
Management of diabetic foot

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Abstract:

Background: Diabetic foot is a common medical and surgical problem, the term is referring to any pathology in the foot that result from diabetes mellitus or its long term complications .It has a socioeconomic impact.

Objectives: To study the presentations of diabetic foot and factors affecting prognosis.

Methods: Case-series hospital based, conducted on 75 patients with diabetic foot at Al-Yarmouk Teaching Hosp. for the period from Oct2001 through Nov.2002. Patients were classified according to Wagner's grading system. The level of control of diabetes was assessed by the level of glycosylated hemoglobin (HbA1c).

Results: The main factors which lead to the failure of conservative treatment were first HbA1c>8, osteomyelitis by x ray, significant impairment of blood flow by Doppler, neuropathy and retinopathy.

Conclusions: Most of our patients with diabetic foot were poorly controlled HbA1c>8% and most common grade (Wagner) of presentation was grade 2.

Key words: Diabetes, Foot, Management

Introduction

Diabetic foot account for about 20% of all hospital admissions of diabetic patients ^[1] 5% of diabetics eventually undergo either a toe or foot amputation ^[2] .This can be prevented by control of diabetes and daily foot care. Control of diabetes can be assessed by (HbA1c), it is an electrophoretically fast moving hemoglobin component that is present in normal person and increase in amount in the presence of hyperglycemia .It is formed by non-enzymatic glycation of amino acid valine and lysine on the beta chain of hemoglobin A .(HbA1c) is irreversibly glycosylated and thus stable ,it reflects the integrated blood glucose control over the life span of erythrocyte (120 days) As (HbA1c) is affected more by recent than earlier events, a large shift in blood glucose control is rapidly accompanied by a change in glycosylated hemoglobin within 2-3 weeks ^[3] .The major factors responsible for development of diabetic foot are diabetic neuropathy, diabetic angiopathy and affection of the immune system.

The study is designed to see the presentation of diabetic foot and to assess factors affecting prognosis.

Patients & Methods:

A case – series hospital based study was conducted on 75 patients with diabetic foot at Al-Yarmouk Teaching Hospital between October 2001and November 2002. Inclusion criteria any diabetic patients with a lesion in the foot, patients were interviewed according to a forma containing personal data, and data regarding the presentation of disease and treatment. Patients were classified according to Wagner grading system ^[4] which consists of 6 grades Grade 0 Foot at risk ,thick callus, claw toes, prominent metatarsal head ,or any bone abnormality. Grade1 Superficial ulcer. Grade 2 Deep

ulcer penetrating dermis into tendons and or joint capsules, there is no bony involvement. Grade 3 includes deep ulcer, with deep abscess or bony involvement. Grade 4 Localized gangrene Grade 5 Gangrene of whole foot.

Features of peripheral neuropathy and peripheral arterial pulsation were assessed. Laboratory tests as fasting blood sugar, complete blood picture, swab for culture and sensitivity, level of glycosylated hemoglobin (HbA1c), Doppler U/S, and colour duplex. Follow up of patients with diabetic foot which consists of daily dressing, wound debridement, and amputation are carried out when indicated. Data collected were analyzed using SPSS: version 11.5 (Statistical package for Social Science –version 11.5) and prepared in frequency and percentage, chi-square tests (CXL) were used to test the significance of difference, the $P \leq 0.05$ are the level of significance.

Results:

Seven patients with type 1 diabetes mellitus, sixty eight patients with type 2 diabetes mellitus were encountered. There were 39 males and 36 females, most of the patients fall in the age group 50-59.

Discussion:

Foot troubles are an important cause of morbidity in patients with diabetes mellitus; both vascular and neurological disorders contribute to this problem. It is accounting for approximately two third of all non traumatic amputations performed in the United States ^[5], the best predictors of future lower limb amputation are history of a previous foot ulcer, the presence of neuropathy, peripheral vascular disease, and poor glycemic control ^[6,7]

Wagner's grading system classification of the patients in our study showed that 30.66% of them

were grade 2 followed by grade 3 accounting for 21.33% and grade 1 which represents 18.6%, while Lipsky et al ^[8] showed that most of the patients presented with grade 1 and grade 2 who were treated as outpatients cases. This difference could be attributed to the delay in presentation, underestimation of the lesion, and negligence on part of our patients, adding to that the stumbling medical care in our country during this period. The most common site of diabetic foot ulcer was the head of the first metatarsal bone, (table 1), this goes with other studies ^[9,10] The reason for this predilection is that chronic motor neuropathy often affects the small intrinsic muscles of the feet so that the action of the larger muscles in the anterior tibial compartment is unopposed, this lead to the subluxation of the proximal interphalangeal joints and metatarsophalangeal joints resulting in claw toe appearance, one consequence of this abnormality is increased pressure on the metatarsal head, which was the commonest site of ulcer development ^[11]

The intensity and duration of treatment can be determined by clinical evaluation of the ulcer. Treatment outcome in relation to grading of diabetic foot showed that conservative treatment which include bed rest, total non weight bearing, antibiotics and simple wound debridement were successful in 100% in grade 1, 65.22% in grade 2, 12.5% in grade 3. So the overall successful conservative treatment was 46.6%, while Ritz et al ^[12] had successful conservative treatment up to 90%. Our relatively low percentage of successful conservative treatment might be due to lack of certain ways of treatment like total contact free cast or felted foam dressing which decrease pressure at the site of ulcer, also we did not practice antibiotic infusion with tourniquet occlusion of the limb. The earlier diagnosis of osteomyelitis by bone scan and MRI gave privilege to the high percentage of the conservative treatment, whilst our use of these methods is limited.

Table (1) Percentage of amputation in relation to the site of ulcer in the foot

Site of ulcer	Amputation No.	%	Conservative treatment No.	%	Total	%
1 st .metatarsal head	8	20	11	31.5	19	25.3
Other metatarsals	1	2.5	1	2.8	2	2.7
Fore foot	7	17.5	1	2.8	8	10.6
Big toe	7	17.5	2	5.7	9	12
Other toes	9	22.5	3	8.6	12	16
Heel	3	7.5	4	11.4	7	9.3
Dorsum of the foot	1	2.5	7	20	8	10.6
All foot	4	10	0	0	4	5.3
Other	0	0	6	17.2	6	8
Total	40	100	35	100	75	100

*P<0.01

Table (2) Diabetic foot grading in relation to treatment outcome

Grade	Amputation N0.	%	Conservative N0.	%	Total
O	0	0	4	100	4
I	0	0	14	100	14
II	8	34.76	15	65.22	23
III	14	87.5	2	12.5	16
IV	15	100	0	0	15
V	3	100	0	0	3
Total	40		35		75

*P<0.0001

The incidence of amputation in this study is 53.33% which is relatively high; this might be explained by the late presentation of our patients and the inadequacy of the conservative measures. The most common type of amputation was toe amputation and ray excision (where head of the metatarsal is excised and tendons are cut back) this represent 35%, this goes with other studies ^[13] Being the commonest type is attributed to the high percentage of patients 56% who presented with toe or metatarsal head lesions.

A casual association between glycaemic control and the development of microvascular complications of diabetes mellitus has been suggested, retinopathy are more likely to occur in patient with poor glycemic control The risk is highest if the hemoglobin A1c value is above 12% but still increased at value above 10% and the risk is lower if the HbA1c are below 8%. A reduction of 1% in HbA1c was associated with 35% reduction in microvascular endpoints, 18% reduction in myocardial infarction and a 17% in all – cause mortality. ^[14, 15] In our study 85.33% of patients were with HbA1c >8 with significant incidence of amputation among them (59.37%), so most of our patients were with poor glycaemic control which

affected the treatment outcome adversely. This can be explained by the negligence, lack of health education and the inadequacy of health care programs

Peripheral vascular disease is another major predictor factor for diabetic foot, this can be detected by palpating the pedal pulses which was absent in 38 patients (50.66%) of our patients, Newman et al showed that the peripheral pulse plays a major role to determine the end result of diabetic foot and type of amputation^[16]

Neuropathy was present in 57 patients (76%), amputation was performed for 36 patients who represent 63%, and this figure is much higher than that shown by Weiman et al (38%), and this was attributed to the use of different modalities of conservative treatment by Weiman like external fixation and osteotomy of bones to reduce high pressure.

Retinopathy is another prognostic index where its incidence increases over time, patients with retinopathy had more incidence of amputation than those without it, and this is due to the reduced visual acuity leading to exposure to repeated unnoticeable trauma ^[17]. This goes with our findings table(3)

Table (3) The association between clinical parameter & the treatment outcome

parameter	Amputation	conservative	Total	P. value
<u>Neuropathy</u>				<0.003
Presence	36	21	57	
Absence	4	14	18	
<u>Retinopathy</u>				<0.0003
Presence	34	16	50	
Absence	6	19	25	
<u>Pedal pulses</u>				<0.001
impalpable	31	7	38	
palpable	9	28	37	

Smoking causes substantial increase in risk for macrovascular and microvascular disease, smoking is also associated with increase serum concentration of serum cholesterol and very low density lipoprotein, a decrease in serum high density lipoproteins concentration and greater degree of insulin resistance. In this study 39 patients were smoker, 29 patients (74%) underwent amputation, and this goes with a study done by Moss et al^[18].

Diabetics have an increase risk for hypertension and ischemic heart disease^[19] there was 31 patients with hypertension 23 patients (74%) underwent amputation. While 21 patients had ischemic heart disease 15 patients (71%) ended with amputation.

Osteomyelitis have an adverse effect on prognosis, 30 patients out of 32 who had osteomyelitis on x- ray underwent amputation, table (4). Akanji et al^[20] considered anemia an adverse factor for treatment outcome and this goes with our findings. Also we found that a rise in the white blood cell count over 11000, and positive urine for sugar and ketone had an adverse effect on prognosis, where the rate of amputation will raise, 12 out of 14 patients with positive urine ended with amputation, table (4).

Other factors were studied like age, sex, type of diabetes, duration of diabetes mellitus, and type of bacterial infection, these show no statistically significant effect on prognosis.

Table (4) Risk factors and type of management

Risk factor	amputation	conservative	total	P. value
Smoking				
Smoker	29	10	39	<0.0001
Non smoker	11	25	36	
Hypertension				
140/90mmHg	23	8	31	<0.003
Ischemic heart disease	15	6	21	<0.05
Hb$\leq$ 10gm/dl	23	6	29	<0.00004
WBC$\geq$11000/mm³	26	3	29	<0.0001
+ve GUE for sugar & ketone	12	2	14	<0.007
Osteomyelitis by X- ray	30	2	32	<0.0001
Significant impairment of flow by Doppler	35	9	44	<0.0001

Table (5) Rate of amputation in relation to glycosylated hemoglobin (HbA1c) level

HbA1c	Amputation	conservative	Total
$\leq 8\%$	2	9	11
>8	38	26	64
Total	40	30	75

*P<0.01

Table (6) Type and rate of amputation of 40 patients with diabetic foot

Type of amputation	No. of patients	%
Toe amputation	14	35
Transmetatarsal	6	15
Syme	1	2.5
Below Knee	12	30
Above knee	7	17.5
Total	40	100

Conclusions:

- 1-Most of our patients with diabetic foot were poorly controlled as reflected by HbA1c > 8% and a significant number of them ended with amputation.
- 2-Most common grade (Wagner) of presentation was grade 2. and the most common site of diabetic foot ulcer was the head of first metatarsal.
- 3-There are statistically significant association between amputation and the following risk factors; neuropathy, vascular impairment, retinopathy, osteomyelitis, smoking, hypertension, ischemic heart disease, uncontrolled blood sugar, leukocytosis, anemia, and positive urine for sugar and ketone.

Recommendations:

A team approach is required to deal with these patients, through the organization of specialized clinics devoted to the care of diabetic patients, and the promotion of primary health care and health education are also required.

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