

## Original Research Article

# Study on the effectiveness of clinical scoring in predicting the outcome of diabetic foot

Sherine E. K.\*, Sasi M. P.

Department of General Surgery, Government Medical College, Kozhikode, Kerala, India

**Received:** 02 August 2017

**Revised:** 01 November 2017

**Accepted:** 01 November 2017

**\*Correspondence:**

Dr. Sherine E. K.,

E-mail: [sherinesajeeth@yahoo.com](mailto:sherinesajeeth@yahoo.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** Diabetic patients will develop diabetic foot ulcerations of which 14-20% will go on to amputation. By this study we aimed to investigate the effectiveness of clinical scoring system predicting the outcome of diabetic foot and also to know whether neuropathy or vasculopathy predominated in these patients.

**Methods:** Patients with Type 2 diabetic ulcers are selected, and the ulcer was graded according to Wagner's grading. The vasculopathy and Neuropathy were assessed by Doppler study and monofilament tests respectively. The patients were grouped based on the grade of ulcer and presence or absence of neuropathy and vasculopathy. These patients were followed up for a duration of 1 year.

**Results:** The patients belonging up to group 6 had better outcome (healing) on conservative management and those in group 8 and group 9 had a bad outcome (amputations). 66% of patients had neuropathy predominance.

**Conclusions:** Even though clinical scoring system could predict the outcome, statistically it is not found to be significant. Neuropathy was the more predominant factor among the patients with diabetic foot.

**Keywords:** Amputations, Diabetic foot

### INTRODUCTION

Diabetes is the single most common cause of non-traumatic foot amputation. Diabetic foot ulcers will complicate the disease in more than 15% of these people during their lifetimes.<sup>1</sup>

In prospective cohort studies conducted among those with diabetes, history of foot ulcer increased the risk of subsequent amputation by two-to over three-fold.<sup>2</sup>

Up to 15% of diabetic patients will develop diabetic foot ulcerations of which 14-20% will go on to amputation. Lower extremity amputations can also be taken as a material to assess the successful management of diabetic patients.

Although the pathway to ulceration and amputation do not differ throughout the world, the prevalence of ulcers and amputations varies markedly between different countries.<sup>3-5</sup>

In India, the prevalence of diabetic foot ulcers in clinic population was estimated to be 3-6%.<sup>6</sup> Socio-cultural practices such as barefoot walking and certain religious practices, as use of improper foot wear contributes towards increase in the prevalence of foot complications in India.<sup>7</sup>

#### *Pathophysiology of foot ulcer*

The breakdown of the diabetic foot traditionally has been considered to result from an interaction of vasculopathy,

peripheral neuropathy, and some form of trauma. More recently, other contributory causes such as psychosocial factors and abnormalities of pressures and loads under the foot has been implicated. A retrospective study to evaluate the clinical profile of diabetic foot infection showed that the recurrence of foot infection was common among South Indian Type 2 diabetic patients.

### **Diabetic neuropathy**

This is the commonest of the long-term complication of DM. Most common among the neuropathies are chronic sensorimotor distal symmetric polyneuropathy and autonomic neuropathies. Poor balance and instability are also being recognized as troublesome symptoms of peripheral neuropathy, presumably secondary to proprioceptive loss.<sup>8</sup>

### **Diabetic vasculopathy**

There is no occlusive arteriolar disease in diabetics and the vasculopathy can be conveniently describe in terms of macrovascular and microvascular disease.<sup>9</sup>

### **Diabetic macrovascular disease**

This is in the form of atherosclerosis, but there are certain factors which show distinct differences from general population. Atherosclerosis is more prevalent in diabetes than in the general population and it preferentially affect the tibial and peroneal vessels. In non-diabetics often, the vessels above the knee are affected.

### **Diabetic microvascular disease**

There are structural abnormalities of the capillary basement membrane in diabetics. Basement membrane is thickened and shows increased capillary permeability due to glycosylation. Paradoxically, there is hyper perfusion at tissue level, but this is translated to hypoperfusion due to loss of autonomic vascular responses and tissue hypermetabolism due to increased warmth at tissue level.

### **Other risk factors for foot ulceration**

- Age and duration of diabetes: Risk of ulcer and amputation increase 2-4-fold with both age and duration of diabetes,<sup>9</sup>
- Sex: Male sex has been associated with a 1.6-fold increased risk of ulcers and even higher risk of amputation in most studies of people with type 2 diabetes,<sup>9,10</sup>
- Previous foot ulceration: History of ulcer increased the risk of new ulceration 13-fold. Similarly, history of prior ulceration is associated with a two to tenfold higher risk of amputation,<sup>9</sup>
- Deformity: Any deformity occurring in a diabetic foot with other risk factors such as prominence of metatarsal heads, clawing of the toes, charcot prominences / hallux valgus increases ulcer risk.

### **Classification of foot ulcer**

Most widely used classification of diabetic foot ulcer is what is known as Meggit and Wagner classification,<sup>11</sup>

- Grade 0: Foot symptoms without ulcers, i.e., foot at risk,
- Grade 1: Superficial ulcers,
- Grade 2: Deep ulcers, i.e., reaching muscles, tendons and abscesses,
- Grade 3: Osteomyelitis,
- Grade 4: Toe / forefoot gangrene,
- Grade 5: Whole foot gangrene.

### **Grade 0: Foot at risk**

Foot ulceration develops as a result of combination of factors already existing in their foot like peripheral neuropathy peripheral vascular disease, bony deformities, callosities etc. Such people are likely to develop foot ulcers at any time. Proper self-care is required to prevent ulcers.

### **Grade 1: Superficial ulcers**

Here mainly infection is up to the level of subcutaneous tissue level. They are usually managed conservatively and have a good prognosis.

### **Grade 2: Deep ulcers**

The infection has spread to deeper planes in this group. They require an adequate surgical drainage and antibiotic treatment to prevent systemic spread.

### **Grade 3: Osteomyelitis**

Infection has spread to bones here. Most of them may have a charcot's deformity.

### **Grade 4: Forefoot gangrene**

Both isolated gangrene of digits and up to forefoot come under this category. Most of the cases under the category end in amputation at various levels.

### **Grade 5: Whole foot gangrene**

Vasculopathy has a major role here, as well as coexisting co-morbidities like nephropathy, atherosclerosis etc.; higher level amputations are required in this group.

## **METHODS**

Study design: Cross sectional study, Study period: 2010-2011, Study setting: Diabetic Clinic and Department of Surgery, Govt. Medical College, Kozhikode, Sample size: 200 cases during the period of study.

**Methods**

Patients with Type 2 diabetes are selected. They should also have grade 2 or grade 3-foot ulcer. Foot ulcer is graded according to Wagner’s grading. Pus culture and sensitivity of the ulcers is done to assess coexistent infection. X-ray of the affected limb is done to rule out osteomyelitis.

Vascular involvement was assessed clinically by palpation of peripheral pulses. It is also assessed by Doppler study of peripheral arterial system.

Neuropathy was assessed clinically by checking sensations and also by monofilament tests.

The site of ulcer, cause of ulcerations, duration of ulcer all are looked into assess probable cause (neuropathic ulcer/ vascular compromise) of the ulcer. Duration of diabetes is also looked into note the period of developing foot complications after detection of diabetes. All above factors are noted, and ulcers are graded into the following groups

- Group 1: Grade 0 Wagner ulcer with no sensory or vascular involvement,
- Group 2: Grade 0-1 Wagner ulcer with no vascular compromise and no infection. There is minimal sensory impairment,
- Group 3: Grade 0,1 ulcer with sensory impairment and super added infection,
- Group 4: Grade 0,1,2 ulcer with sensory impairment and vascular involvement. No infection,
- Group 5: Grade 0,1,2 ulcer with sensory and vascular involvement and super added infection,

- Group 6: Grade 0,1,2,3 ulcer with sensory impairment only,
- Group 7: Grade 0,1,2,3 ulcer with vascular involvement only,
- Group 8: Grade 4 ulcers,
- Group 9: Grade 5 ulcers.

**Inclusion criteria**

- Type 2 DM patients admitted in Calicut Medical College,
- Type 2 DM patients attending the OPD section of Surgery and Diabetic Clinic at Calicut Medical College.

**Exclusion criteria**

Type 1 DM patients

**RESULTS**

The chief observation was that the patients belonging upto group 6 had better outcome(healing) on conservative management. There was no patients enrolled in group 7. Those patients in group 8 and group 9 had a bad outcome (amputations) (Table 1).

It was also noticed that majority of patients presented with grade 2 ulcers and superadded infection (group 5). We had least number patients with grade 1 ulcer and superadded infection (group 3). Grade 2 ulcers were the main reason for the patients to consult the physician. Presence of gangrene was the second main reason for attending to the hospital. Total number of male patients were more in our study.

**Table 1: Outcome of diabetic foot according the respective groups.**

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9
No. of cases	8	8	4	12	64	24	0	52	28
RAY Amputation	0	0	0	0	4	4	0	40	0
MT Amputation	0	0	0	0	0	0	0	4	12
BK amputation	0	0	0	0	4	0	0	4	4
AK amputation	0	0	0	0	0	0	0	4	12
Healed	8	8	4	12	56	20	0	0	0
Death	0	0	0	0	0	0	0	0	1

As per this study we noticed that pure vasculopathy alone was not present in any of the group. There was combination of both neuropathy and vasculopathy in all the group out of which the neuropathy part predominated (Table 2 and 3).

There have been various clinical classifications and gradingsystems for diabeticfoot. None of them were able

to cover all the aspects of diabetic foot. Here we had tried a new system by incorporating few earlier grading system and few clinical parameters. This new system also was found to have its merits and demerits.

We were able to predict the outcome of the diabetic foot on the first visit itself. We were able to predict which all category was likely to go for amputation.

**Table 2: Dominance of neuropathy and vasculopathy in each group.**

Group	Neuropathy alone	Vasculopathy alone	Neuropathy+ vasculopathy
1	4	0	4
2	4	0	4
3	4	0	0
4	8	0	4
5	44	0	20
6	4	0	20
7	0	0	0
8	0	0	52
9	0	0	28

**Table 3: Dominance of neuropathy and vasculopathy in percentage.**

Neurovascular assessment	Number	%
Neuropathy alone	132	66
Vasculopathy alone	0	0
Neuropathy + vasculopathy	68	34

As the healing was 100% in group one to four and the amputation was 100% in group eight and nine they are not included in calculating the p value. Group 7 was also not included since no cases were in that group. When the p value was assessed with the remaining groups it was not found to be significant. Hence though we can clinically predict the outcome by grouping the cases into various groups, statistically it is not found to be significant (Table 4).

**Table 4: Statistical significance of the study in group 5 and group 6.**

Group	Healed	Amputation
Group 5	56	8
Group 6	20	4
		P value <0.05

**DISCUSSION**

Cases in group I to group IV had a better healing rate. None of them underwent amputation. All of them were healed. No deaths were observed in these groups.

Cases in group V had a variable distribution from healed ulcer to below knee amputation. The number of healed ulcers are 56 (18.25%) and only 4 cases underwent ray amputation (6.25%), but 4 cases underwent below knee amputation (6.25%). Of these 44 cases had only neuropathy while 20 cases had both neurovascular involvement. Cases in group VI either had a ray amputation or were healed with secondary intention. Healing was observed in 20 (83%) cases and 4 (17%) cases had ray amputation of the digit out of the 24 cases in this group. Neuropathic foot was only 4 (17%) while neurovascular cases were 20 (83%) in number.

Cases in group VIII and IX were subjected to amputation at various levels. None of the cases had a healing ulcer. All the cases had a gangrene at various levels. Ray amputation were done in 40 cases (77%) of group 8, while midtarsal, BK, AK amputations were 4 (8%) each. Group 9 had 12 (43%) mild tarsal amputations, 12 (43%) AK amputations, and 4 (14%) BK amputations. Out of the 80 cases (group 8 + group 9) all had both vascular and neuropathic foot. Coexisting infection was also present in all the cases.

Death: There was only a single death out of the total cases. Death was due to myocardial infarction in a case of group 9.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

**REFERENCES**

1. Palumbo PJ, Melton LJ III. Peripheral Vascular Disease and Diabetes. In: National Diabetes Data Group (US), National Institute of Diabetes and Digestive and Kidney Diseases (United States), eds. Diabetes in America. Bethesda MD; National Institute of Health, National Institute of Diabetes and Digestive and Kidney Diseases;1995:401-408.
2. Adler AI, Boyko EJ, Ahroni JH, Smith DG. Lower-extremity amputation in diabetes. The independent effects of peripheral vascular disease, sensory neuropathy, and foot ulcers. Diabetes Care. 1999(7):1029-1035.
3. International working group on the diabetic foot. International consensus on the diabetic foot. Apelqvist J, Bakker K, Van Houtum WH, Babuurs-Franssen MH, Schaper NC eds. Maastricht, Schaper NC: 1999.
4. Jeffcoate WJ, van Houtum WH. Amputation as a marker of the quality of foot care in diabetes. Diabetologia. 2004;47(12):2051-8.
5. Ramachandran A. Specific problems of the diabetic foot in developing countries. Diabetes Metab Res Rev. 2004;20:Suppl 1:S19-22.
6. Pzendsy SP. Epidemiological aspects of diabetic foot. Int J Diabetes Dev countries. 1994;14: 7-38.
7. Vijay V, Snehalatha C, Ramachandran A. Sociocultural practices that may affect the development of the diabetic foot. IDF Bull. 1997;42:10-12.
8. Katoulis EC, Ebdon-Parry M, Hollis S, Harrison AJ, Vileikyte L, Kulkarni J, et al. Postural instability in diabetic neuropathic patients at risk of foot ulceration. Diab Med. 1997;14(4):296-300.
9. Mayfield JA, Reiber GE, Sanders LJ, Janisse D, Pogach LM. Preventive foot care in people with diabetes. Diabetes care. 1998;21(12):2161-77.
10. Abbott CA, Carrington AL, Ashe H, Bath S, Every LC, Griffiths J et al. The Northwest Diabetes Foot

Care study: incidence of and risk factors for new diabetic foot ulcers in a community based cohort. *Diabetes Med.* 2002.

11. Bal A, Das AK, Pendsey S, Suresh KR, Vishwanathan V, Ambardekar P. Handbook of diabetic foot care. Diabetic Foot Society of India, Bangalore. 2005.

**Cite this article as:** Sherine EK, Sasi MP. Study on the effectiveness of clinical scoring in predicting the outcome of diabetic foot. *Int J Res Med Sci* 2017;5:5273-7.