A Comparative Study of the SINBAD and DUSS Scoring Systems in Predicting the Outcome of Diabetic Foot Ulcer Management

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Abstract: *Many diabetic foot ulcer classification systems are being devised in an attempt to categorize ulcers more effectively and allow us to use a better scoring system to predict the outcome of routine management. Objectives: To compare SINBAD and DUSS scoring system in diabetic foot ulcer. Predicting the prognosis and outcome of diabetic foot ulcer. Methods: Total of 130 diabetic patients attending surgical outpatient clinic or admitted into the hospital (BMCRI) with foot ulcer from February 2021 to August 2022 were included in the study. Relevant data was collected. SINBAD and DUSS score were calculated for each patient and analysis was done using IBM SPSS Version 22 for windows. Results: Most common age group affected was between 61-70 years. Males were more commonly affected by foot ulcers. In both scoring system lower the score wound healing was by primary intention and with SSG, as the higher score need for minor and major amputation was noted. Conclusion: At the end of statistical analysis comparison between both scoring system showed SINBAD has 96% of sensitivity, 62% specificity, 60 % positive predictive value, 96% of negative predictive value with 75% of accuracy whereas DUSS score had 35% sensitivity, 84% specificity, 57% positive predictive value, 68% negative predictive value and 65% accuracy. Hence, SINBAD scoring can be recommended as an easy diagnostic tool for predicting probability of healing or amputation.*

Keywords: Diabetic foot ulcer, DUSS, SINBAD score, Accuracy, ROC curve.

1. Introduction

Diabetic foot infections are a significant cause for the non-traumatic amputations which are preventable. Diabetes has considered a substantial threat due to variations in demography, culture, and aging factors. It is a primary causative factor in cardiovascular diseases, amputation, renal disorders and blindness and causes an economic burden to the patients. Gangrene and ulcer in foot are most severe complications of diabetes, with morbidity same as that due to cancers. Diabetic population also suffers from delayed wound healing; therefore, patients present with varying degree of complications. Although many scoring and wound classification systems are available for assessment, in this study SINBAD and DUSS scoring systems are being compared so that it can be implemented in clinical practice, help in predicting the outcome and selection of appropriate management for the same.

2. Materials and Methods

Source of Data-Patients with diabetic foot ulcer attending OPD/ IPD of General Surgery Department of Victoria hospital and Bowring and Lady Curzon hospital affiliated with BMCRI.

Method of Collection of Data: This is a cohort study conducted during the period February 2021 to August 2022. Total 130 patients with clinical diagnosis of diabetic foot ulcers with inclusion criteria were taken into the study.

Inclusion criteria:
1) Age – 18 to 80 years.
2) Gender – Both male and female.
3) Patient willing to give informed consent.
4) Patient coming to hospital with foot ulcers and known case of diabetes mellitus as per WHO guidelines.
5) Diabetic ulcer grade >/= 2

Exclusion Criteria:
1) Patient not willing to give informed consent.
2) Age – less than 18 years.
3) Patient presenting with gangrenous toe/s without ulcer.
4) Non diabetic patient with venous foot ulcers.
5) Diabetic patients with past history of amputation.

The patients were followed up during the study period.

130 patients attending general surgery outpatient clinic and admitted in general surgery department in BMCRI and its attached hospital are studied prospectively during this study period. A detailed clinical history was taken for all patients. Proper clinical examination was done for all the patients. Patients are followed up regularly and those who underwent surgical procedures are noted. Standard treatment care was given to all these patients, which included oral hypoglycemic or insulin for good control of diabetes, health education, antibiotics and regular wound care. Healing was defined as complete epithelization or healing after skin grafting. Amputation rate was defined as the percentage of patients undergoing either minor or major amputation within the observation period. Toe or forefoot amputations were taken as minor amputation and below knee or above knee amputation were taken as major amputation. Dressings were done every day for inpatients and patients who were discharged and who visited on OPD basis were followed up in the surgical outpatient clinic. For both groups the scoring was applied at once in fortnight for 1 st month, then once in

a month till the ulcer healed or for a minimum period of up to 6 months. Ulcer healing was assessed as mentioned earlier.

Statistical Data Analysis

Categorical data was represented in the form of frequency and percentage. Association between variables was assessed with Chi Square Test. Fisher's Exact test was applied if the cell values were small. Quantitative data were represented as Mean &standard deviation. Sensitivity, Specificity, PPV, NPV and accuracy was assessed. ROC was plotted to check the area covered. A p value of <0.05 was considered statistically significant. Data was analyzed using IBM SPSS Version 22 for windows.

3. Assessment Tools

Table 1: Diabetic ulcer severity score (DUSS).

Parameter	Score 0	Score1
Palpable pedal pulse	Present	Absent
Probing to bone	No	Yes
Ulcer site	Toes	Foot
Ulcer number	Single	Multiple

Scores-maximum=4 and minimum=0

Table 2: SINBAD scoring system

Category	Definition	Score
Site	Forefoot	0
	Midfoot and hind foot	1
Ischemia	Pedal blood flow intact, one pulse palpable	0
	Clinical evidence reduced pedal blood flow	1
Neuropathy	Protective sensation intact	0
	Protective sensation lost	1
Bacterial infection	None	0
	Present	1
Area	Ulcer < 1 cm^2	0
	Ulcer > 1 cm^2	1
Depth	Ulcer confined to skin and subcutaneous tissue	0
	Ulcer reaching muscle, tendon, or deeper	1

Total possible score = 0 – 6

4. Results

Table 3: Age-wise distribution of study population

| Age	No of Cases	Percent
≤ 40	5	3.80
41-50	33	25.40
51-60	40	30.80
61-70	43	33.10
>70	9	6.90
Total	130	100.00

Most common age group with diabetic foot was between 61-70 years, n=43. The second group is between 51-60 years in our study.

Table 4: Gender wise distribution of study population

Gender	No of Cases	Percent
Male	94	72.30
Female	36	27.70
Total	130	100.00

Males were commonly affected by diabetic foot ulcers accounting to 72.3% whereas 27.7% females in our study

Table 5. Distribution of diabetic foot outcome under DUSS scoring system
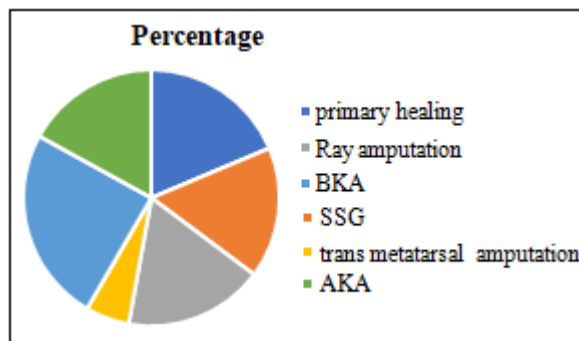
Among the study population under DUSS scoring system 16.9% (score 0-2) foot ulcer healed by primary intention, 15% (score 0-3) underwent split thickness skin grafting, 16% (score 0-2) ray amputation, 5% (score 4) transmetatarsal amputation, 22.3% (score 2-3) underwent below knee amputation and 15.4% (score 2-3) above knee amputation respectively.
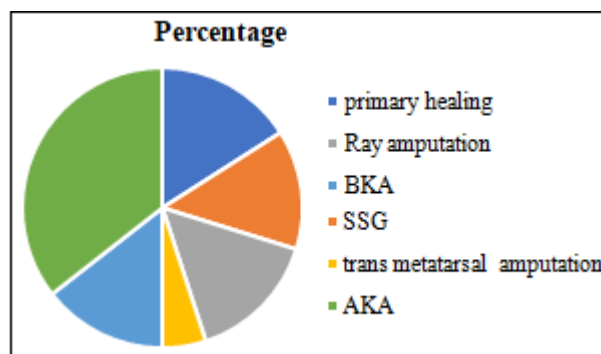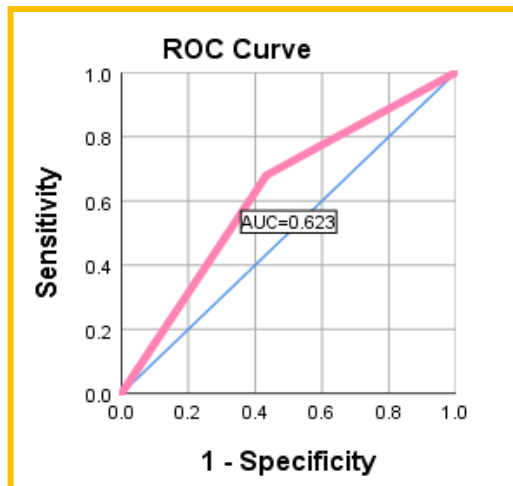

Table 6. Distribution of diabetic foot outcome under SINBAD scoring system under SINBAD scoring system 16.9% (score 4) foot ulcer healed by primary intention, 14.6% (score 3-5) underwent split thickness skin grafting, 16.1% (score 3-5) ray amputation, 5.3% (score 4-6) trans metatarsal amputation, 15.3% (score 5-6) underwent below knee amputation and 37.6% (score 5-6) above knee amputation respectively.

By using Receiver Operating Characteristic curves, the area under the curve for DUSS was 0.63 and for SINBAD was0.782. Whereas accuracy was 65% and 75% for DUSS and SINBAD respectively.
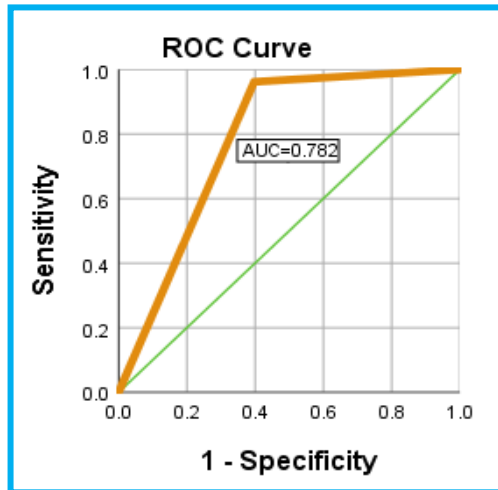
Graph 1: Showing the ROC curve for SINBAD score

Graph 2: Showing the ROC curve for DUSS score

5. Conclusion

Accurate classification of diabetic foot ulcers is essential for inter assessment of healing, and choose of treatment options. Both clinician communications, scoring system provides an easy diagnostic tool for predicting probability of healing or amputation by combining clinical assessable wound based various parameters. Study groups can be stratified depending on severity of ulcers and thus can help provide a simple, streamlined approach in clinical setting without need of any advanced investigative tool, but it does not alter the procedure of wound management.

In this study wound predictability was almost similar between both scoring system but SINBAD was more accurate. Where lower SINBAD scores did not require any major amputation, whereas those with higher scores required major amputation as a part of their management. Even though both scores used are simple and easily reproducible that can be used in diabetic foot ulcers in routine surgical practice. Parameters and predicts the outcome better. SINBAD involves more parameters and predicts the outcome better

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