between Jan 2006 to Dec 2006.

The results were expressed, as mean and their standard deviation (SD) along with chi-square and T-test wherever applicable. All patients were type 2 diabetic, grouped in two groups (diabetes < 5 years and > 5 years) on oral hypoglycemic agents (OHA) and/or insulin, the baseline characteristics were shown in table 1. As expected the patients included in the study had age 44 to 73 with their average being 55.6 ± 11.91 years in Group A and 59.9 ± 12.83 years in Group B.

Table 1: Characteristics of Study Groups

Groups Variables		Group A (50 patients) (DM < 5 years)	Group B (50 patients) (DM > 5 years)
Age		55.6 ± 11.91	59.9 ± 12.83
Sex	**Male**	26 (52%)	24 (48%)
	Female	24 (48%)	26 (52%)
Body Mass IndexBMI	**Acceptable range (18.5-24.9)**	14 (24%)	12 (24%)
	Overweight (25.0-29.9)	16 (32%)	15 (30%)
	Obese (30.0-39.9)	18 (36%)	20 (40%)
	Morbidly Obese (e"40)	02 (04%)	03 (06%)
Drugs	**Sulphonyluneas**	25 (50%)	10 (20%)
	Biguanide	05 (10%)	05 (10%)
	Both	15 (30%)	20 (40%)
	Insulin + Biaguanide	05 (10%)	08 (16%)
	Insulin only		07 (14%)
Compliance	**Good**	14 (28%)	20 (40%)
	Poor	36 (72%)	30 (60%)
Diet	**Diabetic diet**	29 (58%)	36 (72%)
	Normal diet	21 (42%)	14 (28%)

There is no statically significant difference regarding the age and sex of patients in either group. At a glance on

study group's characteristics it is seen that most of the patients are overweight 72% in Group A and 76% in Group B patients had BMI>25.0. The BMI is high, the compliance is poor 72% Vs 60% (Table-1) though 58% patients of Group A and 72% patients of Group B are adherent to diabetic diet.

Table 2: Blood Glucose Parameter of Study Groups

Groups Variables		Group A (50 patients) (DM < 5 years)	Group B (50 patients) (DM > 5 years)
GlucoseMonitoring	**Occasionally**	33 (66%)	31 (62%)
	Regularly	17 (34%)	19 (38%)
Glycosylated Hb level (HbA_{IC})	10.5 ± 4.5 (85.9%)	10.5 ± 5.5 (91.6%)	
Blood Glucose	**FBG**	150 ± 41	175 ± 43
	RBG (PP)	350 ± 92	350 ± 60

It was found that most of the patient in either group were not that regularly monitoring their glucose level and both the group had high glycosylated hemoglobin (HbA_{IC}) level. Similarly fasting and post-prandial blood glucose level were found to be high as shown in Table 2.

Table 3: Prevalence rate of Micro-vascular complication between two different groups of patients

Groups Types of Complication	Group A (50 patients) (DM < 5 years)		Group B (50 patients) (DM > 5 years)	
	Present	**Absent**	**Present**	**Absent**
Nephropathy	30 (60%)	20(40%)	36 (72%)	14(28%)
Retinopathy	32 (64%)	18(36%)	40 (80%)	10(20%)
P. Neuropathy	18 (36%)	32(64%)	30 (60%)	20(40%)

Frequency of nephropathy is 60% Vs 72% in two groups, 64% patients in Group A and 80% in Group B have had retinopathy as well as 36% and 60% neuropathies in A and B respectively. These increasing prevalence of complications correlates with increasing duration of diabetes.

Table 4: Association of DAN with Different stage of Nephropathy

Groups Types of Nephropathy	Group A (50 patients) (DM < 5 years)		Group B (50 patients) (DM > 5 years)	
	Present	**Absent**	**Present**	**Absent**
Microalbuminuria	12 (40%)	24	8 (22.3%)	16
Proteinuria	18 (60%)	36	28 (77.8%)	56
Total	30 (100%)	60%	36 (100%)	72%

Proteinuria among 28 (77.8%) patients of Group B significantly correlates with the increasing period and severity of disease (DM > 5 years) and micro albuminuria among 12 (40%) of patient mainly found among Group A patients having history of DM < 5 years signifies early involvement of kidneys in diabetes

Table 5: Association of DAN with Different Types of Retinopathy

Groups Types of Retinopathy	Group A (50 patients) (DM < 5 years)		Group B (50 patients) (DM > 5 years)	
	Present	**Percentage**	**Present**	**Percentage**
Background	17 (53.2%)	34%	16 (40.0%)	32%
Prefroliferative	10 (31.2%)	20%	13 (32.5%)	26%
Proliferative	5 (15.6%)	10%	11 (27.5%)	22%
Total Retinopathy	32 (100%)	64%	40 (100%)	80%

Background and pre-proliferative retinopathy (17 and 10 patients in Group A i.e. 84.4% and 16 and 13 patients in Group B i.e. 72.5%) significantly dominates the proliferative retinopathy in either groups or the dominance is also higher within the group A (53.2% and 31.2% VS 15.6%) and Group B (40% and 32.5% VS 27.5%) respectively. Higher percentage of proliferative retinopathy among Group B patients also correlate with increasing age and poor glycemic control of the patients in this group.

Table 6: Association of DAN with Different Type of Neuropathy

Groups Types of P. Neuropathy	Group A (50 patients) (DM < 5 years)		Group B (50 patients) (DM > 5 years)		Average
	Present	**Percentage**	**Present**	**Percentage**	
Mixed(Sensory+Motor Neuropathy)	6 (33.3%)	12	9 (30%)	18	
Motor Neuropathy	3 (16.7%)	6	7 (23.4%)	14	
Sensory Neuropathy(Glove/Staking)	9 (50%)	18 (36%)	14 (46.6%)	28 (56%)	
Total P. Neuropathy	18 (100%)	36%	30 (100%)	60%	48%

Frequency of peripheral neuropathy is 36% VS 60% in two groups and 18% patients of Group A and 36% patients of Group B has also had DAN showing significant co-relation between two complications.

18 (36%) patients of Group A and 30 (60%) patients of Group B, in average 48% patients had peripheral neuropathy. Sensory neuropathy (glove and stocking) is the commonest peripheral neuropathy 50% Vs 46.6% in Group A and Group B and motor neuropathy is least frequent among both groups.

Table 7: Frequency of Diabetic Foot (DF), Diabetic Foot Ulcer (DFU) and Amputation

Group Foot Conditions		Group A (50 patients) (DM < 5 years)		Group B (50 patients) (DM > 5 years)	
		Present	**Percentage**	**Present**	**Percentage**
Diabetic foot changes	**Total**	10	20%	17	34%
Causes of diabetic	**Spontaneous**	4 (28.8%)	8%	5 (25%)	
foot ulcer	**Thorn/Nail**	6 (43.2%)	12%	9 (45%)	
	Trauma	3 (21.6%)	6%	4 (20%)	
	New shoes	1 (7.2%)	2%	2 (10%)	
	Total	14	28%	20	40%
Amputation	**Toe and ray**	8		10	
	Foot amputation	4		6	
	Below knee amputation	2		3	
Total amputation		14	28%	19	38%

This study shows that out of 100 patients, 54% patients had diabetic foot problems. Trauma, thorn and nail are frequent causes of foot ulcers (64.8% in group A and 65% in Group B). Spontaneous ulceration were also found in many cases

28.8% in group A and 25% in Group B, poor foot hygiene and inappropriate shoes/slippers were also found to be the causative factors. Surprisingly many of the patients had recurrent foot problem and amputation rate increased with the duration of disease 28% VS 38% in Group A and Group B respectively.

Discussion

Diabetes mellitus is a very common metabolic disorder. Micro-vascular complications due to diabetes mellitus are the cause for much morbidity and mortality. Many patients had hypertension, ischemic heart disease and acute myocardial infarction, TIA and stroke, diabetic foot ulcer and amputation due to macro-vascular complications of diabetes.

In many studies worldwide it was documented that macro as well as micro-vascular complications of diabetes mellitus had statistically significant association among the complications which increases with duration of disease and poor glycemic control.[35, 47]

As expected by observation, this study found that most of the patients were overweight, 72% in Group A (diabetes< 5 years) and 76% in Group B (diabetes > 5 years); as in Table 1. They showed poor compliance to drugs, 70% in Group A and 60% in Group B and poor adherence to diabetic diet, 60% in Group A and 72% in Group B. It was found that 85.9% patients of Group A and 91.6% patients of Group B had glycosylated hemoglobin (HbA_{IC}) > 6.5%, as in Table 2.

According to most large studies the prevalence of DAN among diabetes mellitus varies between 17%, 27% and 40% as high as 70.6% in a different study.[64, 63, 73, 107, 120]

In this study of 100 patients with type 2 diabetes, 18 (36%) of Group A and 30(60%) of Group B also had peripheral neuropathy and 9 patients of group A and 18 patients of group B also had DAN and peripheral neuropathy with statistically significant association (p-value 0.02 and 0.03) between them.

Another study conducted in India of 726 patients with history of DM > 25 years, showed retinopathy 52%, nephropathy 12.7% and neuropathy 69.8% along with ischemic heart disease 32.8%.

In our study 32 (64%) of Group A and 40 (80%) of Group B, in average 72% patients had diabetic retinopathy. Among Group B, 80% of the patients (DM for > 5 years) had retinopathy, which does not surprise us, as our patients had poorer control of DM due to several underlying reasons. Out of 80%, 62.5% had background and pre-proliferative retinopathy and 27.5% had proliferative retinopathy and among the Group A patients having diabetes for < 5 years, 64% had diabetic retinopathy, background and pre-proliferative which comprise (84%) and proliferative (15.6%). Increased frequency of proliferative retinopathy in Group B (DM > 5 years) again suggests poorer control of DM. Older group of people with long history of diabetes are difficult to convince to add insulin to their regimen for tight control of disease.

Another study conducted in BIRDEM(Bangladesh) in a series of study of 1647 patients they found that 25% patients had nephropathy who had type 2 diabetes of 5years with mean HbA_{IC} of 8.01% and on follow-up, by reducing the HbA_{IC} by 1% they are able to reduce the incidence of nephropathy by 17%.[133]

In another study conducted in Bombay Hospital (India), 8793 patients of DM >14 years were studied for macro-vascular complications. 81.8% had complications like hypertension in 42.2%, ischemic heart disease in 27.2%, cerebro-vascular accident in 9.2% and prolapsed inter-vertebral disc 4.2%. The mean interval between onset of diabetes and the appearance of proteinuria was 9.5 ± 7.5 year. Proteinuria appeared within one year in 23 patients (9.2%) 1-5 years in 32 (12.8%), 6-10 years in 86 (34.4%) and >10 years in 109 (43.6%). Renal insufficiency was present in 206 (82.4%) patients and occurred in 10.5 ± 7.5years after the detection of diabetes and end stage renal disease occurred in 11.8 ± 6.8 years of diabetes. Hypertension was present in 61.2% and was first detected 7.5 ± 5.4 year onset of diabetes.[142]

In this study among 100 patients with type 2 diabetes less than 5 years compared with another group of patients with diabetes more than 5 years; micro-albuminuria was found among 12 (40%) and proteinuria among 18 (60%) patients in group A (DM < 5 years), compared to micro-albuminuria in 8(22%) and proteinuria among 28 (78%) in group B (DM > 5 years). In group A, 28 (56%) patients had proteinuria; in average 66% patients had nephropathy. Out of those 66% patients 18 patients of group A and 28 patients of group B (i.e. 46%) had already developed chronic renal failure and/or end stage renal failure. Though the prevalence rate of nephropathy is high among those patients, there is no statistically significant (p-value <0.69 vs <0.85) association between DAN and nephropathy.

In another study of 100 patients conducted at Baqai Institute of Diabetology and Endocrinology to detect "feet at risk", in between 1997 to 1999, ninety nine patients of type-2 diabetes were studied; 65% were male and 35% were female. Glycemic control was poor in 70%, fair in 16% and good in 14% only. Regarding the duration, 58% patients had

diabetes for more than 10 years. Toe was affected in 44%, and sole was affected in 18%. 11% patients had ulcers had in both feet. Spontaneous ulcer was 29%, started as blister/ boil in 14%, history of trauma/cuts 17%, burn 8%, and callus was found in 10%. Foot ulcers of 59 patients, healed on conservative management, 6% had below knee amputation, 1 5% had toe/ray amputation, 9% still in follow up most of them may need amputation and 11 patients who lost in follow up, mostly had bad wounds.[145]

In this study also the causal relation and amputation rates are comparable with above, 54% patient had diabetic foot problem. Spontaneous ulceration is found in 29% vs. 25% of patient in both groups. Thorn, trauma and nail are the frequent causes of ulceration in 64.8% patients among group A and 65% patients among group B. In total 33% patients had their toe, rays, foot and below knee amputation in this series which is significantly high as compared to worldwide data.

Conclusion

All micro-vascular group of complication ranges nearly the same i.e. retinopathy among 72%, nephropathy among 66% and neuropathy among 48% are slightly less than the previous two.

These percentages of complication are quite high as expected in Pakistani population and should be compared among patients of Nepal. Emphasis must be given to educate the people regarding low calorie diet, weight reduction, and tight sugar control to decrease the complication of DM.

Prevalence of diabetes as well as its complication in Nepal, as expected, is high and may be more than those in other neighboring countries, India and China, was the diabetes is rampant. As most of the people are non-affording for diabetic medicines and are illiterate to follow the proper health education. We expect much more complication rates than else where among our diabetes patients in Nepal.

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