

Original Research Article

A prospective cohort study of hypoalbuminemia as risk factor of wound healing in diabetic foot: a study from tertiary hospital in south India

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ABSTRACT

Background: Diabetic foot ulcers is a major complication of diabetes mellitus, and precedes >80% of all diabetes related lower leg amputations. One of the risk factors in non-healing diabetic ulcer is low serum albumin level. The objectives of this study were to study the effect of low serum albumin level in patients with diabetic foot ulcer and to study the factors affecting wound healing in diabetic ulcer.

Methods: Prospective cohort study in a tertiary hospital.

Results: The mean age among study was 57.8 out of which 68.3% were males and 31.7% were females. 55% patients presented with slough over ulcer, 29.2% patients presented with healthy granulation and 15.8% patients presented with extensive wound infection. Among study group 50% patients had good glycaemic control and 50% patients had poor glycaemic control.

Conclusions: Low serum albumin level is one of the attributable risk factor of non-healing ulcers in diabetic foot. Poor glycaemic status is also a risk factor for non-healing ulcer.

Keywords: Diabetic foot ulcer, Factors affecting wound healing, Normal wound healing pattern

INTRODUCTION

Foot disorders such as ulceration, infection, and gangrene are the leading causes of hospitalization in patients with diabetes mellitus.^{1,2} Approximately 15 to 20 percent of the estimated 16 million persons in the United States with diabetes mellitus will be hospitalized with a foot complication at some time during the course of their disease.³

The diabetic foot and its sequelae account for billions of dollars in direct medical expenditures, as well as lengthy hospital stays and periods of disability.^{3,4} Approximately 85 percent of all diabetes-related lower-extremity amputations are preceded by foot ulcers.^{5,6}

Many of the risk factors for foot ulcer are also predisposing factors for amputation, because ulcers are primary causes leading to amputation.⁷ An adequate description of ulcer characteristics, such as size, depth, appearance, and location, also provides for the mapping of progress during treatment.⁸ Failure to perceive the pressure of a 10-g monofilament is a proven indicator of peripheral sensory neuropathy and loss of protective sensation.^{9,10} A positive probe-to-bone finding has a high predictive value for osteomyelitis.¹¹

Failure to diagnose underlying osteomyelitis often results in failure of wound healing. The existence of odor and exudate, and the presence and extent of cellulitis must be noted.¹²

METHODS

The present study was a Prospective cohort study done in diabetic foot ulcer patients admitted in General surgery Department, Government Medical College, Calicut from January 2015-June 2016. Study was carried out in 120 patients.

Inclusion criteria

All diabetic foot ulcer patients above the age of 35.

Exclusion criteria

Patients with chronic liver diseases, chronic renal diseases, underlying osteomyelitis, associated peripheral vascular diseases.

Patients admitted, in Government Medical College under General Surgery Department with diabetic foot ulcers were selected, and followed up for a minimum period of 3months. Serum albumin levels and diabetes status

evaluated, initial wound status assessed, detected. Hypoalbuminemia corrected with high protein diet and supplementations and wound status after 3 months reassessed. During hospitalisation wound managed with daily cleaning and dressings, slough cutting and extensive debridement.

Statistical analysis

Data was entered in Excel and the analysis was performed on SPSS software. A P value of <0.05 was accepted as significant.

RESULTS

Total no of study group: 120. Total no of male patients: 82 (68.3%). Total no of female patients: 38 (31.7%). Among study group 35.8% presented with ulcer over dorsal aspect of foot 22.5% patients presented with ulcer over plantar aspect of foot 21.7% presented with ulcer over toe. 9.8% presented with ulcer over lateral aspect of foot.

Table 1: Pattern of procedure done.

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Daily cleaning and dressing	39	32.5	32.5	32.5
	Slough cutting	62	51.7	51.7	84.2
	Extensive wound debridement	19	15.8	15.8	100.0
	Total	120	100.0	100.0	

Table 2: Wound status after 3rd month.

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Healed/healing	61	50.8	50.8	50.8
	Not healed	35	29.2	29.2	80
	Amputated	17	14.2	14.2	94.2
	Lost follow-up	7	5.8	5.8	100
	Total	120	100	100	

Table 3: Showing correlation between diabetes status and wound status Crosstab.

	Wound status after 3 months				Total
	1	2	3	4	
Count	54	2	1	3	60
% within diabetes status	90.0%	3.3%	1.7%	5.0%	100.0%
Count	7	33	16	4	60
% within diabetes status	11.7%	55.0%	26.7%	6.7%	100.0%
Count	61	35	17	7	120
% within diabetes status	50.8%	29.2%	14.2%	5.8%	100.0%

Among study group 50% presented with controlled diabetes 50% presented with uncontrolled diabetes. Among study group the mean age was 57.8 and the mean serum albumin level was 2.99, 3.1, 3.17 at the time of

admission, after one month and after 3rd month of follow-up respectively. Among study group 55% presented with slough over ulcer initially 15.8% presented with extensive infection, 29.2% patients

presented with healthy granulation. Among study group 50.8% wound healed after 3 months 29.2% wound not healed after 3rd month 14.2% patients underwent amputation 5.8% lost follow up. 90% wound healed in patients with controlled diabetes, 2% wound not healed in patients with controlled diabetes. 55% wound not healed in patients with uncontrolled diabetes. Only 11.7% wound healed in patients with uncontrolled diabetes. 3% patients lost follow up. 1.7% patients undergone amputation. Only 25% wound healed in patients with low serum albumin level. 47.2% wound not healed in patients with low serum albumin level. 23.6% patients underwent amputation among low serum albumin level group.

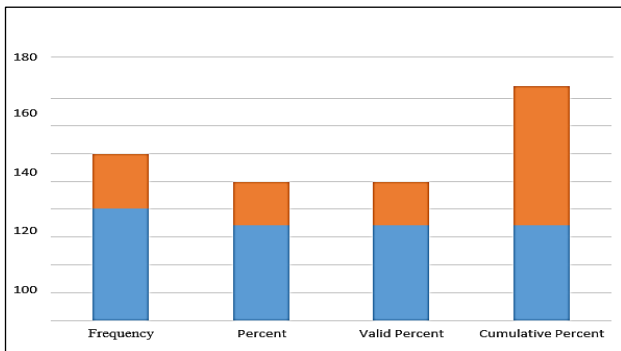


Figure 1: Gender distribution among study group.

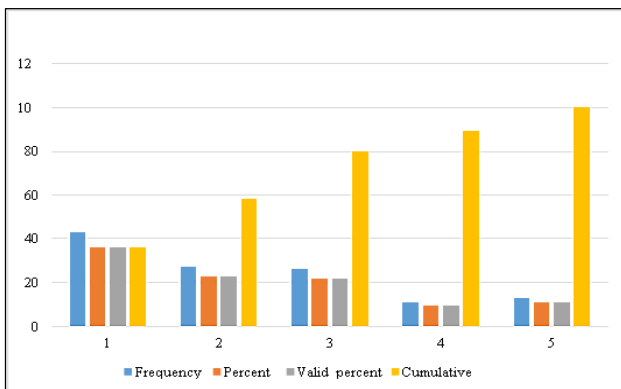


Figure 2: Distribution of ulcer site.

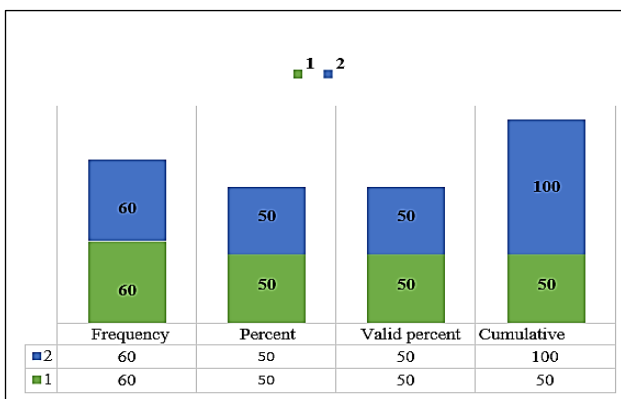


Figure 3: Diabetes status among study group.

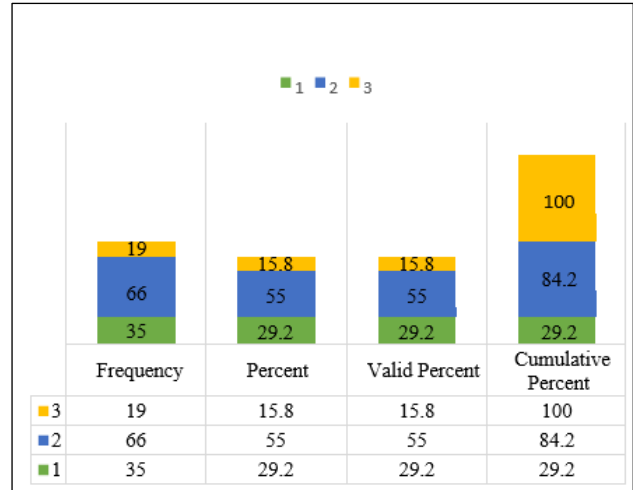


Figure 4: Initial status of wound.

No amputated patients in group 14.2% lost follow-up in group 18.3% lost follow-up in group 2. Chi-square value of 0.000 is significant. So, the study is significant.

It states that hypoalbuminemia is a risk factor of wound healing in diabetic foot ulcers. Considering the site of ulcer, ulcer over toes showed better wound healing than other sites (61.5%).

DISCUSSION

During the study period, each patient’s diabetes status also followed up. Patients above the age of 35 were included in the study. The mean age among study was 57.8. Out of which 68.3% were males and 31.7% were females. Among study group 55% patients presented with slough over ulcer, 29.2% patients presented with healthy granulation and 15.8% patients presented with extensive wound infection. Patients were followed up every 2 weeks.

During these times wound managed with daily dressing, slough cutting, and extensive debridement according to the wound status. Detected hypoalbuminemia corrected with high protein diet and nutritional supplements. Serum albumin levels assessed at the end of 1st month and after 3rd month.

Among study group 50% patients had good glycemic control and 50% patients had poor glycemic control. The criteria for wound to be considered as healed is that, complete skin over the initial ulcer. The definition for healing wound is considered as that, wounds covered with granulation tissues at the end of 3rd month. coverage It shows that 50.8% wound healed/healing at the end of 3rd month, 29.2% wound not healed properly, 14.2% patients underwent amputation and 5.8% patients lose follow up. Among group one, that is patients with initial hypoalbuminemia, only 25% wound is healed and 47.2% wound not healed at the end of 3rd month.

Whereas 89.6% wound healed in group 2, is patients with normal albumin levels at the time of admission. 23.6% patients underwent amputation in patients with low serum albumin group.

This states that hypoalbuminemia is a major contributing factor in wound healing. If considering the glycemic control and wound healing pattern, in well controlled diabetic patients 90% of wound healed where as in patients with uncontrolled diabetes only 11.7% of wound healing observed. 55% wound not healed in uncontrolled diabetes. The healing pattern is uniform in both males and females. Considering the site of ulcer as shown in 61.5% wound healing observed over toe ulcers than other sites.

The study conducted among hospitalised patients in Calicut Medical College with diabetic foot ulcers. Analysis done in 120 patients for a period of 3 months prospectively. The total group was further divided into cases and control, with reference to serum albumin level at the time of admission. Reference serum values ranges from 3.5-4.5. Patients with normal range of serum albumin were assigned as group 2 and patients with low serum albumin level were assigned as group 1. Patients presented with low serum albumin due to non-diabetic conditions like chronic liver diseases, chronic kidney diseases were excluded from the study group.

The ulcers were managed with daily cleaning and dressing, slough cutting and extensive wound debridement in patients with healthy granulation, with slough and extensive infection respectively. Each patient was followed up for a minimum period of 3 months. Serum albumin level monitored at 1st month and 3rd month. The total duration of study was one and a half years from January 2015 to June 2016. Hospitalised cases of diabetic ulcer patients from Government Medical College, Calicut, above the age of 35 were included in the study. The diabetes status also monitored during the follow-up. The wound status was assessed at the end of 1st month and at 3rd month.

For patients presented with initial low serum albumin levels, high protein diet and nutritional supplementations given and further followed up. The study findings were tabulated in MS Excel format and analysed using SPSS software. After analysis, a significant difference noticed among the two groups in terms of wound healing, which is proved by a p value of 0.000 which is significant. This states that low serum albumin is a risk factor in diabetic wound healing. Poor glycaemic control is also a risk factor of wound healing in diabetic foot. An adequate description of ulcer characteristics, such as size, depth, appearance, and location, also provides for the mapping of progress during treatment.⁸ Failure to perceive the pressure of a 10-g monofilament is a proven indicator of peripheral sensory neuropathy and loss of protective sensation.^{9,10} A positive probe-to-bone finding has a high predictive value for osteomyelitis.¹¹ Failure to diagnose

underlying osteomyelitis often results in failure of wound healing. The existence of odor and exudate, and the presence and extent of cellulitis must be noted.¹²

CONCLUSION

Diabetic foot ulcer is one of the major complication of diabetes mellitus, it is a major component of diabetic foot. The major increase in morbidity and mortality among diabetic patient is considered to be due to micro and macrovascular complications, that lead to failure of normal wound healing process. Low serum albumin level is one of the attributable risk factor of non-healing ulcers in diabetic foot. Poor glycemic status is also a risk factor for non-healing ulcer.

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

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