ORIGINAL ARTICLE

EPIDEMIOLOGY AND OUTCOME IN PATIENTS OF DIABETIC FOOT

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Background: The aim of study was detailed analysis of the presentation of diabetic foot ulcers, characteristics and predictors of outcome (incidence of amputation in neuropathic, ischemic, neuro ischemic) in patients presenting with diabetic foot at our hospital. **Methods:** This prospective analytic study was conducted from January 2009–August 2010 at POF Hospital Wah Cantt. Diabetic patients who presented with foot ulcers were enrolled in this study. Demographics of patients along with ulcer size, type, site and Grade according to Wagner Classification were recorded. Wounds were managed with daily dressings, nursing care and de-sloughing of necrotic tissue along with appropriate antibiotic cover. Patients were followed over period until wound healed completely or a lower limb amputation performed, the outcome noted and patient was deemed to have completed study. **Results:** One hundred and fifteen patients with mean age 55.46±8.23 years, both male and female were included in this study. Out of 115 patients 111 patients had Type-II diabetes while only 4 presented with Type-I. Mean Duration of diabetes was 14.61±2.17 years. With respect to underlying causes 18.3% foot ulcers were ischemic, 22.6% were neuropathic and 59% were neuro-ischemic. Median ulcer size was 74% of ulcer classified as Wagner grade-II and III while 24% were of Grade-V. Lower limb amputation were performed in 25% of patients whereas limb salvage achieved in 75% of patients with wounds healed (median healing time 5 (3–10 weeks). **Conclusion:** Preservation of the limb function without endangering the patient must be a goal of treating diabetic foot. Once foot amputation is successful, rehabilitation with orthotic or prosthetic devices may allow years of a functional extremity along with preventive measures like cessation of smoking, daily foot hygiene and foot inspection.

Keywords: diabetic foot, lower limb amputation, ulcer.

INTRODUCTION

Neuropathy, a serious complication of diabetes, can lead to Charcot changes in the foot. These disrupt the joint stability and the architecture of the foot. There is increased pressure under the sole of the foot with prominence of the metatarsal heads. This leads to ulceration. There is progression from superficial infection to deep and then abscess formation and osteomyelitis.

Ulceration, infection, and gangrene of foot are the leading causes of hospitalisation in patients with diabetes mellitus.[1,2] Diabetic foot ulcers are a complex problem that leads to foot infection, necrosis and most of the time results in major amputation. Other most common complications include boil, carbuncle, necrotizing fasciitis and gangrene of the foot. Approximately 3–4% of individuals with diabetes have foot ulcers or deep infections and 15% develop foot ulcers during their lifetime. The risk of lower extremity amputation increases by a factor of 8 once an ulcer develops. At 2 years following transtibial amputation, mortality rate is 36%. Figure-1 shows a diabetic foot with spreading gangrene and cellulites.

Although infection is rarely implicated in aetiology of diabetic foot ulcers, the ulcers are susceptible to infection once the wound is present. Many of the risk factors for foot ulcer are also predisposing factors for amputation, because ulcers are primary cause leading to amputation.[3,4]

Figure-1: Diabetic foot with spreading gangrene and cellulitis

Whenever a viable tissue is evident at the ankle or distally, the treating physician should consider the distal amputation level. A careful physical examination, monofilament testing for neuropathy, trans-coetaneous oxygen mapping, distal Doppler pressure measurements, Doppler flow studies and lower extremity blood pressure measurements should be done to determine the safe amputation level. The goal of examination and assessment is to determine pre-operatively which site may be chosen for amputation with fair certainty that healing will follow. A multidisciplinary approach should be employed because of the multifaceted nature of foot ulcers and the numerous co-morbidities that can occur in these patients.[3,5]

The aim of this study was detailed analysis of presentation of diabetic foot ulcers, characteristics and predictors of outcome in patients presenting with diabetic foot.

MATERIAL AND METHODS

This prospective study was conducted from January 2009–August 2010 at POF Hospital Wah Cantt. Diabetic patients presenting with foot ulcers were enrolled in this study. All of them were admitted in the hospital. History was taken with special emphasis on the treatment given, appearance of the wound and ulceration. A detailed examination was carried out to exclude other medical complications of diabetes mellitus. Then the foot was examined for areas of ulceration and gangrene. The colour of limb, skin, nail, hair or any atrophic changes were noted. A standard neurological examination was performed testing the sensation to light touch (cotton-wool), pain (neurological examination pins), vibration (128 Hz tuning fork), and tendon reflexes at the ankle. Peripheral neuropathy was considered to be present, if three of the four sensations were absent. The state of circulation was checked by palpating dorsalis paedis and posterior tibial artery followed by Doppler study. Baseline investigations were carried out including: complete blood picture, urine analysis, blood sugar, urea and electrolytes, chest X-rays and ECG. Demographics of patients including age, sex, along with ulcer size, type, site, duration and type of diabetes and Grade according to Wagner Classification were recorded. Wounds were managed with daily dressings, nursing care and de-sloughing of necrotic tissue along with appropriate antibiotic cover. Patients were followed over period, once wound healed completely or a lower limb amputation performed, the outcome noted and patient was deemed to have completed study.

RESULTS

One hundred and fifteen patients with mean age 55.46±8.23 years, both male and female were included in study. Out of 115 patients, 111 patients had Type-II diabetes while only 4 presented with Type-I. Mean Duration of diabetes was 14.61±2.17 years. Median ulcer size was 6.61±3.33. With respect to underlying causes 18.3% foot ulcers were ischemic, 22.6% were neuropathic and 59% were neuro-ischemic (Table-1). Sites of ulcer are shown in Table-2.

Seventy-four percent of ulcer were classified as Wagner grade II and III, while 24% were of Grade V. Lower limb amputation were performed in 25% patients whereas limb salvage was achieved in 75% patients with wounds healed (median healing time 5 weeks (3–10 weeks).

Table-1: Baseline demography and foot ulcer characteristics in 115 patients

Age (years)	55.46±8.23
Diabetes (type I/type II)	4/111
Duration of diabetes (years)	14.61±2.17
Ulcer size (Cm^2)	6.61±3.33
Type of Ulcer (underlying factor)	
Neuropathic	21 (22.6%)
Neuro-ischemic	68 (59%)
Ischemic	26 (18.3%)

Table-2: Site of ulcer in Diabetic foot patients

Site of Ulcer	Number	%
Dorsum foot	58	50.43
Plantar foot	9	7.83
Interdigital	30	26.09
Heel	16	13.91
Big toe	2	1.74

Below knee amputation was done in 6 patients. Distal foot amputations were done in 2 cases. In 3 cases ray amputation of the right big toe was done, while 18 ray amputation of the other toes were performed.

The wounds in all other cases healed well. Primary closure was achieved in 16 patients while split thickness skin grafts were used in 30 patients. The ulcers and wounds took an average of 5 weeks to heal completely.

DISCUSSION

Approximately 85% of all diabetes-related lower-extremity amputations are preceded by foot ulcers suggesting the importance of prevention and appropriate management of foot lesions.[4,6] Approximately 15–20% of the estimated 16 million persons in the United States with diabetes mellitus will be hospitalised with a foot complication at sometime during the course of their disease.[3] Diabetes is a modern day world wide epidemic and diabetic foot complications are responsible for more than 50% of major limb complications. In our study 25% of patients had amputation including below knee, fore foot ray etc. The annual incidence of foot ulceration is slightly more than 2% among all patients with diabetes and between 5–7.5% among diabetics with peripheral neuropathy. Peripheral neuropathy results in loss of protective sensations of pain and in autonomic dysfunction with sympathetic denervation, dry skin and warm feet. In 22.6% of study patients had neuropathy as the underlying cause of ulceration. Appropriate medical education regarding early assessment of lesion or warning signs of imminent ulceration in patients with sensory loss is essential. A main stay of ulcer therapy is debridement of all necrotic, callus, and fibrous tissue.[7,8] 75% of the study patients underwent serial debridments which was main stay for limb salvage. Soaking of ulcers is controversial and should be avoided because the neuropathic patient can easily be scalded by hot water.[7]

In vascular complications it is the microangiopathy which is more important. The

commonest site is beneath the head of 1st metatarsal. Organisms from the exterior secondarily infect it. The infective process if unchecked also erodes inside involving bones, tendons, producing cellulitis, plantar abscesses, and osteomyelitis. Ulcers may develop else where on the foot due to constant local irritation and friction. 26.09% of the study patients had ulcer started in the interdigital space, rest of the sites are given in table 2. Management of the foot ulcer is largely determined by its severity (grade) and vascularity, and the presence of infection.[9,10] Seventy-four percent of our patients had grade II and III ulcers (Wagner) and 24% were of grade V. Appropriate antibiotic therapy in the infected diabetic foot should be instituted promptly and should take into account that the necrotic-infected foot requires broad spectrum empirical coverage initially. A subsequent culture report may disclose one or more organisms which can be treated with a single antibiotic.[11]

Treatment of ulcers of the hind foot and ankle may be extremely difficult. Marked instability and deformity from Charcot arthropathy may direct external pressure of the malleoli or talus head against shoes or braces, or skin lesions over a bony prominence. If the ulcer is likely to recur after successful debridement and immobilisation, realignment osteotomy and arthrodesis may be required.[12] Amputation is another option. Refractory heel ulcers may respond well to partial calcanectomy if the vascular and nutritional parameters reflect adequate healing potential,[13] but full-time use of an ankle foot orthosis is required because the posterior calcaneal tuberosity and Achilles tendon insertion are ablated.[13] The quality of the results after a partial foot (transmetatarsal, Lisfranc, or Chopart) amputation is not necessarily related directly to the length of the stump.[14] Factors that contribute to successful partial foot amputation include the presence of normal, healthy, full thickness skin covering the stump and mobility of remaining joints.[14] Distal foot amputations was done in 2 patients, ray amputations in 18 and split thickness grafts were used in 30 patients with satisfactory results. The major focus of current diabetic foot care is prevention. Preventive strategies combine patient education, prophylactic skin and nail care, and protective footwear, optimising organ function for patients with multisystem disease and tightening blood glucose control in diabetics is advantageous.[15]

The multidisciplinary approach to limb salvage cannot be overemphasised. Specialists both surgical and non-surgical must be called upon to optimise care in the limb salvage effort.

CONCLUSION AND RECOMMENDATION

Preserving the function of the lower extremity must always be taken into account as well as danger to patient's life. Once distal foot amputation is successful, rehabilitation with orthotic or prosthetic devices may allow years of a functional extremity especially when the patient observes preventive measures like cessation of smoking, daily foot hygiene and foot inspection.

Patients must always be advised that the contra-lateral extremity is also at risk and the systemic nature of the disease requires careful compliance with medical intervention.

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