

Management and outcomes of foot ulcer patients with and without diabetes

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Abstract

Background: Foot ulcer is considered a very common but serious complication of DM. People with diabetes and people with peripheral vascular disease are more likely to develop foot ulcers. Fifteen percent of diabetic patients develop a foot ulcer sometime in their life. If an infection occurs in an ulcer and is not treated properly, it can develop into cellulitis, osteomyelitis, or gangrene that may require some part of the toe, foot or lower leg to be amputated.

Aim of the study: This study aimed to assess the management and outcomes of foot ulcer patients with and without diabetes.

Methods: This was a prospective observational study that was conducted in the Department of Surgery, Rajshahi Medical College Hospital, Rajshahi, Bangladesh, during the period from March 2012 to August 2012. In total 100 patients with foot ulcers attended the different surgical units of the mentioned hospital and were enrolled in this study as study subjects. The purposive sampling technique was used for this study. All the demographic, as well as clinical data, were in the prescribed questionnaire. All data were processed, analyzed, and disseminated using MS Excel and SPSS version 23 programs as necessary.

Results: In this study, among the cases, 68% had DM, 18% had Buerger's disease, 6% had Atherosclerosis and 8% had malignancy. The maximum number of patients (42%) were from the age group of 51-60 years. The majority of the patients (66%) were male. Most of the male patients (87.88%) were 'smokers'. Abnormal lipid profiles like elevated cholesterol and low HDL were found in 51% of patients. Most of the diabetic patients (95.59%) were hyperglycemic on admission and 55.88% had diabetes for 6-10 years. Among diabetic foot ulcers, 63.16% had neuropathy and 31.18% had neuro ischaemia. Wound culture revealed Staphylococcus in 53.33% of wound swabs. Foot ulcers of 64.47% of diabetic patients healed, and 22.37% needed amputation. Foot ulcer of 44.44% Buerger's disease patients healed and 27.78% needed amputation. Foot ulcer of 50% of Atherosclerotic patients healed and 16.67% needed amputation. 12.5% of malignant foot ulcer needed amputation.

Conclusion: Effective glycemic control, optimal wound care, aggressive medical management and timely surgical intervention may decrease disabling morbidity with a better outcome in the management of foot ulcer. This needs to develop a multidisciplinary team in all medical institutions for better care of foot ulcers.

Keywords: Socio-demographic, Clinical status, Diabetes, Foot ulcer

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I. INTRODUCTION

Foot ulcer is one of the most common complications of diabetes. Twenty-four (24) million Americans have diabetes and 3.6 million or 15% will develop a foot ulcer at some time. [1,2] Foot complications are the most frequent reason for hospitalization in patients with diabetes accounting for up to 25% of all diabetic admission in the United States and Great Britain. [3] The vast majority of diabetic foot complications resulting in amputation begin with the formation of skin ulcer [4] The incidence of diabetes is increasing in many parts of Asia, where resources may not enable targets for glycaemic control to be achieved. About 5 million Bangladeshi have diabetes. The prevalence of diabetes for all age groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. [5] The annual incidence of ulcers among people with diabetes is 2.5% 1 0.7% and the annual incidence of amputation is 0.251.8%. [6] Any illness that decreases circulation to the feet can cause foot ulcers. Less blood reaches the feet, which deprives cells of oxygen. This makes the skin more vulnerable to injury and slows the foot's ability to heal. Poor circulation in the leg arteries, called peripheral artery disease, also causes pain in the leg or buttock during walking. It is caused by atherosclerosis, a disease in which fatty deposits of cholesterol build up inside arteries, and Buerger's disease in which thrombosis and inflammation of small and medium-sized arteries. Peripheral arterial disease (PAD) is a highly prevalent atherosclerotic syndrome that affects approximately 8-12 million individuals in the United States and is associated with significant morbidity and mortality. [7] Lower extremity arterial disease with foot ulcer has been considered to be among the most important reasons for amputation in the individual with or without diabetes. Peripheral vascular diseases (PVD) with foot ulcer accounted for 46.30% of amputations in a study. [8] It is important to differentiate between neuropathic and neuro ischemic ulcers concerning factors related to outcome and extent of co-morbidity. [9] More than any other group, people with diabetes have a particularly high risk of developing foot ulcers. Without prompt and proper treatment, this ulcer may require hospital treatment or may lead to deep infection or gangrene and amputation. Raynaud's phenomenon causes sudden episodes of decreased blood flow to the fingers and toes. Surgery is often needed for the treatment of infected ulcers and for the revascularization of the limb [10] Deep infection needs to be drained urgently and deep tissues thoroughly debrided. Skin grafting may be needed. If an ulcer is healed the use of appropriate insoles and shoes can protect against further ulceration. Endovascular technique and surgery in the form of bypass and endarterectomy have a great role in limb saving. Amputation may be needed in the unavoidable case.

II. METHODOLOGY

This prospective observational study was conducted in the Department of Surgery, Rajshahi Medical College Hospital, Rajshahi, Bangladesh, during the period from March 2012 to August 2012. In total 100 patients with foot ulcers in the different surgical units of Rajshahi medical college hospital, were enrolled in this study as study subjects. The study was approved by the ethical committee of the mentioned hospital. The whole intervention was conducted following the principles of human research specified in the Helsinki Declaration [14] and executed in compliance with currently applicable regulations and the provisions of the General Data Protection Regulation (GDPR) [15]. Data from the study regarding age, sex, occupation, smoking habit and socio-demographic condition were recorded in the prescribed questionnaire. The purposive sampling technique was used for this study. As per the inclusion criteria of this study, patients admitted to the surgery ward with foot ulcers, age 18 years or above were included. On the other hand, according to the exclusion criteria of this study, patients with acute foot ulcers following trauma, aged below 18 years were excluded. All the demographic and clinical data of the participants were recorded. All data were processed, analyzed and disseminated by using MS Excel and SPSS version 23 program as per necessity.

III. RESULT

In this study, the maximum number of patients (42%) were from the age of 51-60 years. Among the total 100 participants, 66% were male whereas the rest 34% were female. Culture and sensitivity were done in 60 patients; in 53.33% of cases growth of staphylococcus, and in 23.33% of cases growth of E. coli was found. All patients were taking the systemic antibiotic. The topical antibiotic was used in addition to the systemic antibiotic in 65% of patients. Among 100 participants, 68% were with diabetes and 32% were in the non-diabetic group. Out of 100 patients, it was revealed that 68 patients (68%) had been suffering from diabetes mellitus, 18% from Buerger's disease, 6% from atherosclerosis (non-diabetes) and 8% from malignant foot ulcer. Most of the diabetic patients (95.59%) were hyperglycemic on admission and 55.88% had diabetes for 6-10 years. During the ulcer management, bilateral lumbar sympathectomy was done in 6 patients (33.33%) and lumbar sympathectomy was not done at all in 2 patients (11.11%). It was found that, among 68 patients of DM, 9 patients (13.24%) were managed by a diabetic diet and oral hypoglycemic agent, 59 patients (86.76%) were managed by a diabetic diet and insulin. In analyzing the outcomes, we observed that, among 18 Buerger's diseases, 08-foot ulcers (44.44%) were healed, 04-foot ulcers (22.22%) were unhealed and 5 patients (27.78%) needed amputation. Among 06 patients with atherosclerotic foot ulcer 03 (50%) were healed, 02 (33.33%) were unhealed and 1 needed

amputation. Among 08 patients with healed foot ulcers, 02-foot ulcer (25%) recurred and in 03 patients with healed atherosclerotic foot ulcer, 01-foot ulcer (33.33%) recurred within 6 months. On the other hand, among 8 malignant ulcers, 6 ulcers (75%) healed (6 squamous cell carcinoma) 1 patient (12.5%) needed amputation (malignant melanoma).

Table 1: Age distribution of patients (N=100)

Age groups	n	%
20-30	6	6%
31-40	14	14%
41-50	20	20%
51-60	42	42%
61-70	18	18%

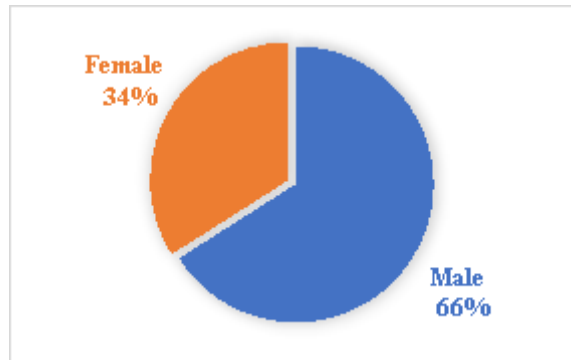


Figure 1: Gender distribution of participants (N=100)

Table 2: Bacteriological study of wound swab (n=60)

Growth of organism	n	%
Staphylococcus	32	53.33%
E. coli	14	23.33%
Proteus	2	3.33%
Klebsiella	1	1.67%
Pseudomonas	7	11.66%
Bacteroides	2	3.33%
No growth	8	13.33%

Table 3: Antibiotic used to control infection (N=100)

Antibiotic	n	%
Systemic	100	100%
topical	65	65%

Table 4: Local wound care of nonmalignant ulcer (n=92)

Management	n	%
Dressing	3	3.26
Debridement, dressing	26	28.26
Debridement, dressing then secondary closure	8	8.70
Debridement, dressing then STSG	8	8.70
Incision and drainage, debridement, dressing	20	21.74
Incision and drainage, debridement, dressing then secondary closure	6	21.74
Incision and drainage, debridement, dressing then STSG	10	6.52
Amputation	11	10.87
Total	92	100

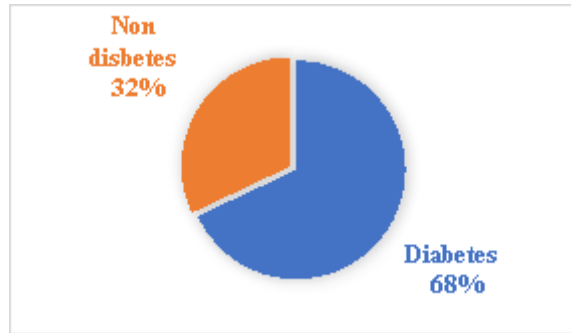


Figure 2: Diabetes status of participants (N=100)

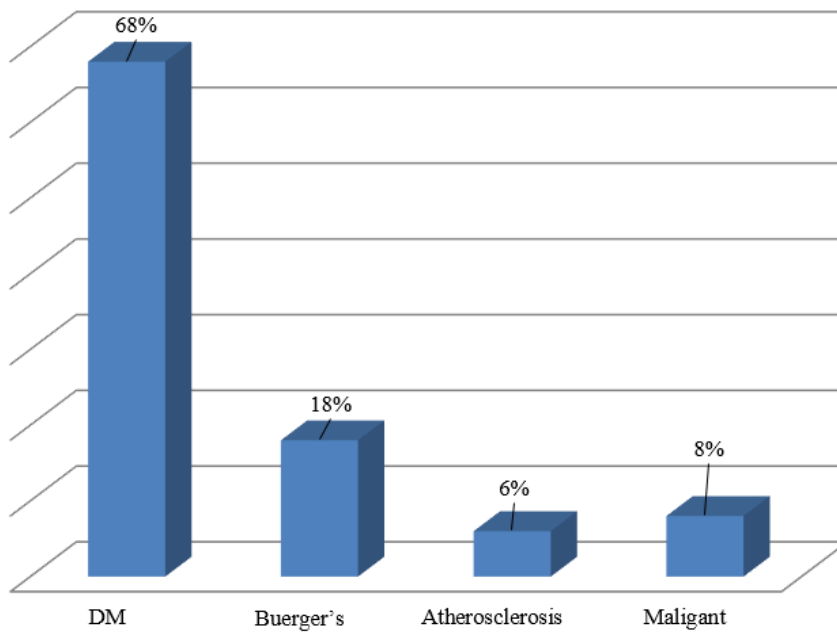


Figure 3: Aetiology of foot ulcer (N=100)

Table 5: Duration of DM before the onset of foot ulcer (n=68)

Duration of Dm	n	%
<5 years	4	5.88
6-10 years	38	55.88
11-15 years	18	26.47
Newly diagnosed	8	11.76

Table 6: Management of malignant ulcer (n=8)

Malignancy	Wide excision & primary closure	Wide excision & STSG	Amputation	Radiotherapy
Squamous cell carcinoma (6)	2	4	0	2
Malignant melanoma (2)	0	1	1	0
Total	2	5	1	2

Table 7: Immediate outcome of non-malignant foot ulcer (n=92)

Management	Cured (n)	Not cured (n) Developed complication	Type of complication
Dressing (3)	3	0	Abscess (2), spreading infection, gangrene (5), slow healing (3)
Debridement, dressing (26)	10	16	Wound infection
Debridement, dressing then secondary (8)	7	1	Rejection

Debridement, dressing then STSG (8)	6	2	Spreading infection
Incision and drainage, debridement (20)	11	9	Osteomyelitis (2), slow healing (3)
Incision and drainage, debridement then secondary (6)	4	2	Rejection (4)
Incision and drainage, debridement, dressing then STSG (10)	6	4	Spreading gangrene (2)
Amputation	9	2	Gangrene (5)
Total	62	30	

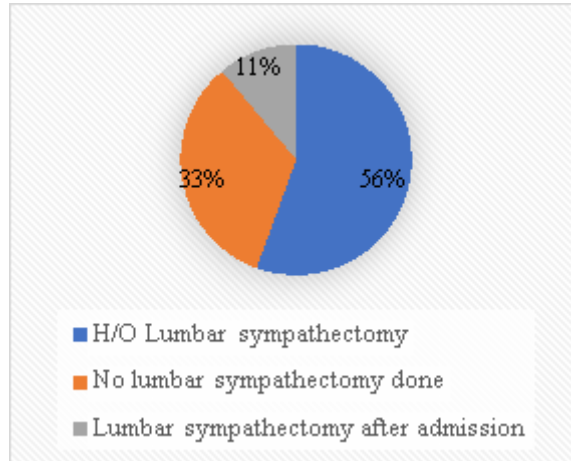


Figure 4: Distribution of Buerger's disease with foot ulcer by bilateral sympathectomy (n=68)

Table 8: Immediate outcome of malignant ulcer (n=8)

Malignancy	Complication
Squamous cell carcinoma (6)	Graft rejection (2)
Malignant melanoma (2)	None

Table 9: Outcome of Buerger's disease and atherosclerosis foot ulcer (n=8)

Disease	n	Healed	Unhealed	Lost follow up	Amputation	Recurrence
Buerger's	18	8	4	1	5	2
Atherosclerosis	6	3	2	0	1	1

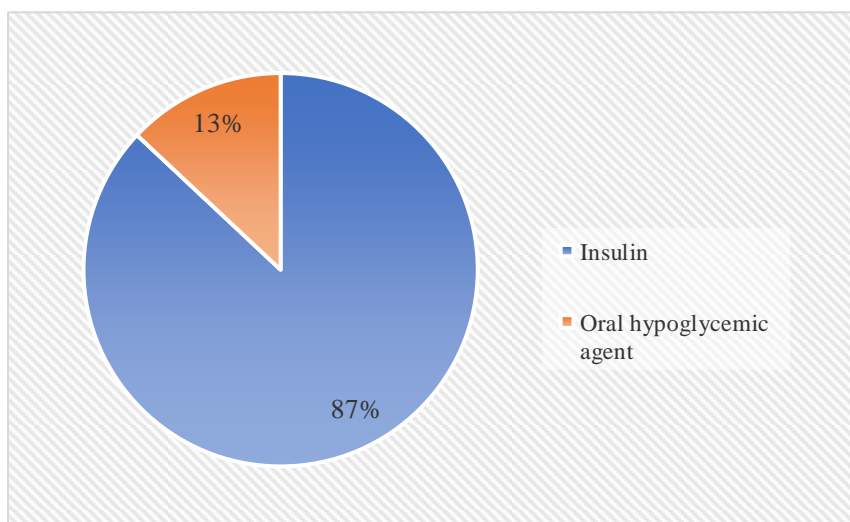


Figure 5: Measures taken for controlling blood sugar (n=68)

IV. DISCUSSION

This study aimed to assess the management and outcomes of foot ulcer patients with and without diabetes. In this study, out of 100 cases of foot ulcer (100%), 66(66%) were male and 34 (34%) were female which is almost consistent with the above study. Foot ulcer to be more common in men than women." In a study male with foot ulcer was 58.6%. [12] The diabetic vascular disease has a prediction for calf vessels, vessels in the foot can often be spared. Buerger's disease mostly affects small and medium-sized arteries that as distal plantar and leg arteries [13,14] In this study, out of 68 (100%) diabetic foot ulcer, 42 patients (61.76%) had neuropathy, 22 patients (32.35%) had neuro-ischemia and 4 patients (5.88%) had only ischemic change which is comparable with above study. Gram-positive cocci are the most common pathogen. Several studies have confirmed that in chronic lesions, ulcer with a deep infection and in wounds with necrotic tissue a polymicrobial flora is most common, with a combination of gram-negative, anaerobic, and gram-positive organisms. [15] In this study, a wound swab study was done in 60 (100%) patients. The organism isolated from the ulcers were mixed in nature. Staph. Aureus was the commonest isolate being recovered in 32 patients (53.33%). In a study, it was 61.2%. [12] In this study, out of 68 (100%) diabetic patients, 9 patients (13.23%) were treated with oral hypoglycemic drugs, and 59 patients (86.76%) were treated with insulin. Out of 68 DM patients (100%), 26 patients (38.24%) were taking vasodilators and antiplatelets like cilostazol had atherosclerosis. All 6 patients with atherosclerosis (100%) and all patients of Buerger's disease (100%) were taken vasodilators and anti-platelet. [16] Comorbidity increases significantly with the severity of foot disease and is strongly related to the outcome. It was revealed in this study that foot ulcer patients with comorbidity were treated accordingly. When an ulcer is present, there is a clear entrance for invading bacteria. Only half of the infection episodes show signs of infection. [17] It was found that all 100 patients (100%) with foot ulcers were treated with a systemic antibiotic. Sixty patients (60%) were treated in addition to systemic antibiotics with topical antibiotics. The most important step in the control of deep infection is urgent incision and drainage of abscess and radical debridement of all infected, non-viable tissue. In the EURODIALE study, 25-75% of patients at various centers were considered to have a wound infection at the time of admission. [18] It was found that 36 (39.13%) patients had deep infections like a deep-seated infections. Incision, drainage, infected tissue planes opened out, and debridement was done in all (39.13%) cases. Among 92 nonmalignant ulcers (100%), delayed healing by secondary intention occurred in 30 (32.60%) patients. Secondary closure of the healthy wound was needed in 14 (15.22%) patients, which was correlated with a study. [19] During ulcer management, bilateral lumbar sympathectomy was done in 6 patients (33.33%). Lumbar sympathectomy was not done in patients with an atherosclerotic foot ulcer. Among 8 malignant ulcers (100%), wide local excision was needed in 7 patients (87.5%). Reconstruction of the wound by primary closure and STSG was needed in 2 patients and 5 patients respectively. Amputation was needed in 1 patient with malignant melanoma. In addition to surgery, radiotherapy was needed in 2-foot ulcer (25%) that was patients with squamous cell carcinoma. Graft rejection occurred in 1 patient. In some studies, a non-healing ulcer also been claimed as an indication. In several studies, the outcome of deep foot infection has been related to the extent of tissue involved, co-morbidity, and coexisting peripheral arterial disease. [18] Among 18 patients with Buerger's disease (100%) 5 patients (27.78%) needed amputation. It was found that among 6 patients (100%) with atherosclerotic foot ulcer 2 patients (33.33%) needed amputation. One patient (12.55) with a malignant ulcer needed amputation. At the end of 6 months follow up it was found that among 68 diabetic patients (100%), 5-foot ulcer (7.35%) were unhealed which was higher than a study (3.45%). 51 Recurrence rate was 19.04% which was higher than a study (12.9%). [20] Among 8 patients with a malignant ulcer 6 patients (75%) healed. No recurrence was found in 6 months of follow-up. Flap coverage and revascularization improved the salvage rate for the most severe foot ulcer. Flap reconstruction for infected and ischaemic foot ulcers provides an additional advantage: Nourishing the distal ischaemic portion of the foot lacking collateral circulation that a revascularization procedure could not successfully reach, aiding in resistance to infection, filling the defect after debridement, resistance to shearing force during walking and protection from trauma. [19] Limited patient education alone is effective in achieving a clinically relevant reduction in ulcer and amputation incidence. The treatment of foot ulcer requires a multidisciplinary approach that involves extensive surgical debridement of the ulcer area, adequate offloading of the foot, aggressive treatment of infection, metabolic control and restoration of blood flow in the peripheral arteries when necessary. [20]

Limitation of the study:

This was a single-centered study with small-sized samples. Risk factors for atherosclerosis (nondiabetic) and malignant ulcer could not be identified as the sample sizes are small. Arterial biopsy and histopathology were not done for the diagnosis of PVD.

V. CONCLUSION & RECOMMENDATION

Effective glycemic control, optimal wound care, aggressive medical management and timely surgical intervention may decrease disabling morbidity with a better outcome in the management of foot ulcers. This needs to develop a multidisciplinary team in all medical institutions for better care of foot ulcers. For getting more

specific results, we would like to recommend conducting similar studies in several places with larger-sized samples.

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Conflict of interest: None declared.

Ethical approval: The study was approved by the institutional ethics committee.

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