

An Observational Study To Test The Efficacy Of Diabetic Ulcer Severity Score

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Abstract:

Background: diabetes mellitus is the most common health problem and one of the most challenging.¹ Foot ulcers are a common complication of diabetes and represent a major source of morbidity. The incidence of foot ulcers with diabetes is around 2% per year.² A clinical severity score is considered to be superior to a classification system. A severity scoring system called Diabetic ulcer severity score (DUSS) considering the four clinically defined parameters, namely palpable pedal pulses, probing to bone, ulcer location and presence of multiple ulcerations to outcome this problem, and have found that healing was independently associated with Peripheral arterial disease, ulcer depth & site and ulcer number.

Materials and Methods: In this prospective observational study, 125 patients of diabetic foot who were admitted in Department of General Surgery, Sawai Man Singh Hospital were included. All the findings were recorded in terms of age, gender, DUSS score, type of amputation done, complications and mortality.

Results: It was observed that most of the subjects scored 0 and 1 in the study. Majority with score 0 and 1 had primary healing of ulcers, majority with score 2 and 3 underwent STSG and minor amputations, majority with score 4 underwent major amputations.

Key Word: diabetic ulcer scoring system, amputation.

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I.Introduction

Nowadays globally, diabetes mellitus is the most common health problem and one of the most challenging.¹ Diabetes resembles the plague of 14th century in terms of number of deaths it accounts for in today modern-day era, as well as a fast increase in occurrence and morbidity.³ Foot ulcers are a common complication of diabetes and represent a major source of morbidity. The incidence of foot ulcers with diabetes is around 2% per year.² Fifteen percent of diabetics develop foot ulcers during their life time with significant health related decrease in quality of life and consumption of a great deal of healthcare resources.⁴

A clinical severity score is considered to be superior to a classification system because, a clinical severity score should be based on a standardized clinical assessment of wound-based parameters facilitating the categorization of wounds into specific severity subgroups for comparison of outcome with respect to the clinical course of wound repair. A severity scoring system called Diabetic ulcer severity score (DUSS) was designed by Beckert et al.⁵ considering the four clinically defined parameters, namely palpable pedal pulses, probing to bone, ulcer location and presence of multiple ulcerations to outcome this problem, and have found that healing was independently associated with Peripheral arterial disease, ulcer depth & site and ulcer number. A lower DUSS score was strongly associated with healing and it is simple, provides an easy diagnostic tool for predicting probability of healing or amputation, which can be applied in daily clinical practice without need of any advanced investigative tool. This study was undertaken to analyze the efficacy of DUSS scoring system in diabetic foot ulcers for prediction of clinical outcomes on the patients and its applicability in day-to-day practice in tertiary care hospital.

II. Material And Methods

This prospective study was carried out on patients of Department of general Surgery at Sawai Man Singh Medical College, Jaipur, Rajasthan, India from January 2021 to November 2022. A total 125 adult subjects (both male and females) were for in this study.

Study Design: Prospective observational study

Study Location: This was a tertiary care teaching hospital based study done in Department of General Surgery at Sawai Man Singh Medical College, Jaipur, Rajasthan, India

Study Duration: January 2021 to November 2022.

Sample size: 125 patients.

Sample size calculation: Sample size is calculated at 95% confidence level and alpha error of 0.05 assuming prevalence of lower extremities amputations at various level of foot is found to be 54 %. At the absolute allowable error of 10 % the required sample size will be 96 subjects which is further enhance to 113 subjects as final sample size with 15% attrition. It is calculated by the formula " $n = \frac{z^2 p q}{d^2}$ " where n is sample size, z is standard deviation, p is prevalence and d is absolute error.

Inclusion criteria: All the patients admitted in SMS hospital for diabetic foot ulcer after taking written informed consent.

Exclusion criteria:

- 1) Patients with coexisting varicose ulcers
- 2) deep vein thrombosis
- 3) Malignant ulcers
- 4) Patients who are known case of vasculitis.
- 5) patients <14 years of age.
- 6) traumatic ulcer.

Statistical analysis

Statistical methods for analysis involved descriptive statistics such as mean, standard deviation and frequencies and inferential statistics including chi square test was used. The data was compiled in MS excel and other relevant softwares. The data has been presented in table and graphs wherever applicable. Data was analysed as per objectives P value <0.05 was considered as significant. Inferences were drawn with the help of appropriate test of significance.

III. Result

TABLE 1: AGE DISTRIBUTION AMONG STUDY SUBJECTS

AGE GROUP	FREQUENCY	PERCENT
41-50	33	26.4
51-60	44	35.2
61-70	48	38.4
TOTAL	125	100.0

TABLE 2: GENDER DISTRIBUTION AMONG STUDY SUBJECTS

SEX	FREQUENCY	PERCENT
FEMALE	34	27.2
MALE	91	72.8

TABLE 3: DISTRIBUTION OF SUBJECTS ACCORDING TO PRIMARY HEALING STATUS

PRIMARY HEALING	FREQUENCY	PERCENT
YES	69	55.2
NO	56	44.8

TABLE 4: DISTRIBUTION OF SUBJECTS ACCORDING TO SSG STATUS

STSG	FREQUENCY	PERCENT
YES	20	16.0
NO	105	84.0

TABLE 5: MINOR AMPUTATION AMONG STUDY SUBJECTS

MINOR AMPUTATION	FREQUENCY	PERCENT
YES	21	16.8
NO	104	83.2

TABLE 6: MAJOR AMPUTATION AMONG STUDY SUBJECTS

MAJOR AMPUTATION	FREQUENCY	PERCENT
YES	15	12.0
NO	110	88.0

TABLE 7: ASSOCIATION OF DUSS SCORE WITH PRIMARY HEALING

PRIMARY HEALING	DUSS SCORE		P VALUE
	MEAN	SD	
YES (69)	0.97	0.954	0.00001*
NO (56)	2.89	1.090	

TABLE 8: ASSOCIATION OF DUSS SCORE WITH STSG

STSG	DUSS SCORE		P VALUE
	MEAN	SD	
YES (20)	2.60	1.142	0.00001*
NO (105)	1.69	1.396	

TABLE 9: ASSOCIATION OF DUSS SCORE WITH MINOR AMPUTATION

MINOR AMPUTATION	DUSS SCORE		P VALUE
	MEAN	SD	
YES (21)	2.90	1.179	0.00001*
NO (104)	1.62	1.339	

TABLE 10: ASSOCIATION OF DUSS SCORE WITH MAJOR AMPUTATION

MAJOR AMPUTATION	DUSS SCORE		P VALUE
	MEAN	SD	
YES (110)	3.27	0.799	0.00001*
NO (15)	1.64	1.346	

TABLE 11: ASSOCIATION OF PRIMARY HEALING WITH DUSS SCORE

PRIMARY HEALING		DUSS SCORE					P VALUE
		0	1	2	3	4	
YES	N	27	22	15	5	0	0.00001*
	%	93.1	81.5	62.5	19.2	0.0	
NO	N	2	5	9	21	19	
	%	6.9	18.5	37.5	80.8	100.0	

TABLE 12: ASSOCIATION OF STSG WITH DUSS SCORE

STSG		DUSS SCORE					P VALUE
		0	1	2	3	4	
YES	N	1	3	3	9	4	0.022*
	%	3.4	11.1	12.5	34.6	21.1	
NO	N	28	24	21	17	15	
	%	96.6	88.9	87.5	65.4	78.9	

TABLE 13: ASSOCIATION OF MINOR AMPUTATION WITH DUSS SCORE

MINOR AMPUTATION		DUSS SCORE					P VALUE
		0	1	2	3	4	
YES	N	1	2	3	7	8	0.002*
	%	3.4	7.4	12.5	26.9	42.1	
NO	N	28	25	21	19	11	
	%	96.6	92.6	87.5	73.1	57.9	

TABLE 14: ASSOCIATION OF MAJOR AMPUTATION WITH DUSS SCORE

MAJOR AMPUTATION		DUSS SCORE					P VALUE
		0	1	2	3	4	
YES	N	0	0	3	5	7	0.00001*
	%	0.0	0.0	12.5	19.2	36.8	
NO	N	29	27	21	21	12	
	%	100.0	100.0	87.5	80.8	63.2	

IV. Discussion

Total 125 subjects were included in the study. Among these 125, majority i.e., 48 (38.4%) belonged to 61-70 years age group, followed by 44 (35.2%) who belonged to 51-60 years age group, 33 (26.4%) belonged to 41-50 years age group. In a study by Shashikala et al.⁶ 51-70 years age group was predominant which was almost similar to this study. Mean age in the study was 56.55 ± 8.431 years similar to a study by Menezes et al.⁷ in which it was 57.88 ± 13.56 years and study by Lokesh et al.⁸ in which it was 53 ± 14 years.

Among 125 subjects, majority i.e., 91 (72.8%) were males and 34 (27.2%) were females. In a study by Menezes et al.⁷ male predominance was 83.5% which was similar to this study. In a study by Shashikala et al.⁶ males were most commonly affected by diabetic foot (55%) similar to this study.

In study done by Harindranath H. R et al.⁹ 61.5% were male and 38.5% were female, with a mean age of presentation being 62 years. In Mohit Sharma et al., 68% were Male and mean age in the study was 70 years. In Kummarkandath SA et al.¹⁰ 51-60 years age group and males were predominant and mean age group was 54.6 ± 12.4 years. The findings of these previous studies were in accordance with the present study.

Among 69 (55.2%) primary healing was seen and among 56 (44.8%) primary healing was not seen. In a study by Kumar et al.¹¹ primary healing was seen in 28% of the subjects with diabetic foot which was less compared to this study. In a study by Shashikala et al.⁶ 25% ulcers healed by primary intention which was less compared to this study.

Among 125 subjects, 20 (16%) underwent STSG and 105 (84%) did not undergo STSG. In a study by Kumar et al.¹¹ STSG was done in 18% of the subjects with diabetic foot which was similar to this study. In a study by Shashikala et al.⁶ 25% ulcers healed by split skin graft which was more compared to this study.

Among 125 subjects, 21 (16.8%) underwent minor amputation. Among 125 subjects, 15 (12%) underwent major amputation. In a study by Shashikala et al.¹¹ 26% and 25% underwent minor and major amputations respectively which was more compared to this study. In a study by Kumar et al.¹¹ amputation was done in 54% of the subjects with diabetic foot which was more compared to this study (28.8%). In a study by Lokesh et al.⁸ 30.67% and 20% underwent minor and major amputations respectively which was more compared to this study.

Among subjects who had primary healing, mean DUSS score was 0.97 ± 0.954 which was significantly higher than mean DUSS score of those in whom primary healing was not seen (2.89 ± 1.090). Association of primary healing with DUSS score was significant ($P < 0.05$).

Among 125 subjects, among subjects who underwent STSG mean DUSS score was 2.60 ± 1.142 which was significantly higher than the DUSS score of those subjects who did not undergo STSG (1.69 ± 1.396). Association of STSG with DUSS score was significant ($P < 0.05$).

Among 125 subjects who underwent minor amputation, mean DUSS score was 2.90 ± 1.179 which was significantly higher than the DUSS score of those subjects in whom minor amputation was not done (1.62 ± 1.339). Association of minor amputation with DUSS score was significant ($P < 0.05$).

Among 125 subjects who underwent major amputation, mean DUSS score was 2.90 ± 1.179 which was significantly higher than the DUSS score of those subjects in whom major amputation was not done (1.64 ± 1.346). Association of major amputation with DUSS score was significant ($P < 0.05$).

In this study, among 125 subjects, on DUSS score 29 (23.2%) scored 0, 27 (21.6%) scored 1, 24 (19.2%) scored 2, 26 (20.8%) scored 3, 19 (15.2%) scored 4. In a study by Lokesh et al.⁸ 10.7% scored 0, 18.7% scored 1, 24% scored 2, 26.7% scored 3 and 20% scored 4 which was consistent with the present study. In a

study by Kumar ST et al.¹² none scored 0, 15.9% scored 1, 66.6% scored 2, 71.42% scored 3 and 42.85% scored 4.

Majority of the subjects with primary healing, i.e., 27 (93.1%) of them scored 0 on DUSS score, followed by 22 (81.5%) scored 1, 15 (62.5%) scored 2, 5 (19.2%) scored 3, and none scored 4. In a study by Kumar et al.¹¹ 100% score 0, 75% scored 1, 46.15% scored 2, 20% scored 3 and none scored 4, these findings were consistent with the present study. In a study by Menezes et al.⁷ 22.2% with primary healing scored 0, 2.4% scored 1, 5.7% scored 2, which was less compared to this study and none scored 3 and 4 which was similar to this study.

Majority without primary healing, i.e., 19 (100%) showed score 4, 21 (80.8%) scored 3, 9 (37.5%) scored 2, 5 (18.5%) scored 2, 2 (6.9%) scored 0 on DUSS score. There was a decreasing trend in the score among subjects with primary healing and increasing trend in the score among those without primary healing similar to a study by Menezes et al.⁷ Significant association was observed between primary healing and DUSS score ($P < 0.05$) similar to a study by Kumar et al.¹¹ and Menezes et al.⁷

Majority of the subjects who underwent STSG, i.e., 9 (34.6%) of them scored 3 on DUSS score, followed by 4 (21.1%) scored 4, 3 (12.5%) scored 2, 3 (11.1%) scored 1, 1 (3.4%) scored 0. In a study by Kumar et al.¹¹ 16.67% scored, 10% scored 3, 38.6% scored 2 and none scored 0 and 1 which was almost similar to this study. In a study by Menezes et al.⁷ majority with STSG, i.e., 34% and 20% scored 2 and 1, 4.5% scored 3 and none scored 0 and 4 which was almost similar to this study.

Majority of those who had not undergone STSG, i.e., 28 (96.6%) showed score 0, 24 (88.9%) scored 1, 21 (87.5%) scored 2, 17 (65.4%) scored 3, 15 (78.9%) scored 4 on DUSS score. There was an increasing trend in the score among subjects with STSG and decreasing trend in the score among those without STSG similar to a study by Menezes et al. [3] Significant association was observed between STSG and DUSS score ($P < 0.05$) similar to a study by Kumar et al.¹¹ and Menezes et al.⁷

Majority of the subjects who underwent minor amputation i.e., 8 (42.2%) of them scored 4 on DUSS score, followed by 7 (26.9%) scored 3, 3 (12.5%) scored 2, 2 (7.4%) scored 1, 1 (3.4%) scored 0. In a study by Menezes et al.⁷ majority with minor amputation, 43.2% scored 3, 28.3% scored 2, 30.6% scored 1, 11.9% scored 0 which was different from this study.

Majority of those who had not undergone minor amputation, i.e., 28 (96.6%) showed score 0, 25 (92.6%) scored 1, 21 (87.5%) scored 2, 19 (73.1%) scored 3, 11 (57.9%) scored 4 on DUSS score. There was an increasing trend in the score among subjects with minor amputation and decreasing trend in the score among those without minor amputation similar to a study by Menezes et al.⁷ Significant association was observed between minor amputation and DUSS score ($P < 0.05$) similar to a study by Kumar et al.¹¹ Lokesh et al.⁸ and Menezes et al.⁷

Majority of the subjects who underwent major amputation i.e., 7 (36.8%) of them scored 4 on DUSS score, followed by 5 (19.2%) scored 3, 3 (12.5%) scored 2, none scored 1 and 0. In a study by Kumar et al.¹¹ 83.33% scored 4, 70% scored 3, 15.39% scored 2, 25% scored 1 and none scored 0 which was almost similar to this study.

Majority of those who had not undergone major amputation, i.e., 29 (100.0%) showed score 0, 27 (100.0%) scored 1, 21 (87.5%) scored 2, 21 (87.5%) scored 3, 12 (63.2%) scored 4 on DUSS score. This was similar to a study by Menezes et al.⁷ in which majority scored 4 and 3 on DUSS score. There was an increasing trend in the score among subjects with major amputation and decreasing trend in the score among those without major amputation similar to a study by Menezes et al.⁷ Significant association was observed between major amputation and DUSS score ($P < 0.05$) similar to a study by Kumar et al.¹¹ Lokesh et al.⁸ and Menezes et al.⁷

V. Conclusion

This study was conducted to assess the role of DUS SCORE in predicting the probability of healing of Diabetic foot ulcer either by primary healing or STSG or by amputation. In this study the most common age group presenting with diabetic foot was 51-70 years and males were commonly affected by diabetic foot ulcer compared to females. It was observed that most of the subjects scored 0 and 1 in the study. Majority with score 0 and 1 had primary healing of ulcers, majority with score 2 and 3 underwent STSG and minor amputations, majority with score 4 underwent major amputations. Mean DUSS score was significantly higher in those with STSG, minor and major amputations compared to their counterparts whereas it was significantly lower among those with primary healing compared to those with other modes of healing. DUSS score showed significant association with primary healing, STSG, minor and major amputation. Hence in this study, DUSS scoring system served as an easy diagnostic tool for predicting probability of healing or amputation by combining four clinically assessable wound based parameters. We conclude that DUSS score is very simple, rapid, easy scoring system which enables categorization of diabetic foot ulcers based on the severity and thus provides a streamlined approach in clinical setting without need of any advanced investigative tool, but it does not alter the procedure of wound management.

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