SURGICAL MANAGEMENT OF DIABETIC FOOT AND ROLE OF UT (UNIVERSITY OF TEXAS) CLASSIFICATION

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ABSTRACT

Objective: To evaluate the role of University of Texas Classification in the management of Diabetic foot.

Design: Descriptive study

Place and Duration of Study: Surgical unit II Combined Military Hospital Rawalpindi (2003 to 2008) and Department of Surgery Combined Military Hospital Peshawar (July 2008 to Jan 2010).

Patients and Method: A total of 300 patients who reported to Surgical Department with a foot ulcer or infection and diagnosed to have Diabetes Mellitus were studied. Patients of both gender and age >12 years were included. Patients of end stage renal disease, compromised immunity or on steroid therapy were excluded. Detailed history and clinical examination were recorded. Routine investigations including complete blood examination, urine routine examination, renal function tests, x-ray foot, chest x-ray, ECG and pus for culture and sensitivity were recorded. Lesions were classified according to University of Texas classification and treated accordingly.

Results: Majority of the patients were of 50 to 70 years age group. Male to female ratio was 4:1. Big toe was the commonest site followed by fore foot and heel. Patients were classified according to UT classification. Patients were managed with antibiotics, dressings, incision and drainage, debridement, vacuum assisted closure (VAC) with or without skin grafting and amputations of different types. *Staphylococcus Aureus* was the commonest isolate.

Conclusion: Our study has shown that UT classification is an effective system of assessing the severity of Diabetic foot at the time of presentation and planning its management. Amputation rates, time of healing and morbidity increases with increasing stage and grade.

Keywords: Diabetic foot, Diabetic ulcer, UT classification.

INTRODUCTION

In Pakistan, approximately 8 million people have diabetes mellitus which is estimated to be doubled in the year 2025[1]. Worldwide the lifetime incidence of foot ulcers in diabetic patients is around 15%[2,3]. The yearly prevalence of foot ulcers in diabetics is approximately 2%.[4] Local studies showed the prevalence of foot ulcer between 4-10.4%[5,6]. Diabetic foot ulcer account for 70% of lower extremity amputations[6] which have a mortality rate of 22% to 76% in 4 years[7]. Neuropathy, ischemia and infection are the main factors responsible for the ulcer, its poor healing and progression[8,9]. The infection is polymicrobial including gram-positive, gram-negative and anaerobic bacteria.

An easy-to-use classification system that provides a uniform description of an ulcer its depth, presence of infection and ischemia is critical to planning treatment strategies, monitoring treatment effectiveness, predicting clinical outcomes, and improving communication among health care providers[10]. Various wound classification systems are used but the two systems used world wide are Wagner and University of Texas (UT) classification. Wagner classification is based on the depth or penetration of the wound, presence or absence of osteomyelitis or gangrene. On the other hand UT classification also takes into account the presence or absence of infection and ischaemia, and hence is a better system[2].

The UT system uses a combination of grade on the horizontal axis and stage on the vertical axis. The grades of the UT system are as follows:

- Grade 1 (superficial wound not involving tendon, capsule, or bone)

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- Grade 2 (wound penetrating to tendon or capsule)
- Grade 3 (wound penetrating bone or joint or deep abscess)

Within each grade there are four stages:

- Stage A-Clean wounds
- Stage B-Non ischemic infected wounds
- Stage C-Ischemic non infected wounds
- Stage D-Ischemic and infected wounds

The aim of our study was to evaluate University of Texas Classification in assessing the severity of diabetic foot and planning its management.

PATIENTS AND METHODS

This descriptive study was conducted in Surgical unit II, Combined Military Hospital Rawalpindi (2003 to 2008) and Department of Surgery, Combined Military Hospital Peshawar (July 2008 to Jan 2010). A total of three hundred patients with a foot ulcer or infection and diagnosed to have diabetes mellitus were included. Patients of both sexes and age above twelve years were included. Patients of end stage renal disease, compromised immunity or on steroid therapy were excluded. Detailed history and clinical examination were recorded. Duration of disease and ulcer, site and size of ulcer, history of previous ulcer and treatment were recorded. Wound area was calculated in square centimeters (cm^2) by multiplying 2 perpendicular linear dimensions, longest and widest, on a wound tracing outlined and marked on to a clear plastic sheet with a marking pen. A second sterile clear plastic sheet was placed under the tracing sheet over the wound to avoid contamination and discarded after tracing.

Pulses of the lower limb were assessed and graded as good, diminished or absent. Sensory neuropathy was assessed by pressing 10 g Monofilament Nylon perpendicular to foot till it buckled at various sites of foot i.e. planter aspect of first toe, head of first, third and fifth metatarsals, heel and dorsum of foot, avoiding callosities, corns and ulcers, for touch and tuning fork for vibration sense. Sensations were graded as normal, diminished or absent. Ulcers were labeled infected if a purulent discharge was present with two other local signs (warmth, erythema, lymphangitis, lymphadenopathy, oedema, pain). Wound depth was evaluated using a sterile blunt probe. Osteomyelitis was diagnosed with probe touching bone, radiography bone for culture sensitivity and the presence of local and systemic signs of infection. The diagnosis of lower extremity vascular insufficiency was made clinically on the basis of symptoms and signs of ischemia eg intermittent claudication, rest pain and skin changes in lower limbs, absence of both pedal pulses of the involved foot, transcutaneous oxygen measurement and an ankle-brachial pressure index (ABPI) of less than 0.9. Patients with clinical evidence of ischemia had noninvasive ultrasound vascular studies and were seen by the vascular surgeon. Angiography was requested in patients having rest pain, absent vessels beyond knee on doppler studies and a decision for revascularization.

Investigations including complete blood examination, urine routine examination, renal function tests, x-ray foot, chest x-ray, ECG, culture and sensitivity of pus swab, deep tissue and bone, where required, were recorded. Each ulcer was graded and staged according to University of Texas (UT) classification and treated accordingly. Patients were managed by multidisciplinary team which consisted of physician, diabetologists, general, plastic, vascular and orthopaedic surgeons, rehabilitation specialists and nurses. Hyperglycaemia, hypertension and hyperlipidaemia were managed. Ulcers were managed with antibiotics, dressings, (vac*) vacuum assisted closure. Surgical procedures performed were incision and drainage, debridement, skin grafting, revascularization and amputations of different types. Each ulcer was photographed at the time of presentation and during various stages of treatment.

*The ulcer was covered with equal size of half inch thick foam with threaded suction tube and air tight covering of Opsite sheet. Continuous or intermittent suction of 100-200mmHg pressure was applied till the required results.

The outcome end points were defined as complete healing, unhealed at 6 months. Major or minor amputations or expired.

RESULTS

Three hundred patients of diabetes were included. Demographic parameters of ulcer and patients are shown in Table 1. Majority (73%) of our patients were males of age group 50-70 years. Only one patient was twenty years old. Majority (54%) of the patients had disease for more than 15 years. Sixty percent of the ulcer were neuropathic and 10% had neither neuropathy nor ischaemia. Right foot was predominantly affected i.e in 180 (60%) patients. Fore foot was the commonest site and in 70 % cases big toe was involved. Size of ulcer varied from 0.5 to 9cm^2. Table-2 shows percentage of amputations and unhealed ulcers on the basis of University of Texas (UT) classification. Infection was polymicrobial in most (90%) of the patients and *Staphylococcus aureus* was the commonest isolate other organisms were *Streptococcus, Escherichia coli, Staphylococcus epidermidis, Proteus vulgaris* and *Pseudomonas aeruginosa*. Antibiotics used were Amoxicillin plus clavullanic acid, Ciprofloxacin, Levofloxacin, Cephradine, Metronidazloe and Amikacin, selected according to culture and sensitivity reports. Majority of the infections responded to oral Amoxicillin plus clavullanic acid, Ciprofloxacin and empirical antibiotic therapy. Parentral antibiotics were reserved for patients showing signs of systemic infection or threatening foot or limb sarrivant. Different treatment options are illustrated in Table-3 and main outcome in Table-4.

Using the UT stage, all of 148 patients without ischaemia and infection (Stage 1A, 2A and 3A) healed completely and none of them underwent amputation. Progression to Grade 2 and 3 with addition of infection and ischemia i-e Stage B, C and D worsened the prognosis to the extent that out of twelve patients in Grade 3 Stage D 6 underwent amputation and 6 remained unhealed (Table-2). The median healing time (4, 8, 12, and 16 weeks) increased with each grade and stage of the UT system.

Out of 300 patients, 6 (2%) patients died, 3 due to septicemia, 2 due to myocardial infarction and one due to chronic renal failure.

Table-1; Demographic parameters and ulcer percentages of patients (n=300).

Demography and ulcer parameters		
Sex	**No**	**%**
M/F	220/80	
Age		
<40	18	6
40-50	60	20
50-60	120	40
60-70	90	30
>70	12	4
Duration of disease (years)		
<10	50	16
10 to 15	90	30
15 to 20	95	32
>20	65	22
Type of ulcer (underlying factor)		
Neuropathic	180	60
Neuroischaemic	60	20
Ischaemic	30	10
Non neuropathic Non ischaemic	30	10
Site of Ulcer		
Forefoot	240	80
Mid foot	24	8
Hind foot	30	10
Whole foot	6	2

DISCUSSION

An easy-to-use classification system that provides a uniform description of an ulcer, its depth, presence of infection and ischemia is critical to planning treatment strategies, monitoring treatment effectiveness, predicting clinical outcomes, and improving communication among health care providers[9-12]. Our study has revealed positive relationship between the grade / stage of UT classification at the time of presentation and number of amputations and healing time. Higher the grade and stage of an ulcer, more was the healing time and greater sumber of patient underwent amputation with similar

Table-2: Diabetic Foot Ulcer Outcome according to UT classification.

		No of ulcers	Amputations No	Unhealed No
Grade 1	**Superficial wound not involving tendon**	**200 (67%)**		
Stage A	No infection /ischaemia	132	0	0
Stage B	Infection	30	0	0
Stage C	Ischaemia	18	0	0
Stage D	Both	20	2	0
Grade 2	**Wound penetrating to tendon or capsule**	**46 (15%)**		
Stage A	No infection /ischaemia	8	0	0
Stage B	Infection	20	4	2
Stage C	Ischaemia	8	0	0
Stage D	Both	10	5	2
Grade 3	**Wound penetrating bone or joint or deep abscess**	**54 (18%)**		
Stage A	No infection /ischaemia	8	0	0
Stage B	Infection	30	6	3
Stage C	Ischaemia	4	0	1
Stage D	Both	12	6	6

Table 3: Table of Treatment

Treatment	No of patients
Aseptic dressing and Antibiotics	30
Incision and Drainage	70
Debridement	176
Vac Pac application	30
Skin Grafting	10
Pedicle Graft	4
Amputations	23
Toe / Ray Amputation	13
Symes Amputation	3
Below Knee Amputation	4
Above Knee Amputation	2
Disarticulation of Hip	1
Revascularization	2
Femoropopliteal Bypass	1
Femorodistal Bypass	1

Table 4: Description of Clinical Outcome (n=300).

Clinical outcome	Frequency
Completely Healed	255
Amputated	24
Not healed	15
Patient Died	6

suggestions made in other studies[13,14]. This study assessed the power of U.T. classification systems in planning the management strategy and predicting outcomes of Diabetic foot. Main factors affecting its outcome are neuropathy, ischaemia and infection. UT classification is a system which is based on infection, ischaemia and a combination of ischaemia and infection in addition to size and depth of the ulcer[12]. Addition of stage to grade i.e. presence and absence of ischaemia and/or infection add more effective descriptive and predictive power to UT classification system as compared to other systems like Wagner classification[13].

In the current study majority of our patients presented at an early stage due to entitlement for free treatment unlike many other studies by surgeons, where patients generally present at a later stage and grade. Patients were more likely to undergo a lower-limb amputation if their ulcers were infected (I-B) when compared with clean non ischemic ulcers (I- A).However, combination of infection and ischemia (2 &3 D) further increased the risk of lower-limb amputation. The cost of treatment, as mentioned by Basit A, is about Rs. 3,433/- in (UT) Grade IB which increases to Rs. 34,495/- in UT Grade 3D[15]. Main factors responsible for poor prognosis are late presentation, bare foot walking, ill fitting footwear, foot deformity and improper toe-nail cutting, shoes with a single throng between hallux and second toe leading to pressure

ulcers, attempts at home surgery, trust in faith healers and gross infection. Like most of other studies the infections was polymicrobial and *Staphylococcus aureus* was the commonest isolate. Peripheral vascular disease was relatively uncommon in our patients as compared to European population. Revascularization was performed in two patients. Local antibiotic and acetic acid were used in few cases of Pseudomonas infection. Use of VAC of wound offloading devices also improved our results. We relied on simple and less expensive measures of wound dressing and management instead of novel and sophisticated ones. The ratio of major amputations to conservative surgery was less as compared to other local and international studies[13-15] due to early presentation and team work treatment approach.

CONCLUSION

Our study has shown that UT classification is an effective system of assessing the severity of Diabetic foot at the time of presentation and its management. Amputation rates, time of healing and morbidity increases with increasing stage and grade. Care of foot at risk, foot examination by patient and attending doctor, control of hyperglycemia and establishing diabetic clinics having facilities for treatment of all aspects of diabetes will minimize diabetic complications, hospital admissions and lower limb amputation.

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