

A Clinical Study on Diabetic Foot Ulcer

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How to cite this article:

Raghunath Mohapatra, Dasarathi Murmu, Alok Mohanty. A Clinical Study on Diabetic Foot Ulcer. New Indian J Surg. 2018;9(5):621-13.

Abstract

Background: Diabetic foot ulcer is one of the common presentation of diabetic foot. The number of people with diabetes worldwide was estimated at 131 million in 2000; it is projected to increase to 366 million by 2030. It is estimated that approximately 20% of hospital admissions among patients with DM are the result of diabetic foot ulcer. The aim of this study is to evaluate the clinical scenario of diabetic foot ulcer patients in our hospital and study the percentage of surgical intervention like debridement, amputation. **Materials and Methods:** 50 patients of diabetic foot ulcer admitted in the Department of General surgery at NRI Institute of Medical Sciences and Hospital, Visakhapatnam, Andhrapradesh, India during the period of April 2017 to March 2018. **Results:** The male to female ratio was approximately 1.7 Maximum number of patients was found in the age group of 56-65 years. Most of the patients had history of diabetes in between 5 to 10 years. Surgical complications was more common in male patients than female patients. Staphylococcus aureus was the most common organism found in culture report. The mainstay of treatment was conservative approach by controlling diabetes with human insulin along with antibiotics and wound debridement. The surgical procedure opted were split skin grafting, disarticulation and below knee amputation in few cases. In our study there was no mortality. **Conclusion:** The success of diabetic foot ulcer management depends on prevention, early assessment and treatment by multidisciplinary approach.

Keywords: Diabets Mellitus; Foot Ulcer; Vasculopathy; Neuropathy; Debridement; Amputation.

Introduction

Diabetic foot ulcer is the long term complications of diabetes mellitus affect 15% of diabetic patients with life time risk up to 25% can be prevented in many cases [1,2]. The number of people with diabetes worldwide was estimated at 131 million in 2000; it is projected to increase to 366 million by 2030 [3]. To date diabetic foot ulcer is considered as a major source of morbidity and a leading cause of hospitalization in patients with diabetes. It is estimated that approximately 20% of hospital admissions among patients with DM are the result of diabetic foot ulcer [4]. Diabetes is growing alarmingly in India and accounts for 65.1 million people with diabetes in the age group 20-74 years. Diabetic foot ulcers are a challenge for the individual and for the health system though it is preventable.

Diabetic foot ulcers are one of the most notorious complications of diabetes mellitus gives major impact on health and economic system of the individual and family and also on the society and nation. The etiology of diabetic foot is multifactorial. Diabetic neuropathy involving the sensory, motor and autonomic nerves is present in majority of the cases. Loss of sensation due to sensory neuropathy and deformity of the foot due to motor neuropathy leads to repetitive trauma causing foot ulceration. In addition, arterial insufficiency due to microangiopathy and macroangiopathy impairs wound healing by reducing the supply of oxygen and nutrients.

The management of diabetic foot ulcer is a complex problem and is best managed by a multidisciplinary team comprising of a diabetologist, general surgeon, microbiologist, radiologist, plastic surgeon, orthopedic

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Received on 13.07.2018, Accepted on 17.09.2018

surgeon and a rehabilitation specialist. The aim of treatment is early wound healing and prevent major amputation thereby preserving the limb. Patient education and the use of appropriate foot wear is of utmost importance, once the wounds have healed. The objective of this study is to assess clinical scenario of diabetic foot ulcer and to study the surgical management of diabetic foot ulcer.

Materials and Methods

This was an institutional based prospective study conducted in 50 patients of diabetic foot ulcer admitted during the period from April 2017 to March 2018 in the Department of General Surgery, NRI Institute of Medical Sciences and Hospital, Visakhapatnam, Andhra Pradesh, India. Patients with diabetes mellitus complicated by diabetic foot ulcer and gangrene were included in the study. Patients without diabetes mellitus having foot ulcer and those patients who are severely ill and those patients in remote areas unable to communicate were excluded in this study.

Results

In the present study of 50 diabetic foot ulcer patients 38% were in the age group of 56-65 and 24% were in the age group of 46-55. It is clearly documented 78% of the patient were above the age of 45 years, elderly individual being affected more as shown in Table 1.

Table 1: Age distribution

Age (years)	Mayfield et al	Present study
25-35	2%	8%
36-45	15%	14%
46-55	29%	24%
56-65	34%	38%
>65	20%	16%

Male to female ratio in this study was 1.7 as comparing with the Mayfield study. Male predominance is observed in our study may be due to more outdoor activities noted as comparison to female patient. Diabetic foot ulcer patients present with various clinical presentation in our study. Ulcer was the most common (72%) presentation followed by gangrene (16%) and abscess with osteomyelitis (12%) cases as shown in Table 2. The most common site of ulcer was the toes and dorsum of the foot was second most common site of ulcer in our study.

Table 2: Clinical presentation

Presentation	Apelquist et al (n=314)	Present study (n=50)
Ulcer	63%	72%
Gangrene	21%	16%
Abscess/osteomyelitis	15%	12%

Diabetic foot ulcer is classically characterized by neuropathy, vasculopathy and infection. In the present study we came across all the pathological significance observed in our patients. Neuropathy was observed in 74% of patients, vasculopathy was observed in 24% of patients whereas both neuropathy and vasculopathy was observed in 20% of patients as shown in Table 3.

Table 3: Pathology

Pathology	Reiber et al	Present study
Neuropathy	78%	74%
Vasculopathy	35%	24%
Neuropathy/Vasculopathy	-	20%

The predictors of infection in diabetic foot ulcer depends on the bacterial load, synergic relationship between bacterial species and the presence of specific pathogens. In our present study the most common organism was *Staphylococcus aureus* (28%) patients followed by *Enterococcus* (20%), *Streptococci* (18%), *Proteus* (12%), *E.coli* (8%), *Klebsiella* (4%) and *Pseudomonas* (6%) patients as shown in Table 4. There was no growth in (4%) patients.

Table 4: Causative organisms

Organisms	Wheat et al (n=54)	Present study (n=50)
<i>Staph.aureus</i>	20%	28%
<i>Enterococcus</i>	15%	20%
<i>Streptococci</i>	23%	18%
<i>Proteus</i>	9%	12%
<i>E. coli</i>	5%	8%
<i>Klebsiella</i>	6%	4%
<i>Pseudomonas</i>	3%	6%

Standard care for diabetic foot ulcer was ensured by glycemic control, local wound care and regular debridement, control of infection by appropriate antibiotics and management of comorbidities. The average duration of hospital stay following treatment was 45 days. In the present study diabetic foot ulcer healed by primary healing (66%), skin grafting (22%) and amputation (12%) patients as shown in Table 5. There was no mortality in our series.

Table 5: Pognosis

Prognosis	Reiber et al	Present study
Primary healing	81%	33(66%)
Amputation	14%	6(12%)
Skin grafting	-	11(22%)
Death	5%	0%

In the present series 50 cases of diabetic foot ulcer patients study was carried out over a period of 12 months and more emphasis was given on various clinical presentation, proper patient care and surgical approach with involvement of multidisciplinary team of experts. Conservative treatment include glycaemic control with human actrapid / human mixtard

insulin and oral hypoglycaemic drugs along with iv antibiotics was given. Ulcer debridement followed by moisture retaining dressing (hydrogels, hydrocolloids) and antiseptic dressing results in primary healing in most of the cases in the present study. The other modalities of treatment includes skin grafting and amputation was performed in selected cases in our study.

Discussion

This study of 50 patients was conducted from April 2017 to March 2018 at NRI Institute of Medical Sciences and Hospital, Visakhapatnam, Andhrapradesh, India. Most of the patients presented with diabetic foot ulcer was in the age of 56-65 years in our series which is found quite similar in Mayfield et al study [5]. It indicates that diabetic foot ulcer affects the older individual very often. In our study 78% of the patients were above the age of 45 years presented with diabetic foot ulcer. In the developing countries majority of the patients with diabetic foot ulcer are in the age group of 45-64 years [6], where as it is more than 64 years of age in developed countries. Patient education and self care practice is definitely plays a great role in the management of diabetic foot ulcer. The male female ratio in our study was 1.7 where as it was almost equal in Mayfield study. There is no clear answer to this gender discrimination may be male are more prone to diabetic foot ulcer due to their occupational and outdoor activities.

The commonest clinical presentation was ulcer similar to the study of Apelquist et al. [7]. The most fatal complications in the form of gangrene and abscess/osteomyelitis was noted in few patients due to their self negligence and proper care of their diabetic foot ulcer. Patients lack of awareness about diabetes, disease process, control of sugar, nutritional diet and foot care further deterioration of the ulcer occur. Dorsal and planter site are most common site of ulcer in diabetic patients. Ulcer severity is more important than site in determining the final outcome [7]. The diabetic patients with neuropathy are at high risk of developing foot ulcer upto seven-fold as compare to non neuropathic patients [3]. In our series 74% of the patients had neuropathy compared with 78% of the patients in Reiber et al series [8]. Neuropathy affects patients with both type 1 and type 2 diabetes mellitus causes more than 60% of the diabetic foot ulcer. There is irreversible metabolic, immunologic and ischemic injury of autonomic, motor and sensory nerves occurs due to microangiopathy following hyperglycemia. In hyperglycemia endothelium derived vasodilators and nitric oxide are decreased leads to constriction of the blood vessels [9] and atherosclerotic [10] changes as well as ischemia occurs. Clinically the patients have signs of vascular insufficiency such as claudication, rest pain, absent peripheral pulses, loss of limb hairs, thinning of skin

[11]. In our present study 24% of patients had vasculopathy and 20% of patients had both vasculopathy and neuropathy.

Infections of the soft tissue and bone are the leading cause of hospital admissions in patients with diabetic foot ulcers [12]. Infections of various types may be more common and more often severe in patients with diabetes mellitus [13]. Culture should be taken from the deeper tissues for selecting appropriate antibiotics. In our study most common organism cultured was Staph. aureus (28%) followed Enterococcus (20%), Stretococci (18%) compared with Wheat et al study [14]. While waiting for the culture report patients were given empirical broad spectrum antibiotics. Antibiotics were given intravenously for limb threatening infections. Subsequently antibiotics were changed as per the culture and sensitivity report. Strict glycaemic control was achieved with use of diabetic diet, oral hypoglycaemic agents and insulin. Routine fasting and post prandial blood sugar estimation was carried out strictly for every patients. In the present series there was no mortality, 66% of patients of diabetic foot ulcer healed by re-epithelisation and 12% of patients underwent amputation compared with Reiber et al study. Skin grafting was performed in 22% of patients in our series.

Standard care for diabetic foot ulcer was provided by a multidisciplinary team by strict glycaemic control, adequate tissue perfusion, local wound dressing and regular debridement, off-loading of the foot, control of infection by appropriate antibiotics and management of comorbidities. Debridement of the wound may hasten healing process by removing the dead necrotic tissue, particulate matter, or foreign materials, and reducing bacterial load [15]. Dressing materials used include saline-soaked gauze dressings, moisture retaining dressings (hydrogels, hydrocolloids) and antiseptic dressings. Medicated honey has anti-inflammatory, antiseptic and osmotic properties and has been used as such or in combination with sterile dressings. For offloading the foot to prevent and treat diabetic foot ulcers removable cast walkers, half-shoes, soft heel shoes, padded socks, wheel chairs, crutches etc. have been used. Patient education was imparted for prevention of ulcer and their recurrence. Self-care practices like maintaining foot hygiene and nail care must be encouraged. Skin should be kept moisturized by applying moisturizers after cleaning the feet with soap and water regularly.

There is direct correlation between glycaemic control and ulcer formation. Strict monitoring of the blood sugar is mandatory in management of diabetic foot ulcer. Self monitoring of neuropathic feet is essential for reducing the risk of ulcer because there is temperature difference between neuropathic and non-neuropathic feet. Smoking and alcohol consumption should be avoided though direct link between them and diabetic foot ulcer is not

established. Offloading and appropriate foot wear is recommended in all diabetic foot ulcer patients to relieve the focal high pressure areas. Comorbid conditions like hypertension and hyperlipidemia predispose to vasculopathy should be treated simultaneously for better management of diabetic foot ulcer. Finally the successful management of diabetic foot ulcer depends on the well co-ordinated multidisciplinary team with input from a variety of health care workers.

Conclusion

Diabetic foot ulcers are a costly and serious devastating complications of diabetes mellitus. It is therefore necessary to have a special care and proper counseling of the patients with diabetes mellitus. Regular clinical examination of the feet and related systemic examination is essential to detect diabetic foot. The treatment is usually conservative with limb sparing approach and proper control of diabetes. Amputation is used as a last resort in non-salvageable limbs. The goal of the treatment is not only to salvage the limb but also to prevent recurrences for which patient education is essential. The health care providers are recommended to enhance preventive measures through promoting foot self-care practice for reduction of diabetic foot ulcer. The optimum management of diabetic foot ulcers require a multidisciplinary team of experts with a multidisciplinary approach working in a close harmony.

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