

The Presentation and Surgical Management of Diabetic Foot

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ABSTRACT

Objective: To highlight the presentation and management of diabetic foot disease.

Study Design: A retrospective study

Place and Duration of Study: This study was conducted at the Surgical Department of Khalifa Gul Nawaz Teaching Hospital (KGNTH) Bannu from June 2017 to July 2019 for a period of 02 years.

Materials and Methods: A total of 320 patients with diabetic foot ulcer with infection were included in this study.

Results: Out of these 320 patients, males were 208 (65%) and females 112 (40%). The average age was 53.5 years (30-75 yrs). Majority of the patients (90%) had type II diabetes mellitus (DM). 109 patients (34%) had suffered from DM for <10 years and 211 (66%) had been diagnosed for >10 years. In this study 272 patients (85%) were on oral hypoglycemic drug with diet control and the remaining 48 (15%) were on insulin. History of trauma preceding the infection was positive in 20% (64) patients. Previous history of ulcer and infection was positive in 45% (144) patients. Positive culture for polymicrobial infections was found in 90% (288) of patients. Staph aureus was the most common isolate along with strepto cocci, pseudomonas and anaerobes and fungi.

Conclusion: Diabetic foot infective disorder is a common cause of morbidity and mortality among patients with diabetes throughout the world and is a leading cause of non-traumatic lower limb amputation. A multidisciplinary team approach concentrating upon a tight glysaemic control, education on foot care, a suitable foot wear, control of infection and early surgical intervention is needed to decrease the morbidity and mortality of diabetic foot disease. Due to polymicrobial infection and antibiotic resistance, early surgical intervention must be provided.

Key Words: diabetic foot infections, diabetic foot ulcer, diabetic neuropathy, diabetic microangiopathy and amputation

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INTRODUCTION

Diabetic foot disease is a rising health problem worldwide and the most frequent cause for hospital admission^(1,2). The incidence of diabetic foot disease is increasing⁽³⁾. Diabetic foot disease is a dangerous and disabling complication of diabetes and the number one cause for non-traumatic lower limb amputation⁽⁴⁾. 15-25% of patients of diabetes are likely to develop diabetic foot disease during their lifetime⁽²⁾. Some 40-70% of the non-traumatic amputations of the lower limb are because of diabetes mellitus⁽⁵⁾.

Peripheral neuropathy and microangiopathy are the two important causes for diabetic foot ulceration and infection.

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Managing patients with diabetic foot ulcer and infection is a multidisciplinary team approach needing; ⁽¹⁾ patient stability by controlling blood sugar, renal and cardiac functions and infection (by physician) and ⁽²⁾ early recognition of the lesion and prompt initiation of an appropriate antibiotic, aggressive surgical debridement of the dead and necrotic tissue and bone, tight control of blood sugar, correction of arterial insufficiency and delayed reconstruction to achieve limb salvage (by surgeon)^(6,7,8).

The risk factors for the development of diabetic foot disease are; gender (male), period of diabetes for more than 10 years, old age of the patient, high body mass index and other co-morbid conditions such as retinopathy, peripheral neuropathy and vasculopathy, high glycated hemoglobin level foot deformity, raised planter pressure, infection and inappropriate foot self-care^(9,10). Regular foot examination, patient education, simple hygiene practices, provision of appropriate foot wear, prompt treatment of minor foot injuries decrease diabetic foot infections and their recurrence by 50% and exclude the need for major amputation in non-ischemic lower limb⁽¹¹⁾.

MATERIALS AND METHODS

The medical record of 320 consecutive patients admitted to Khalifa Gul Nawaz Teaching Hospital

surgical ward with diabetic foot disease from June 2017- July 2019 were reviewed retrospectively. Patient demography e.g. age, sex, occupation, education level, socioeconomic state and co-morbid condition were collected. Clinical features e.g. the type and duration of diabetes, the treatment received, the specific site of diabetic foot infection, past history of ulcer, amputation and Wagner's grades were reviewed. The past history of any type of surgical procedure performed and the outcome, the length of hospital stay was recorded. Routine tests for diabetes mellitus e.g. blood sugar, glycated haemoglobin (HbA1C) (an indicator for glycemic control), swab for c/s from the depth of wound, urine analysis, blood urea and serum creatinin, ECG, echo and chest X-ray were reviewed. The results of lower limb arteriography, the doppler studies and the assessment of pedal pulses were also reviewed.

HbA1C \leq 7% good control of diabetes.

Hb1AC 7-10% fair control.

Hb1AC \geq 10% poor control of diabetes.

Statistical Data: The data collected were analyzed using SPSS computer software 22. The data were expressed in the form of proportions and frequency for categorical variables. Means and standard deviation were used for continuous variable. Student's t test and chi square tests were used for differences between qualitative variable. Significance was defined as P value $<$ 0.05.

Various Surgical Procedures Adapted

Type of operation	Frequency	Percentage
Debridement	192	60%
Lower limb amputation;		
Toes/Rye's amputation	30	9.4%
Below knee amputation	20	6.25%
Above knee amputation	10	3%
Incision and Drainage	42	13%
Skin grafting	6	1.8%
Sequesterectomy	4	1.25%

RESULTS

A total of 320 patients (all having diabetic foot disease) were included in the study, males were $>$ females. The mean age was 54 years (range 30-75 years). Most of the patients (95%) had type II diabetes mellitus (DM), the mean duration was 8 yrs since diagnosis of DM. In this study 109 patients (34%) had suffered from DM for $<$ 10 years and 211 (66%) had suffered for $>$ 10 years. 272 patients (85%) were on oral hypoglycaemic agents and 48 patients (15%) on insulin, both the group were having poor diabetic control. HbA1C assay indicated that 198 patients (62%) had $>$ 7 HbA1C (poor diabetic control). 144 patients (45%) had previous history of ulceration and infection. Only 64 patients (20%) were febrile on presentation and leucocytosis was present in 80 patients (25%).

The fore foot was commonly affected in 53% of cases. Neuropathic foot with infection was more common

(52%) than ischemic foot (35%). Wagner's grades II & III were most common (62.5% and 14% respectively). Debridement and incision and drainage (for cellulitis and abscess) were the most common surgical procedures performed (65.5% & 14% respectively).

Table No.1: Wagner's Grades for the Wounds of Diabetic Foot Disease Patients

Grade	Frequency	Percentage
Grade I	35	11.1%
Grade II	200	62.5%
Grade III	45	14%
Grade IV	25	7.8%
Grade V	15	4.6%

Post-operative complication rate was 26.8 %. Surgical site infection was the most common one. Bacterial culture showed polymicrobial series. Staph aureus was the most common isolate, also were streph cocci, pseudomonas, E coli, anaerobes and fungi. The organism showed a high resistance to the commonly used antibiotics, however they were susceptible to lenzolid, vancomycin, clindamycin, imepenems and meropenems.

There were 20 deaths with a mortality rate of 6.25 %. Mortality was associated with post-operative complications and Wagner's grades \geq 4 (p = 0.011). Causes of death were; sepsis in 10 cases, diabetic coma in 4 cases, myocardial infarction in 3 cases and renal failure in 3 cases. The mean hospital stay was 14-21 days and the mortality rate was 6.25%.

Table No.2: Site Specific Incidence of Infection in Diabetic Foot

Site	Frequency	%age
Fore foot	170	53%
Mid foot	44	13.7%
Hind foot	42	13.5%
Whole foot (with ascending infections in some cases)	64	20%

DISCUSSION

The prevalence of diabetic foot disease in diabetic population is 4-10% and it is more frequent in older patients^(12, 13, 14). Some 15-20% patients with diabetes mellitus will develop diabetic foot during their life time. The prevalence of diabetic foot disease is variable worldwide, it was 2-6% in USA, 4.6% in Kenya, 20% in Netherland, 11-19% in Nigeria and 20.4% in Iran, due to the regional variation in the prevalence of DM. The high prevalence of diabetic foot disease in the developing countries is due to illiteracy, poor socioeconomic status, bare foot walking, inadequate control of diabetes and lack of self-care.

From this study it became clear that males were affected more than the females, the mean age of presentation was 54 years and the mean duration of DM was 8 years which are comparable with other studies⁽¹⁵⁾.

¹⁶). It was also clear that those patients with poor glycemic control, illiterate, with poor socioeconomic conditions were the usual sufferer from diabetic foot infection and amputations. Past history of diabetic foot ulceration and amputation are the known risk factors for subsequent lower limb amputation. The combination of neuropathy and trauma from repetitive pressure during walking result in ulcer formation which resist to heal (Neuropathic/ Trophic ulcer).

In our study the recurrence rate of diabetic foot infection was 45% (144) which is similar to other studies ⁽¹⁷⁾.

Diabetic Foot Status (Regarding Vasculature and Sensation)

Type of diabetic foot	Frequency	%age
Neuropathic foot	166	52%
Ischemic foot	112	35%
Neuroischemic foot	42	13%

Wagner's grades II & III (for the severity and depth of diabetic foot wounds and which are widely used by surgeons) were more common (62.5% & 14% respectively) which is comparable to the other study.

Almost all diabetic foot ulcers are septic (infected) at the time of first assessment ^(18,19). The least invasive infection is the cellulitis followed by an abscess. Ulceration arising from peripheral neuropathy, peripheral arterial disease and trauma are highly susceptible to secondary infection and gangrene.

Diabetic foot disease is a preventable and curable complication of DM. The rate of lower limb amputation in our studies was 18.75% which comes near to the other studies ^(16,20). The mortality rate was 6.25% which is comparable to some other studies ^(21, 22, 20).

Surgical procedure was performed mainly to limit the spread of infection and gangrene through repeated debridement's and amputation. Minor trauma leading to major synergistic foot infection was the common story ^(23,24). Patients were followed for the next one year. Diabetic control was mandatory.

Surgical Procedures Complications

Complications	Frequency	%age
Surgical site infection	25	7.8%
Revision amputation	8	2.5%
Stump gangrene	15	4.7%
Wound dehiscence	20	6.2%
Phantom pain	8	2.5%
Wound haematoma	10	3%

The mortality rate in our study is 6.25% and the mortality rates from western Sudan was 7.4%, 6.7% in a study conducted by Omdurman and 13.7% in Tanzania.

CONCLUSION

Diabetic foot infective disorder constitutes a major cause of morbidity and mortality worldwide and is leading cause of non-traumatic lower limb amputation.

A multidisciplinary team approach, targeting a good glycemic control, education on foot care, appropriate foot wear, control of infection (through antibiotic) and early surgical intervention are required to reduce the morbidity and mortality associated with diabetic foot disease. Due to polymicrobial infection and the antibiotic resistance, surgical intervention must be provided.

Author's Contribution:

Concept & Design of Study: Gul Sher Khan
 Drafting: Muhammad Amir, Asif Mehmood
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 Revisiting Critically: Gul Sher Khan, Muhammad Amir
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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