

Prevention of Lower Extremity Amputations in Patients of Diabetic Foot Ulcer: An Experience

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Research Article

Rizwan Khalid^{1*}, Muhammad Usman Malik², Misbah Zeb³ and Hafiz Muhammad Abbas⁴

¹Assistant Professor Surgery, Central Pak Medical College Lahore

^{2,3,4}Resident Surgery, Mayo Hospital Lahore

*Correspondence authors

Dr. Rizwan Khalid

Asst Professor Surgery

Central Pak Medical College Lahore

Pakistan

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Abstract

Aim: To evaluate risk factors leading to major lower extremity amputations in DFU patients and prevention of amputations.

Study Design: Observational study.

Study Setting: East Surgical Ward, Mayo Hospital, Lahore.

Duration: February 2020 to April 2020

Introduction: Diabetic Foot Ulcer (DFU) is a relatively common complication of Diabetes Mellitus and is known to be the main cause of major lower extremity amputations. We tried to seek the predictors of Leg Amputations after development of Diabetic Foot Ulcer (DFU) and its prevention in hospitalized patients.

Discussion: Diabetes Mellitus is known to increase the risk of major leg amputations by 15 to 20 times. Few studies have evaluated the risk factors for major amputations in diabetic patients along with amputation rates. Total 6 parameters were evaluated and good control of all parameters seemed to prevent major amputations in DFU patients.

Conclusion: Study revealed that Wagner stage of diabetic wound, co-morbidities, wound sepsis, poor glycemic control, inadequate caloric intake and loss of follow-up are major risk factors of amputation in diabetic foot ulcer patients.

Keywords: Diabetic Foot, Amputations, Wound Sepsis, Wagner Stage

Introduction

Diabetic Foot Ulcer (DFU) is a relatively common complication of Diabetes Mellitus. The lifetime risk for a Diabetic patient to develop DFU is about 25% [1]. Diabetic Foot ulcer is known to be the main cause of major lower extremity amputations in diabetic patients along with diabetic foot gangrene. Up to 70% of all leg amputations are performed on diabetic people and about 85% of lower limb amputations in patients with diabetes are preceded by foot ulceration [2,3]. In short, among diabetic person 25% develop foot ulcer during lifetime and in those patients with foot ulceration risk of lower extremity amputation increases to 15 times compared to non-diabetic persons [1,4]. Limb amputation is a life changing event that signifies long-term physical, social, psychological and environmental changes [5]. Diabetic foot wound is not only a serious health problem but also poses socioeconomic burden to patient and country due to prolonged hospitalization and rehabilitation time [6]. Therefore, early recognition and proper management of risk factors of amputations in patient of DFU (diabetic foot ulcer) may prevent major amputations and their adverse impacts.

In spite of list of risk factors for the development of DFU (diabetic foot ulcer), there is little data about predictors of amputations once foot ulcer has developed in diabetic patients. Therefore, the objective of current study is to evaluate risk factors leading to major lower extremity amputations in DFU patients and prevention of amputations.

Method

An observational study conducted between Feb, 2020 to April, 2020 in East Surgical Ward, Mayo Hospital, Lahore, Pakistan. We followed 31 patients with Diabetic Foot Ulcer presented and managed by surgical team until recovery or death. Good diabetic control, nutritional status, wound Care, antibiotic coverage and strict follow up was observed. Patients evaluated on the basis of following 6 parameters and course of DFU observed till healing, infection or amputation. The risk factors leading to amputations are sought out based on these parameters:

- Wagner stage of diabetic ulcer classification
- Co morbidities of diabetic patient like Heart Failure and Chronic Kidney Disease.
- Wound sepsis (local infection, leukocytosis and osteomyelitis)
- Glycemic control.
- Nutritional status
- Follow up.

Results

A total number of 31 patients with DFU were included in our study. Table 1 represents the demographic characteristics which show that males were 65% (n 20) higher than females 35% (n 11). Majority of them were in 35-70 years age category. Among the surgeries in our study, below knee amputations 58% (n 18), above knee amputations 9.6% (n 3), trans-metatarsal amputations 6.4% (n 2) and foot saved with debridement only 25.8% (n 8).(Table 2)

Among all patients, 65% (n 20) had complete wound healing, 25.8% (n 8) still managing infected wounds and 9.6% (n 3) died due to sepsis or co morbidities. (Table 3)

Demographics	F	%age
Gender		
Male	20	65
Female	11	35

Table 1: Demographic characteristics of patients in the study. (n=31)

Surgery	F	%age
Below knee amputations	18	58
Above knee amputations	03	9.6
Trans-metatarsal amputations	02	6.4
Debridement	08	25.8

Table 2: Type of Surgeries performed (n=31)

End Results	F	%age
Healed wounds	20	65
Infected wounds	8	25.8
Expired	3	9.6

Table 3: Patient follow up (n=31)



A 50yr male. Ultimately underwent Rt BKA on 20th Feb,2020.



A 42yr male. Underwent left BKA on 28th Feb,2020.





A 50 yr female, first BKA , then finally Right AKA on 21st Feb,2020



A 50yr male underwent aggressive debridement and wound care and ultimately referred to plastic surgery for skin grafting on 27th Feb.2020.



A 49yr female underwent Trans-metatarsal amputation of R foot on 21st Feb,2020.



Predictors/ Risk factors of amputations:

- Wagner classification of Diabetic foot ulcer

Ulcer grading	Description
Grade 0	No ulcer but high-risk foot
Grade 1	Superficial ulcer
Grade 2	Deep ulcer, no bony involvement or abscess
Grade 3	Abscess with bony involvement (as shown by X-ray)
Grade 4	Localized gangrene e.g. toe, heel etc
Grade 5	Extensive gangrene involving the whole foot

Note: Grade 1–3 ulcers are termed *non-gangrenous ulcers* and Grade 4 and 5 ulcers are termed *gangrenous ulcers*

Wagner grade is directly linked to risk of amputation.

- Co-Morbidities such as Ischemic Heart Disease, Heart Failure and CKD.

Functional class	Description
I	No physical limitation in activity
II	Slight limitation in ordinary physical activity, resulting in fatigue, palpitations, dyspnea, or angina
III	Marked limitation in activity: patients comfortable at rest, but ordinary activity leads to signs and symptoms
IV	Signs and symptoms present at rest, and any activity leads to increased discomfort

Higher the functional class of Heart failure, greater the risk of amputation after DFU.

In CKD patients, risk of amputation is directly linked with proteinuria.

- Wound Sepsis presented in following ways:
 - Local wound infection along with leukocytosis (WBC>15x10³)
 - Deep tissue infected in the form of osteomyelitis.
- BSL(Basal sugar Level) control
Fasting Blood Glucose Level consistently higher than 200

during hospital stay was good predictor of amputation.

- Nutritional Status: Inadequate caloric intake and low protein consumption led to poor healing of diabetic foot ulcer and increased tendency towards non healing ulcer and major amputations in diabetic patients.
- Follow up status: Loss of follow up lead to poor wound management and ultimately resulting in wound infection and amputation in severe cases.

Following factors were not taken into account as predictor of amputation in DFU patients in our study

- Age of patient
- Gender of patient
- Type of Diabetes mellitus
- Duration of Diabetic foot Ulcer

Discussion

Diabetes Mellitus is known to increase the risk of major leg amputations by 15 to 20 times [4,7,8]. Few studies have evaluated the risk factors for major amputations in diabetic patients along with amputation rates. Se Young Kim identified Wagner grade, CHF, Leukocytosis, Dementia and PAOD (peripheral arterial occlusive disease) as significant risk factors for amputations in diabetics [9]. In the present study, we identified and evaluated many predictors of amputations in diabetics which were neglected in previous studies including Wagner classification grade of diabetic foot ulcer, Co-morbidities sp. IHD, CHF and CKD, wound sepsis, Basal sugar level control, Nutritional status and Follow-up status. Total 6 parameters were evaluated and good control of all parameters seemed to prevent major amputations in DFU patients.

Wound state at presentation according to Wagner classification grade was principle predictor for major amputations in all Diabetic patients as previous studies have clearly reported the significant correlation between Wagner grading and diabetic foot amputations [10,11]. Current study demonstrate that co-morbidities like Ischemic Heart Disease, Heart Failure and Chronic Kidney Disease proportionately increase the risk of major amputations in diabetic patients as reported individually in previous studies [9,12,13]. Our study revealed that wound sepsis including local infection along with leukocytosis (WBC count $> 15 \times 10^3$) and deep tissue infection in the form of osteomyelitis are potential risk factors preceding major amputation in diabetic foot wound patients. Osteomyelitis is an independent risk factor for amputation in diabetic foot patients despite aggressive surgical debridements to control deep infection [9]. Wound care plays a pivotal role in management of diabetic ulcer, which comprises cleaning the wound with normal saline and use of modern wound care techniques that promotes moist wound healing environment [14]. There are numerous topical regimens available for management of diabetic foot wound depending upon patient's general health, wound state and process of tissue repair [15]. We observed excellent results of Vacuum assisted dressings along with vinegar, papaya and hydro gel dressings. The principle of antibiotic treatment was based on culture sensitivity report of wound [16,17].

In addition, poor glycemic control was potential risk factor for non-healing ulcers and amputations. Good glycemic control is important to reduce amputation risk in diabetic patients [11,13]. Fasting Blood Glucose Level consistently greater than 200 during hospital stay was good predictor of amputation in diabetic foot patients. Nutritional therapy plays a vital role in management of diabetes and its all complications [18]. Poor nutrition before and during healing process may delay wound healing and impair wound strength [19,20]. Protein is one of the most important macro-nutrients that is essential and required during all stages of wound healing [21]. It was observed that good follow up of patient was very important for proper management of diabetic foot ulcer and prevention of amputation.

The present study has several limitations. First, number of patients with diabetic foot ulcers enrolled in the study was small. Therefore, we observed relatively higher rates of amputations. Moreover, duration of study was not long enough to establish statistical significant relationship of risk factors. In addition, PAOD (peripheral arterial occlusive disease) of patients was not taken in account in the study which is already identified as an independent risk factor of amputation in diabetic foot wound patients in previous studies [9].

To sum up, major risk factors leading to amputation in diabetic foot ulcer patients are Wagner stage of diabetic ulcer, co-morbidities, wound sepsis, poor glycemic control, inadequate caloric intake and loss of follow-up.

Conclusion

Study revealed that Wagner stage of diabetic wound, co-morbidities like IHD, CHF and CKD, wound sepsis, poor glycemic control, inadequate caloric intake and loss of follow-up are major risk factors of amputation in diabetic foot ulcer patients. Good attention and reduction of these factors may prevent major amputations in patients with diabetic foot ulcers. Patient education about self wound care, early mobilization, addressing the co-morbidities and following proper diet plan are essentials for management of Diabetic foot ulcer.

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