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DIABETIC FOOT ULCER;
RISK FACTORS STRATIFICATION IN PATIENTS. A STUDY OF 150 PATIENTS.

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ABSTRACT… Objectives: To determine the risk factors contributing to the development of diabetic foot ulcers. **Study Design:** A descriptive observational study. **Setting:** Unit of surgery, City Hospital Lakki Marwat, Khyber Pakhtunkhwa. **Period:** 1st July 2013 to 30th June 2015. **Patients and Material:** One hundred and fifty diabetic patients with foot ulcer were studied. After taking informed consent, detailed history, clinical examination and relevant investigations were performed according to a devised proforma. All the proformas were analyzed in the end of study. **Results:** One hundred and fifty patients comprising 95 male and 55 female were studied. The average diabetic duration was 11 years. HbA1c was more than 8% in 98 (65.3%) patients. Peripheral neuropathy was present in 60 patients (40%), peripheral vascular disease in 80 patients (53.3%), neuro-ischemic ulcers in 45 patients (30%), hypertension in 70 patients (46.6%), Ischemic heart disease in 20%, Dyslipidemia in 50%, foot deformity in 42% and accidental/ foot wear trauma in 44%. **Conclusion:** Foot ulcer in diabetes results from multiple pathophysiologic mechanisms. Implementation of strategies for prevention, early detection, and appropriate treatment at the primary health care level are urgently needed.

Key words: Diabetes mellitus, Diabetic foot ulcers, Ischemia, Neuropathy, Dyslipidemia, Foot deformity.

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INTRODUCTION

Diabetes mellitus is a syndrome with disordered metabolism and inappropriate hyperglycemia due to either a deficiency of insulin secretion or to a combination of insulin resistance and inadequate insulin secretion to compensate for the resistance.[1] In 2014 the global prevalence of diabetes was estimated to be 9% among adults above age 18 years of age. In 2012 diabetes was the direct cause of 1.5 million deaths. More than 80 % of deaths occur in low and middle income countries.[2] WHO projects that diabetes will be the 7th leading cause of death in 2030.[3] Diabetes puts a lot of burden on the economy of countries where prevalence of diabetes is high. In 2007, 14 billion dollars were spent on the treatment of diabetic patients where diabetic foot ulcers (DFUs) contributed one third of the total cost.[4,5] Pakistan is situated in high prevalence area (5-7%) where 6.9 million people are affected by diabetes with the International Diabetes Federation estimation that this number will grow to 11.5 million by 2025 unless measures are taken to control the disease.[6,7]

Currently, Pakistan is ranked 7th in the list of countries with major burden of diabetes mellitus where as it is the 4th leading cause of death in developed countries.[8,9]

This grave situation is an alarming sign and a challenge for the health authorities in our country as well as abroad.

Diabetic foot ulcers are one of the most common complications of diabetes mellitus. About 20-40% of diabetic patients suffer diabetic neuropathy of which almost 50% usually develop symptomatic peripheral vascular disease within twenty years of diagnosis. The lifetime prevalence of foot ulceration is about 15% and diabetes is an important non-traumatic cause of major amputations of the lower limbs.[10,11]

Lower-limb amputation and foot ulcer results in

considerable morbidity, mortality, and health care expenditures among patients with diabetes. More than half of lower-limb amputations in the U.S. occur in patients with diagnosed diabetes, who comprise only 3% of the U.S. population.[12] A study conducted by Reiber GE et al, United States in 1995, nonhealing foot ulcer preceded 85% of diabetic lower-limb amputations.[13]

Foot ulcers are usually divided into two groups. Acute ulcers occur due to poorly fitting shoes and other minor trauma. Chronic planter ulcers occur over weight bearing areas. In most cases, the initiating event is a minor trauma. The recognized causal pathways leading to diabetic foot ulcers and then amputations alone or in combinations are neuropathy, ischemia, infections, impaired wound healing, minor trauma, dermal abrasions and gangrene.[13,14,16] Poor glycemic control is a recognized risk factor.[17] The frequent evaluation of the feet in diabetic patients is important to identify those at risk for foot ulceration.[16,18] The cost implication of hospital care, treatment products, nursing, dressing and debridement, amputations, rehabilitation and long term care, social support, transport and provision of orthoses is very high. Besides this, heavy psychological burden due to morbid life have a significant impact on healing.[19] Hence the lone solution is early identification with proper treatment of diabetic foot ulcers which will go a long way in improving clinical and economic outcome. This calls for prevention of diabetes, its complications, prevention of foot ulcers and prevention of amputations.

The aim of the present study is to find out the risk factors contributing to the development of diabetic foot ulcers so that early measures be taken to prevent their occurrence.

PATIENTS AND METHODS

This single center descriptive observational study was conducted in the Department of Surgery, City Hospital Lakki Marwat, Khyber Pukhtunkhwa from 1st July 2013 to 30th June 2015. One hundred and fifty patients with diabetes mellitus and foot ulcer were studied. Ninety five were male and 55 were female. Informed consent was obtained from all patients. Patients who had bilateral foot amputation, wheel chair bound or unable to walk, foot ulcers due to vasculitis/ artertitis, too sick patients to participate in trial, diabetics without foot problems and all patients who refused to participate in the study were excluded from the study. All patients were interviewed to collect data on demographics, socio-economic conditions of the patients, smoking history, self-care behaviors and any delay in seeking proper treatment. Lower limbs of all patients were thoroughly examined along with general physical examination. Particular attention was given to evidence of hypertension, heart and renal failure, ischemic foot (cold skin, weak peripheral pulses), neuropathy (insensitive foot, loss of vibration and position sense), foot deformity (claw toes, call us at pressure areas and Charcot joints), visual acuity with Snellen Chart, immobility of patient (stroke, frailty), footwear trauma, accidental trauma (Thorne, glass, insect bite) infection in feet (bacterial and fungal) and neglected foot (unawareness on patient's side). Various investigations were performed including fasting and random blood sugar, lipid and renal profile, HbA1c level, chest X-ray, X-ray foot, echocardiography, urine examination, swabs culture from wounds. After the completion of 150 cases, all the proformas were analyzed for the results.

RESULTS

One hundred and fifty patients including 95 (63%) male and 55 (37%) female were studied as shown in Figure-1.

Most of the patients (65%) were above 50 years of age while only 5 patients (3.3%) were below 30 years of age. The mean age was 55 years.

The average diabetic duration was 11 years. 93% patients had type 2 diabetes mellitus and only 7% had type 1 diabetes in only 7% of patients. Of the total 150 diabetic patients, 139 contributed both lower limbs while 11 amputee diabetic patients contributed only one limb. The mean body mass index (BMI) was more than 25.1 in male patients and 28.2 in female patients. Fifteen (10%) patients were smokers. HbA1c

was more than 8% in 98 (65.3%) patients and less than 6% in none. Peripheral neuropathy was present in 60 patients (40%), peripheral vascular disease in 80 patients (53.3%), neuro-ischemic ulcers in 45 patients (30%), hypertension in 70 patients (46.6%), retinopathy in 18 patients (12%). Ischemic heart disease and nephropathy was present in 30 patients (20%) and 20 patients (13.3%) respectively. Lipid profile was deranged in 75 patients (50%). Structural foot deformity was present in 63 patients (42%). Thirty five patients (23.3%) were immobile either due to loss of vision or stroke or frailty. Trauma either accidental or foot wear were noted in 66 patients (44%). Infected foot ulcers were noted in 112 patients (74%). These results are shown in figure-2.

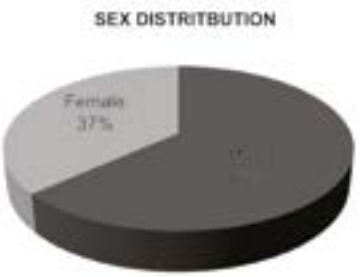

Figure-1.

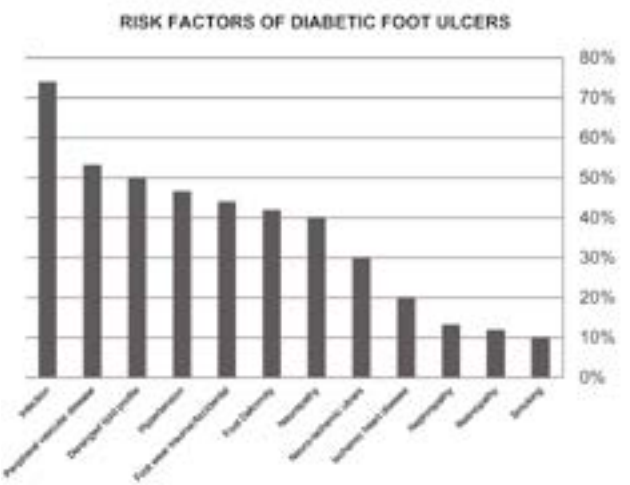

Figure-2

DISCUSSION

Diabetic foot is one of the many serious life threatening complications having major medical and socio-economic consequences. Nearly 15 % of all diabetics will develop foot ulcers during the course of their illness.[20,21] Macro and micro-angiopathy and neuropathy play a major role in causation, progression and healing of diabetic foot ulcers.[22] Foot infection and the subsequent amputation of a lower extremity are the most common cause of hospitalization among diabetic patients.[23] There are multiple contributory factors and there is evidence to suggest that up to 50 % of foot ulcers and amputations could be prevented by early identification of the risk factors, their management and education of the patients.[24]

We studied the contributory risk factors for foot ulcers in 150 diabetic patients with diabetic foot ulcers. Male to female ratio was almost 3:2. The male predominance was also evidenced in other local studies conducted by Muqim R, et al where male predominance was 62% and Khan H, et al where male predominance was 63%.[25,26] A study conducted in Bahrain, females outnumbered males in a ratio of 1.3:1 which contradicts our study.[27] The more prevalence in males in our set up may be due to more exposure to trivial foot injury, foot wear trauma and bare foot walking.

Sixty five percent of the patients were above the age of 50. In most of the studies conducted locally or abroad, the mean age of the patients was > 50 years which coincides well with our study.[26-28]

The average duration of disease was more than 11years in our study. A study conducted by Edward J, et al the average duration of diabetes mellitus was 11.4 years which match our results.[29] Same result is also evidenced in another study.[30] Mean duration of 15 years was seen in a local study.[31] The longer the duration of diabetes, the higher are the chances of diabetic foot ulcers.[29,32]

The mean BMI was 28.2 in female diabetic patient. Obesity is very common in our set up especially in female population. The main cause may be over eating habits, lack of exercise and poor health education. Obesity is mentioned as a risk factor in diabetic foot ulcers in other studies.[26,27,33]

Smoking is an independent risk factor for diabetic

foot ulcer.[26,29] Smoking leads to peripheral vascular disease, dyslipidemia, ischemic heart diseases and ischemic foot. Although less common in our society as compared to western societies, still it was present in 10 % of our study population.

Neuropathy, peripheral vascular disease and neuro-ischemic ulcers were found in 40%, 53.3% and 30% diabetic patients respectively. Peripheral neuropathy and peripheral vascular diseases are the major complications of diabetes mellitus leading to foot ulceration, infection and amputation.[13,17,34] Prevalence rates of neuropathy and its complications are high in our society as compared to Western or American society which may be due to better management of diabetes, better foot care and better health education. A local study conducted by Khan H, et al, neuropathy, ischemia and neuro-ischemic foot ulcers were present in 86%72% and 43% diabetic patients which is higher than our study.[26] Another study conducted in UAE showed peripheral neuropathy in 30% and PVD in 13% patients which is quite low as compared to our study.[34] Ali SM, el al found neuropathic ulcers in 42 % and neuro-ischemic in 58%.[33] This study nearly correlates with our study.

HbA1c was more than 8 in 65.3% patients which show poor diabetic control. A significant positive association of the glycated hemoglobin level and diabetic neuropathy has been found, which indicates the role of poor glycemic control in the development of diabetic neuropathy.[27] Poor glycemic control in patients with diabetic foot ulcers has been found in other studies.[15,26,27,29]

Hypertension, ischemic heart disease and dyslipedimia were found in 46.6%, 20% and 50% respectively. These all are significant independent risk factors for the development of neuropathy, PVD and diabetic foot ulcers as shown in other studies.[26,32]

Nephropathy and retinopathy was observed in 13.3% and 12% respectively. Nephropathy can lead to end stage renal disease while retinopathy can cause diminished visual acuity which is a major cause of foot injury as the patient cannot see the objects.

Structural foot deformity is another risk factor for the development of diabetic foot ulcer. Peripheral vascular disease and neuropathy augment the risk of foot ulcer many fold in patients with foot deformity. Foot deformities are more common in diabetic patients due to atrophy of the intrinsic musculature responsible for stabilizing the toes.[32,35,36] It was present in 42% of our patients.

Accidental/ foot wear trauma was noted in 44% of patients. Ill-fitting shoes were the commonest cause of foot wear trauma in our study.

Foot infection was present in 74 % of patients. Although it is not directly related to development of foot ulcers but can lead to osteomylitis, chronic ulceration and foot amputation.[26,37]

CONCLUSION

Obesity, poor glycemic control, peripheral neuropathy, peripheral vascular disease, dyslipidemia and accidental or footwear trauma are the major contributory risk factors leading to development of diabetic foot ulcer. Therefore every physician sitting in primary health facility should have ample knowledge of diabetes mellitus, its early diagnosis and proper management.

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"Every saint has a past.
Every sinner has a future."

Unknown

AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Dr. Hanifullah Khan	Statistical analysis & guidance in writing the manuscript	
3	Dr. Ishtiaq Ahmad	Data collection & compiling results	
4	Dr. Matiullah Khan	Writing the article, Critical revision of the article	