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### RESEARCH ARTICLE

#### EVALUATION AND MANAGEMENT OF DIABETIC FOOT.

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#### Abstract

Diabetic foot ulcers are main cause of hospitalization in diabetic patients. Patients with diabetes mellitus are at higher risk of lower extremity complications than their non diabetic counterparts. Every year approximately 5% of diabetic patients develop a foot ulcer. Approximately 15% of all diabetics develop foot problems during course of their illness (1-2). Diabetic foot ulcers carry a significant risk of amputation. Therefore diabetic foot disease has major medical, economic and social consequences. This was a prospective observational study conducted Tertiary Care Teaching Hospital of North India and included 100 patients with diabetic foot ulcer presenting over a period of one year. The aim of this study was to evaluate and manage different lesions of diabetic foot according to Wagner classification. A treatment oriented assessment of diabetic foot ulcers based on a cross-examination of the medical, foot, and wound history, risk factors, a systemized and detailed physical examination and the results of complementary diagnostic procedures were recorded. Diabetic foot disease presented more among male in older age group and was more common in patients with uncontrolled diabetes, with longer duration of disease, with more than one co morbid condition. 38 patients (38%) had insulin dependent diabetics; and 87 (87%) of them were on irregular treatment. Other 58 patients (58%) had non-insulin dependent diabetes; out of which 19 (70.0%) were on irregular. Treatment. Remaining 4 patients (4%) were not getting any treatment for their disease. The commonest disease was Grade 4 that comprised of 34 patients, followed by Grade 2 in 22 patients, followed by Grade 3 in 16 patients. These patients were managed according to Wagner classification as shown above. Conservative management with good diabetic control, antibiotic cover and foot care was carried out in 25 patients. Surgical intervention was carried out in rest of 75 patients. The commonest procedure was incision & drainage of foot abscess and debridement, that was performed in 40 (40 %) of patients; while 35 (35.0%) patients needed some form of amputation. Multiple amputations were performed in 2 (2%) patients. This study confirmed that diabetic foot ulcers is quite prevalent among diabetic population and thus, a multidisciplinary approach prioritizing invasive infection drainage, necrosis debridement, and the prompt start of empirical antibiotic therapy, followed by complete, appropriate

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vascular reconstruction and patient education would be the most important tool in dealing with this major problem.

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### Introduction:-

Diabetic foot ulcers are main cause of hospitalization in diabetic patients. Patients with diabetes mellitus are at higher risk of lower extremity complications than their non diabetic counterparts. Every year approximately 5% of diabetic patients develop a foot ulcer. Approximately 15% of all diabetics develop foot problems during course of their illness (1-2). Diabetic foot ulcers carry a significant risk of amputation. Therefore diabetic foot disease has major medical, economic and social consequences. It is very difficult to treat if proper protocol is not followed, resulting in longer hospital stay. Patients with diabetes have increased risk of lower extremity amputations and main cause is diabetic peripheral arterial disease accelerated by direct damage to nerves and blood vessels by high blood glucose levels. Wound healing is also impaired from affected collagen synthesis. Diabetic vascular disease has three main components : arteritis , neuropathy and large vessel atherosclerosis. the diabetic foot ulcers are often deeper and more frequently infected than other leg ulcers reflecting severe end vessel ischemia and opportunistic infection which is common affliction of diabetes. Factors such as age and duration of the disease will increase its incidence (3). Once tissue damage has occurred in form of ulceration or gangrene, aim is preservation of viable tissue. Diabetic foot ulcers are commonly classified according to Wagner classification (4). Wagner classification assesses ulcer depth and presence of osteomyelitis or gangrene.

To best of our knowledge no similar study exist from this place hence the current prospective observational study was undertaken to evaluate and manage different lesions of diabetic foot according to Wagner classification.

### Materials and Methods:-

This was a prospective study conducted at SGRR Medical College, Dehradun and included 100 patients with diabetic foot ulcer presenting over a period of one year. The patients were enrolled from surgical and medical outdoor clinics, emergency units, and from other wards of the hospital. A detailed history was obtained regarding the duration of the diabetes and its type whether insulin dependent (type I) or on oral hypoglycaemic agents (type II). They were asked about compliance and control of diabetes. A detailed history was obtained about the foot ulcers, its onset duration and progression. A detailed foot examination was performed and ulcers were classified according to Wagner's classification. (4) The Wagner classification is most commonly used for grading diabetic foot ulcers. Wagner developed a classification system and a treatment algorithm for each grade of ulcer. He asserted that ischemic index derived from Doppler flow pressures is an essential baseline test to predict ulcer healing. Vascular evaluation was performed checking capillary refill and distal pulses of the foot which included dorsalis pedis, posterior tibial, popliteal and femoral arteries. Neurological examination included light touch, pinprick, position sense and vibration sense on every patient, and data was recorded on the specified proforma. The patients were evaluated and managed by classifying their disease according to Wagner's classification for diabetic foot. (Table-1)

**Table 1:-** Standard Treatment of Diabetic Foot According to Wagner Classification

<b>Grade - 0</b>	Foot at Risk	Prevention
<b>Grade – I</b>	Localized,	Antibiotics & glycemic superficial ulcer control
<b>Grade – II</b>	Deep Ulcer to bone , ligament, or joint	Debridements, Antibiotics and glycemic control
<b>Grade - III</b>	Deep abscess, osteomyelitis	Debridements, some form of amputation
<b>Grade – IV</b>	Gangrene of toes, forefoot	Wide debridement and amputation
<b>Grade -V</b>	Gangrene of entire foot	Below knee amputation

### Statistical Analysis:-

Data was compiled and analyzed using SPSS version 16.0, and frequencies were calculated.

### Results:-

The data revealed that diabetic foot diseases affected males somewhat more frequently (66%) as compared to females (34%); the male to female ratio was 1.94:1. The most common age groups of diabetic patients with foot involvement were the 4th and 5th decades. 38 patients (38%) had insulin dependent diabetics; and 87 (87%) of them were on irregular treatment. Other 58 patients (58%) had non-insulin dependent diabetes; out of which 19 (70.0%) were on irregular treatment. Remaining 4 patients (4%) were not getting any treatment for their disease. The grade frequency of diabetic foot according to Meggitt and Wagner classification is shown in above table. The commonest disease was Grade 4 that comprised of 34 patients, followed by Grade 2 in 22 patients, followed by Grade 3 in 16 patients. (Fig. 1-10). These patients were managed according to Wagner classification as shown above. Conservative management with good diabetic control, antibiotic cover and foot care was carried out in 25 patients. Surgical intervention was carried out in rest of 75 patients. The commonest procedure was incision & drainage of foot abscess and debridement, that was performed in 41 (41%) of patients; while 35 (35.0%) patients needed some form of amputation. Multiple amputations were performed in 5 (5%) patients. (Table-2-4).

### Discussion:-

In the study of Viswanathan *et al.* (5) while evaluating post amputation outcome and associated complications in type 2 diabetic patients who had undergone major amputations in developing countries. The prevalence of minor amputation and foot deformity was high among Bangladesh population. Recurrence of foot ulceration was more in Tanzania (30%) than in India (9%) and

**Table 2:-** Epidemiological Profile of Study Population

**Parameters Variables**

<b>Male to Female ratio</b>	1.94:1
<b>Common Age Groups</b>	4th and 5th decades
<b>Urban Vs Rural</b>	65(65%) Vs 35(35%)
<b>Smoking Vs Non Smoker</b>	29(29%) Vs 71(71%)
<b>Alcohol Vs Non Alcoholics</b>	12(12%) Vs 88(88%)
<b>Co-morbid conditions Rate</b>	37(%)
<b>Infected Vs Non infected</b>	09(09%) Vs 91(91%)
<b>Normal weight Vs Overweight Vs Underweight</b>	59(59%) Vs 39(39%) Vs 2(2%)
<b>PVD Vs No PVD</b>	8(8%) Vs 92(92%)
<b>Glycaemic control : Poor Vs Fair Vs Good</b>	79(79%) Vs 15(15%) Vs 6(6%)
<b>On Insulin Treatment Vs On OHA V</b>	
<b>Not getting any treatment</b>	38(38%) Vs 58(58%) Vs 4(4%)
<b>Duration of diabetes in years &gt;5 years Vs &lt; 5 years</b>	67(67%) Vs 33(33%)

**Table 3:-** Classification of Diabetic Foot Study Population

**Wagner Classification N(%)**

Grade-0	0(0%)
Grade -I	18(18%)
Grade-II	22(22%)
Grade-III	16(16%)
Grade -IV	34(34%)
Grade-V	10(10%)

**Table 4:-** Management of Diabetic Foot Study Populati Treatment No. of Patients (%)**Conservative** 25(25%)**Surgical** 75(75%)

Incision and drainage 4(4%)

Debridement 36(36%)

Amputations 35(35%)

Ray's 4(4%)

Transmetatarsal 7(7%)

Below Knee Amputation 12(12%)

Above Knee Amputation 10(10%)

Multiple 2 amputations(2%)

**Discussion:-**

In the study of Viswanathan *et al.* (5) while evaluating post amputation outcome and associated complications in type 2 diabetic patients who had undergone major amputations in developing countries. The prevalence of minor amputation and foot deformity was high among Bangladesh population. Recurrence of foot ulceration was more in Tanzania (30%) than in India (9%) and Bangladesh (11%). Re-amputation rate was similar in all groups (3%). The use of artificial limb was most in Bangladesh (97%). The causes of death were infection due to septicemia and cardiovascular events which finally led to multisystem organ failure. The results of the current study are in accordance with the study of Ali SM *et al* (6) as there were 65% males and 35% females. Ninety nine patients were type II diabetics, 38% were either smokers or had other addictions (or were addicted to tobacco). Awareness about risk factors causing foot problems was lacking among all patients. Fifty percent patients were on oral hypoglycaemic agents, 48% were insulin treated, while 2% were on diet and exercise alone. Glycaemic control was poor in 70%, fair in 16% and was good in 14%, 31% were overweight and 5% patients were underweight. Duration of diabetes was greater than ten years in 58%, toes were affected in 44%, sole/metatarsal in 18%; rest included malleoli, heel etc. Eleven patients had ulcers on both feet. Neuropathic ulcer were 42%, neuroischaemic 58%, Sixty nine percent patients were in the age group between 40-60 years. Cause unknown 29% blisters and boil 14%, trauma/cutting 17%, burns 8%, dry skin/callus .10%. Fundal changes were present in 37%; proteinuria in 37%, ischaemic heart disease in 20%, hypertension 18%, In 60% more than one antibiotic was used. Foot ulcers of fifty nine patients healed on conservative management, six patients had below knee amputation, fifteen had toe amputation; nine were still on treatment, eleven lost contact. In the study of Viswanathan *et al* (7) while determining the prevalence of foot complications such as neuropathy, peripheral vascular disease (PVD), amputations and infections and the associated diabetic complications and practice of foot care among these subjects reported that the prevalence of infection was 6-11% and prevalence of amputation was 3% in type 2 diabetic patients. Neuropathy (15%) was found to be an important risk factor for diabetic foot infections. Further study suggested that effective foot care advice should be propagated to reduce the burden imposed by diabetic foot complication particularly in developing countries like India. In the study of Ahmad Wet *al* (3) male dominated the study population with majority in the age range of 40-70) years. Right foot was more commonly involved (65.3%). 91.3% patients had diabetes of more than 5 years duration. No treatment had been received by 47.4% patients while 41.3% were on oral anti-diabetics; 11.2% patients were on insulin. All patients had type 2 diabetes mellitus. Neuropathy was present in 51% patients, 62.8% had absent or diminished peripheral pulses, 43.4% had poorly controlled diabetes. According to the Wagner classification 30.6% patients had grade 1, 26.5% had grade 2, and 42.9% had grade 3 diabetic foot. Evidence of infection was seen in 85.7% patients: staphylococcus aureus was isolated in 43.4% patients. Osteomyelitis was present in 42.9% patients. Surgical intervention was performed in 85.7% patients. Direct relation was found between the duration of diabetes, sugar control, peripheral neuropathy, peripheral arterial disease. grade of diabetic foot, evidence of osteomyelitis, intervention and the outcome of the disease. In view of the results of the current study, we stress the need for a clinical diagnosis of diabetic foot ulcers.

Regarding treatment, we propose a multidisciplinary approach prioritizing invasive infection drainage, necrosis debridement, and the prompt start of empirical antibiotic therapy, followed by complete and appropriate vascular reconstruction. For severe Diabetic foot ulcers, we suggest that negative pressure wound therapy (NPWT) be included in the treatment pathway. We also provide rules for managing particular situations, such as osteomyelitis.

**Conclusion:-**

This study also confirmed that diabetic foot ulcers is quite prevalent among diabetic population and thus, a multidisciplinary approach prioritizing invasive infection drainage, necrosis debridement, and the prompt start of empirical antibiotic therapy, followed by complete, appropriate vascular reconstruction and patient education would be the most important tool in dealing with this major problem.

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