MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2024.6.120.123

OPEN ACCESS

Key Words
Diabetic ulcer severity score (DUSS), predicting outcome, diabetic foot ulcers

Corresponding Author
Vikram Nagathan,
Department of General Surgery, S Nijalingappa Medical College and Hospital, Bagalkot, Karnataka, India

Author Designation
[1-3]Assistant Professor

Received: 15 March 2024
Accepted: 14 April 2024
Published: 16 April 2024

Citation: Prashant Yadahalli, Ramesh Singaraddi and Vikram Nagathan, 2024. Role of Diabetic Ulcer Severity Score (DUSS) in Predicting Outcome in Diabetic Foot Ulcers. Res. J. Med. Sci., 18: 120-123, doi: 10.59218/makrjms.2024.6.120.123

Role of Diabetic Ulcer Severity Score (DUSS) in Predicting Outcome in Diabetic Foot Ulcers

[1]Prashant Yadahalli, [2]Ramesh Singaraddi and [3]Vikram Nagathan

[1]Department of General Surgery, SDM College of Medical Sciences and Hospital, Dharwad, Karnataka, India
[2,3]Department of General Surgery, S Nijalingappa Medical College and Hospital, Bagalkot, Karnataka, India

ABSTRACT
DUSS (Diabetic Ulcer Severity Score) is one of the latest wound based system of classification which needs to be validated. This diabetic ulcer severity score (DUSS) designed by Becker in 2006, defines four clinical parameters, namely palpable pedal pulses, probing to bone, ulcer location and presence of multiple ulcerations. It is a simple and easily reproducible scoring system. A total of 82 diabetic patients with diabetic foot ulcers irrespective of the duration, attending surgical outpatient clinic or admitted to the hospital were studied based on the inclusion and exclusion criteria mentioned previously. The baseline demographic data which includes age, sex, occupation, educational qualifications, habits (smoking/consumption of alcohol) and socioeconomic status were recorded. At the time of follow up after 6 months, in all the patients with DUSS score 0 ulcers were healed completely. Among patients with DUSS 1, 87.2% of ulcers were healed completely where as 12.3% of ulcers were not healed. Among patients with DUSS score 2, 57.1% of ulcers were healed completely where as 42.9% of ulcers were not healed. Among patients with DUSS score 3, 11.1% of ulcers were healed completely where as 44.4% of ulcers were not healed and 44.4% of ulcers required amputation.

INTRODUCTION

The diabetic foot is defined as an infection, ulceration or destruction of deep tissues of the foot, associated with neuropathy and/or Peripheral artery disease in the lower extremity in diabetic patients[1]. The incidence of foot ulcers in patients with diabetes is around 2% per year[2]. A number of foot ulcer classification systems for example, the Wagner system and the University of Texas (UT) systems have been devised in an attempt to categorize ulcers more effectively and thereby, allow effective comparison of the outcome of routine management in different centres and treatment strategies. These systems are variously based on the site of ulcer, its depth, presence/absence of neuropathy, infection and peripheral arterial disease and have been used to compare the outcomes. DUSS (Diabetic Ulcer Severity Score)[3] is one of the latest wound based system of classification which needs to be validated. This diabetic ulcer severity score (DUSS) designed by Beckert in 2006, defines four clinical parameters, namely palpable pedal pulses, probing to bone, ulcer location and presence of multiple ulcerations. It is a simple and easily reproducible scoring system[4]. Diabetic foot ulcer is commonly seen in surgical outpatient department. The most dreaded outcome of diabetic foot ulcer is amputation of limb. Amputations and other complications of diabetic foot ulcer are still commonly encountered in all the surgical wards. An amputation almost doubles the hospital stay and is associated with significant mortality and morbidity. St Philomena's Hospital Bangalore is tertiary care centre, where we get a good number of Diabetic patients undergoing amputations. This study is an effort to predict the chances of Diabetic foot ulcer that may end in amputations. To validate this scoring system in an Indian population, a prospective study will be conducted at our institute.

MATERIALS AND METHODS

Study Population: Patients with Diabetes Mellitus in the age group 20-80 years.

Study Design: A prospective, observational study.

Sample Size: The main objective of the present study is the validation of DUSS Score and comparing outcomes including healing and amputation rates. Considering that the amputation rate at a DUSS score of 4 was 94.3% 10 and by taking 5% absolute precision, with 95% Confidence limits, sample size was calculated using the formula.

Sample Size: $\frac{Z_{(1-\alpha)}^{2} * p * q}{L^{2}}$

α is the level of significance.
Z is the Standard Normal Variate for 95% of Confidence Interval.
p = 94.3%
q = 100-p
L = absolute Precision or Maximum Allowable Error = 5%.
Accordingly, sample size calculated was 82 and hence, 82 study subjects were considered for this study.

Inclusion and Exclusion Criteria:

Inclusion Criteria:

- **Age Limit:** 20-80 years
- All subjects suffering from diabetes mellitus (as per WHO criteria) with foot ulcers
- Symptoms of Diabetes plus random blood sugars >200 mg/dl or
- Fasting blood sugars >126 mg/dl or
- Two hour plasma glucose levels >200 mg/dl
- All diabetic foot ulcers irrespective of its duration
- Patients willing to participate in the study

Exclusion Criteria:

- Venous stasis ulcers with Diabetes mellitus
- Non diabetic neuropathic ulcers
- Ulcers above the ankle
- All non-diabetics with foot ulcers
- Patients not giving consent to participate in the study
- Patients with an immun. compromised state

Data Collection: A total of 82 diabetic patients with diabetic foot ulcers irrespective of the duration, attending surgical outpatient clinic or admitted to the hospital were studied based on the inclusion and exclusion criteria mentioned previously. The baseline demographic data which includes age, sex, occupation, educational qualifications, habits (smoking/consumption of alcohol) and socioeconomic status were recorded. Duration of diabetes and treatment history of management of diabetes were recorded. Ulcers were scored by the below mentioned variables. Diabetic ulcer severity score (DUSS) were calculated by adding these separate scored variables to a theoretical maximum of 4.

RESULTS AND DISCUSSIONS

In patients with age less than 40 years, 66.7% had DUSS score 1, 33.3% had score 2, none of them had score 0, 3, 4.
In Patients with age group 41-50 years, 42.9% had score 3, 28.6% had score 2, 28.6% had score1 and none had score 0, 4.
In Patients with age group 51-60 years 51.6% had score 1, 25.8% had score 0, 12.9% had score 3, 9.7% had score 2, none had score 4.
In Patients with age group 61-70 years 61.5% had score 1, 19.2% had score 2, 11.5% had score 0, 7. 7% had score 3, none had score 4.

Table 1: Association between age (in Years) and DUSS score (N = 82)

Age (in Years)	DUSS Score			
	3 (n = 9) n (%)	0 (n = 12) n (%)	1 (n = 47) n (%)	2 (n = 14) n (%)
< 40	0 (0.0)	2 (66.7)	1 (33.3)	0 (0.0)
41-50	0 (0.0)	2 (28.6)	2 (28.6)	3 (42.9)
51-60	8 (25.8)	16 (51.6)	3 (9.7)	4 (12.9)
61-70	3 (11.5)	16 (61.5)	5 (19.2)	2 (7.7)
71-80	1 (8.3)	8 (66.7)	3 (25.0)	0 (0.0)
>80	0 (0.0)	3 (100.0)	0 (0.0)	0 (0.0)

Chi-Square Test, p-value = 0.199, Not Significant

Table 2: Association between gender and DUSS score (N = 82)

Gender	DUSS Score			
	0 (n = 12) n (%)	1 (n = 47) n (%)	2 (n = 14) n (%)	3 (n = 9) n (%)
Male	5 (9.4)	32 (60.4)	9 (17.0)	7 (13.2)
Female	7 (24.1)	15 (51.7)	5 (17.2)	2 (6.9)

Chi-Square Test, p-value = 0.205, Not Significant

Table 3: Association Between Ulcer Site and DUSS Score (N = 82)

Ulcer Site	DUSS Score			
	0 (n = 12) n (%)	1 (n = 47) n (%)	2 (n = 14) n (%)	3 (n = 9) n (%)
Toes	9 (36.0)	14 (56.0)	1 (4.0)	1 (4.0)
Foot	3 (5.3)	33 (57.9)	13 (22.8)	8 (14.0)

Chi-Square Test, p-value = 0.001, Significant

Table 4: Association between pulses and DUSS score (N=82)

Pulses	DUSS Score			
	0 (n=12) n (%)	1 (n=47) n (%)	2 (n=14) n (%)	3 (n=9) n (%)
Present	12 (24.5)	33 (67.3)	3 (6.1)	1 (2.0)
Absent	0 (0.0)	14 (42.4)	11 (33.3)	8 (24.2)

Chi-Square Test, p<0.001, Significant

Table 5: Association between treatment and DUSS score (N = 82)

Treatment	DUSS Score			
	0 (n = 12) n (%)	1 (n = 47) n (%)	2 (n = 14) n (%)	3 (n = 9) n (%)
Conservative	0 (0.0)	4 (8.5)	1 (7.1)	0 (0.0)
Debridement	4 (33.3)	27 (57.4)	5 (35.7)	4 (44.4)
Toe disarticulating, Ray Amputation, Amputation Below Ankle	8 (66.7)	16 (34.0)	5 (35.7)	3 (33.3)
Below Knee Amputation	0 (0.0)	0 (0.0)	3 (21.4)	2 (22.2)

Chi-Square Test, p-value = 0.024, Significant

Table 6: Association between follow up and DUSS score (N = 82)

Follow up	DUSS Score			
	0 (n = 12) n (%)	1 (n = 47) n (%)	2 (n = 14) n (%)	3 (n = 9) n (%)
Healing	12 (100.0)	41 (87.2)	8 (57.1)	1 (11.1)
Non Healing	0 (0.0)	6 (12.3)	6 (42.9)	4 (44.4)
Amputation	0 (0.0)	0 (0.0)	0 (0.0)	4 (44.4)

Chi-Square Test, p<0.001, Significant

In Patients with age group 71-80 years 66.7% had score 1, 25% had score 2, 8.3% had score 0, none had score 3, 4.

In patients with age group more than 80years, all had score 1, none had score 0, 2, 3.

Among males 60.4% patients had score 1, 17% had score 2, 13.2% had score 3 and 9.4% had score 0.

Among females, 51.7% had score 1, 24.1% had score 0, 17.2% had score 2 and 6.9% had score 3, none had score 4. Among toe ulcers, 56% had score 1, 36% had score 0, 4% had score 2 and 4% had score 3.

Among foot ulcers 57.9% had score 1, 22.8% had score 2, 14% had score 3, 5.3% had score 0.

In those patients with palpable peripheral pulse, 67.3% patients had score 1, 24.5% had score 0,6.1% had score 2 and 2% had score 3.

In those patients with non-palpable peripheral pulse, 42.4% patients had score 1, 33.3% had score 2, 24.2%had score 3 and none had score 0.

Among patients with DUSS score 0, 66.7% have undergone toe disarticulation, Ray amputation, amputation below ankle where as 33.3% have undergone debridement.

Among patients with DUSS score 1, 57.4% have undergone debridement, 34% have undergone toe disarticulation, Ray amputation, amputation below ankle where as 8.5% underwent conservative management.

Among patients with DUSS score 2, 35.7% have undergone debridement, 35.7% have undergone toe disarticulation, Ray amputation, amputation below ankle, 21.4% underwent below knee amputation and 7.1% underwent conservative management.

Among patients with DUSS score 3, 44.4% have undergone debridement, 33.3% have undergone toe disarticulation, Ray amputation, amputation below ankle where as 22.2% underwent below knee amputation.

At the time of follow up after 6 months, in all the patients with DUSS score 0 ulcers were healed completely. Among patients with DUSS 1, 87.2% of ulcers were healed completely where as 12.3% of ulcers were not healed. Among patients with DUSS score 2, 57.1% of ulcers were healed completely where as 42.9% of ulcers were not healed. Among patients with DUSS score 3, 11.1% of ulcers were healed completely where as 44.4% of ulcers were not healed and 44.4% of ulcers required amputation. Diabetic foot ulcer is a common problem encountered in the surgical OPD. It's necessary to assess the wound for predicting outcome. In our study, most of the patients were in the age group 51-60 years (37.8%) followed by 61-70 (31.7%) years. Out of 82 patients 72 were elder than 50 years (87.8%). Youngest patient was 39 year old and the eldest was 85 year old. In a study by Shashikala C.K. Vedavathi, Nandini and Satish Kagwad, the most commonly affected age group was 41-60 Years which is comparable to our study[5]. A clear gender based distinction was observed among the participants, with 64.6% of them being males. In a study by Shashikala C.K. Vedavathi, Nandini and Satish Kagwad males were most commonly affected accounting to 68% which is comparable to our study[5]. Majority of patients had DUSS score 1 (57.3%), followed by score 2 (17.1%), score 0 (14.6%) and score 3 (11%). None of the patient had score 4. In a study by Shiva Kumar T., Srinivas

Arava, Pavan B. M., Guru Kiran C. S., Chandan G. B., Naveen Kumar M. most common DUSS among study population was 1 followed by 2, which is comparable to our study[6]. In our study on Kaplan Meier analysis the probability of healing with score 0 was 100%, 87.2% with score 1, 57.1with score 2, 11.1% with score 3. In our study there was 100% probability of healing for score 0, decreasing to 11.1% with score 3. Peripheral sensory neuropathy is the major risk factor for diabetic foot ulceration. The patient history and physical examination utilizing the 5.07 Semmes-Weinstein monofilament (10-g) wire are sufficient to identify individuals at risk for ulceration. Vibration perception threshold assessment with the biothesiometer is also useful in identifying patients at high risk for ulceration[7]. High plantar foot pressure is a significant risk factor for ulceration. Measurement of high plantar foot pressure is possible utilizing a variety of modalities. Several computerized systems can provide quantitative measurement of plantar foot pressure. While these measurements may be important in identifying areas of the foot at risk for ulceration and possibly in evaluating orthotic adjustments, they are primarily used in diabetic foot research. The Harris mat, while not as sophisticated, can provide a qualitative measurement of plantar foot pressures and can identify potentially vulnerable areas for ulceration. A newer non computerized device (PressureStat, Foot Logic, New York City, NY), which is similar to the Harris mat and uses pressure-sensitive contact sheets that provide a semi-quantitative estimation of pressure distribution under the foot[8].

CONCLUSION

DUSS scoring system provides an easy diagnostic tool for predicting probability of healing or amputation by combining four clinically assessable wound based parameters. Study groups can be stratified depending on severity of ulcers and thus can help provide a simple, streamlined approach in a clinical setting without need of any advanced investigative tools. However, the DU SS scoring system did not corroborate well with the type of treatment carried out for the ulcer and hence did not alter the management of the ulcer.

REFERENCES

1. Bennett, P.H. and W.C. Knowler, 2010. Definition, diagnosis and classification of diabetes mellitus and glucose homeostasis. In: Joslin's Diabetes Mellitus,, Kahn, C.R., G.L. King, A.C. Moses, G.C. Weir, A.M. Jacobson and Smith, R.J., (Eds.)., Walter Kluwer Pvt. Ltd., New Delhi, India, pp: 331-339.
2. IWGDF., 2005. Diabetes and foot care-put feet first prevent amputations. International Diabetes Federation and International working Group on The Diabetic Foot, Denmark, Europe.
3. Hirst, M., 2013. Diabetes in 2013. The new figures. Diabetes Res. Clin. Pract., Vol. 102 .10.1016/j.diabres.2013.11.017.
4. Schaper, N.C., J.J. Van Netten, J. Apelqvist, B.A. Lipsky, K. Bakker and IWGDF, 2016. Prevention and management of foot problems in diabetes: A summary guidance for daily practice 2015, based on the IWGDF guidance documents. Diabetes Metab Res. Rev., 32: 7-15.
5. Shashikala, C.K., V.K. Nandini and S. Kagwad, 2017. Validation of Diabetic Ulcer Severity score(DUSS). Ann. Int. Med. Den. Res., 3: 27-30.
6. Kumar, S.T., S. Arava, B.M. Pavan, C.S.G. Kiran, G.B. Chandan and M.N. Kumar, 2016. Diabetic ulcer severity score: Clinical validation and outcome. Int. Surg. J., 3: 1606-1610.
7. Beckert, S., 2006. A new wound-based severity score for diabetic foot ulcers: A prospective analysis of 1,000 patients. Diabetes Care, 29: 988-992.
8. Kummankandath, S., S. Mohammed, A. Karatparambil, M. Nadakkavil and R. Pappala, 2016. Validation of diabetic ulcer severity score. Int. Surg. J., 3: 1509-1516.