

Assessing Role of Pedis Scoring in Predicting Complications of Diabetic Foot: An Observational Study

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Abstract

Aim: The aim of the present study was to assess the usefulness of PEDIS scoring in identifying the severity of diabetic foot ulcer and its management.

Methods: This was a hospital based prospective observational study conducted in Department of General Surgery. Patients who came to hospitals with Diabetic foot ulcers below the level of malleolus including both outpatients and inpatients were taken into this study after getting consent. This study was conducted for 1 year. Totally 100 patients were included in the study and followed up for 6 months.

Results: Out of 100, 68 (68%) were males and 32 (32%) were females. White blood cell counts were found to be elevated in 34 (34%) patients. The cut-off value for high WBC was considered to be more than 11,000/mm³. Cut-off value taken for high random blood sugar was 140 mg/dl. About 65 (65%) patients were having abnormally elevated random blood sugar. 10 (10%) patients were found to have osteomyelitis and they were tested positive for probe to bone test. Patients with score of less than 7 managed with debridement showed good results at the end. Patients with score more than 4 with high random blood sugar and elevated white cell count being showed delayed healing.

Conclusion: In our study, PEDIS score helped us in identifying the severity of the diabetic foot ulcer. Patients with higher score needed amputation. Majority of the patients with low score were managed successfully with debridement alone and the outcome was good.

Keywords: Diabetic foot ulcer, PEDIS scoring, Osteomyelitis, Non healing, Amputation.

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Introduction

Diabetic foot and lower limb complications are an important cause of morbidity and mortality among people with diabetes mellitus (DM).^{1,2} People with diabetic foot ulcers (DFU) require more hospital visits and admissions than those without this complication. [3] Disease-related complications such as DFU can negatively impact the patient's quality of life, as well as increase healthcare costs. [1,2] Primary healthcare centers are the patient's first contact with the health system in many countries, and its role in the prevention and treatment of chronic conditions such as DM and its complications is fundamental. Therefore, the task of primary health professionals is crucial for the prevention, early detection, and treatment of diabetic foot complications. Increasing the knowledge and awareness of the risk factors that worsen the prognosis of people with DFU at this

level of the healthcare system (i.e. primary care) is necessary to act in a more focused, resourceful and decisive way. So far, several studies on the prognosis of the diabetic foot and its associated contributing factors have been carried out in hospital settings, in specialized diabetes clinics and multidisciplinary foot centers. [4-7]

One potentially preventable complication of diabetes that is associated with high morbidity and mortality is diabetic foot ulcer (DFU). It is estimated that a person with diabetes has up to 25% chance of developing DFU in his/her lifetime. [8] A recent update suggested that nearly 2 out of every 10 out-patients with diabetes in Nigeria have diabetic foot disease [9] and DFU accounts for nearly a third of diabetes-related hospital admissions. [10] Diabetic foot ulcer is associated

with prolonged hospital stay, substantial economic burden and high mortality. [11,12] Perhaps the most unpleasant potential consequence of DFU besides death is lower extremity amputation (LEA). An initially trivial amount of trauma may often result in chronic ulcers and become the reason for hospital admission thus entails high cost to the patients. [13] The co-existence of neuropathy, peripheral arterial disease (PAD), and poor glycemic control may favor the development of severe infections and/or foot gangrene, which if not treated properly, can lead to lower extremity amputation (LEA) or even death. [14] Therefore, the DFU have a major medical, social, and economic consequences, especially when hospitalization become necessary. [15]

The aim of the present study was to assess the usefulness of PEDIS scoring in identifying the severity of diabetic foot ulcer and its management.

Materials and Methods

This was a hospital based prospective observational study conducted in department of General Surgery, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India. Patients who came to hospitals with Diabetic foot ulcers below the level of malleolus including both outpatients and inpatients were taken into this study after getting consent. This study was conducted for 1 year. Totally 100 patients were included in the study and followed up for 6 months. The primary goal of the study is to find the usefulness of PEDIS classification in diabetic foot ulcer, a study (PEDIS scoring and its role in management of diabetic foot ulcer) suggestive of PEDIS score <7 correctly picking up 87.5% of patients who had healed ulcer. [16]

Statistical Analysis

Shapiro wilk's test was used to assess the normality pattern of the data. If they are normally distributed, they were expressed as Mean \pm SD, otherwise median (interquartile range). Categorical variables were expressed by percentage. ROC curve was drawn to find the best cutoff PEDIS score in the prediction of amputation. Comparison of categorical variables was done by either Chi square test or Fischer's exact test. Comparison of continuous variables if any, was done by independent sample t test, if they were normally distributed. Non-normally distributed continuous variables were done by Mann Whitney U test. Data entry was done in Microsoft Excel 2007. Statistical analysis was done by IBM SPSS statistics for windows version 25.0 (IBM corp, Armonk, Newyork USA). All p values <0.05 were considered as statistically significant.

Inclusion Criteria

Patients with known DM with foot ulcer below the level of malleolus, more than 18 years of age, with past history of amputation of part of the foot/toes, multiple diabetic ulcer in the same foot, with recurrent diabetic foot ulcer were included in the study.

Exclusion Criteria

Patients with diabetes presenting only as soft tissue infections in the foot without any evidence of ulcer, ulcer in the foot following a trauma in a diabetic patient, patients with diabetic foot ulcer presenting with acute limb ischemia were excluded.

PEDIS Scoring

Perfusion: 0-no signs of peripheral arterial disease, 1-signs of peripheral arterial disease, but no critical limb ischemia and 2-critical limb ischemia. Extent: 0-skin intact, 1-<1 cm², 2-1-3 cm², 3-> 3 cm². Depth: 0-skin intact, 1-superficial, 2-fascia, muscle, tendon, 3-bone or joint. Infection: 0-none, 1-surface, 2-abscess, fascitis, and/ or septic arthritis, 3-Systemic inflammatory response syndrome (SIRS). Sensation: 0-sensation intact, 1-loss of sensation. PEDIS score interpretation: low:0-7, high:8-12.

All the patients were briefly explained about the study and were included in the study only after ensuring that they were fulfilling the inclusion and exclusion criteria. All the patients presenting with foot ulcers with diabetes mellitus were taken up for survey and classified according to the PEDIS score after a proper assessment. Perfusion i.e. blood supply to the foot was clinically tested by palpating the peripheral pulses of the foot, most importantly the dorsalis pedis pulsation. Hand held doppler study was carried out in patients with feeble pulsation in the foot. In suspected cases of peripheral vascular disease, ultrasound doppler study was done additionally.

CT peripheral angiogram has been carried out for patients only with the features of limb ischemia. The extent of ulcer was determined with the help of measuring tape. Depth of the ulcer was made out by palpating the base of the wound or by inspection of the wound. We can grade the depth according to tissue that is found over the base like muscle, ligaments, tendon, underlying bone. Along with these features and general hemodynamics of the patient being taken into consideration, severity of the infection like sepsis, systemic inflammatory response syndrome, multiorgan dysfunction syndrome can be identified and graded which helps to intervene promptly. Sensation of the foot ulcer was checked by touching the affected foot with cotton, fingertip and giving pain stimuli. Apart from these scores we also tried to validate the

reliability of probe to bone test in diagnosing osteomyelitis of diabetic foot. If the test was found to be positive in order to justify its reliability, X-ray of the foot was done for these patients. All of them were managed appropriately with conservative and surgical procedures based on the obtained score. Following the procedure, patients were followed-up

for 6 months to find out the healing status of the wound and the approximate time taken by the wound for healing. Both verbal and written informed consent was obtained from the patient before performing procedures.

Results

Table 1: Gender distribution

Gender	N	%
Female	32	32
Male	68	68
Total	100	100

Out of 100, 68 (68%) were males and 32 (32%) were females.

Table 2: White blood cell counts, blood glucose level, Positive probe to bone test and presence of osteomyelitis in DFU patients

WBC	N	%
No	66	66
Yes	34	34
Total	100	100
RBS		
No	35	35
Yes	65	65
Total	100	100
PTB test		
No	88	88
Yes	12	12
Total	100	100
Osteomyelitis		
No	90	90
Yes	10	10
Total	100	100

White blood cell counts were found to be elevated in 34 (34%) patients. The cut-off value for high WBC was considered to be more than 11,000/mm³. Cut-off value taken for high random blood sugar was 140 mg/dl. About 65 (65%) patients were having abnormally elevated random blood sugar. 10 (10%) patients were found to have osteomyelitis and they were tested positive for probe to bone test.

Table 3: The classification of patients based on PEDIS score and their management

Parameters	PEDIS score 0-7	PEDIS score 8-12	Total	P value
Male	40	28	68	-
Female	20	12	32	-
RBS	45	20	65	0.001
WBC	14	20	34	0.000
PTB	3	9	12	0.000
Osteomyelitis	2	8	10	0.000

Patients with score of less than 7 managed with debridement showed good results at the end. Patients with score more than 4 with high random blood sugar and elevated white cell count being showed delayed healing.

Discussion

Diabetes mellitus is a chronic condition characterized by abnormally increased blood glucose level with raised level of insulin and presence of resistance to the secreted insulin. [17] 15-25% of people with diabetes mellitus are

estimated to be at risk to develop foot ulcer in their lifetime. [18] Diabetic foot ulcer is defined as full thickness wound that occurs in the foot just below the level of malleolus. [19] Most commonly affected sites are the pressure points such as plantar aspect of toes, metatarsal heads and heel. It will often progress to non-healing ulcer, infection, dry and wet gangrene, ultimately leading to amputation of the involved parts. With early diagnosis and timely intervention, these complications can be prevented. Foot ulcers are very likely to recur in the

future with an incidence of 50% after 3 years of occurrence of foot ulcer. [20]

Increased glucose can cause hypercoagulability by altering the endothelial function and impairment of fibrinolysis, platelet aggregation. [21] Increased concentration of glucose in the local tissue precipitates development of infection. It also alters the course of wound healing by impairing neovascularization. [22] Trauma to the foot causing deformity of the foot. Loss of elasticity of tendons and ligaments causes flattening of foot by altering the arches of foot leading to development of ulcer. Complications of diabetic foot are non healing ulcer which is defined as any ulcer which is not showing any signs of healing for more than 3 months of duration, ischemia of foot indicates decreased blood supply to the foot, gangrene of foot which is described as macroscopic death of the tissue with blackish discoloration, Charcots neuroarthropathy a destructive syndrome affecting bones and joints in patients who already have neuropathy. Osteomyelitis infection of bone and bone marrow. [23,24]

Out of 100, 68 (68%) were males and 32 (32%) were females. White blood cell counts were found to be elevated in 34 (34%) patients. The cut-off value for high WBC was considered to be more than 11,000/mm³. Cut-off value taken for high random blood sugar was 140 mg/dl. About 65 (65%) patients were having abnormally elevated random blood sugar. 10 (10%) patients were found to have osteomyelitis and they were tested positive for probe to bone test. Patients with score of less than 7 managed with debridement showed good results at the end. Patients with score more than 4 with high random blood sugar and elevated white cell count being showed delayed healing. Ahmad et al, Bijan Iraj et al showed that uncontrolled blood glucose level, abnormally high white blood cell counts can affect the outcome of foot ulcer and also has an impact over the wound healing. [25,26]

We predicted the complications of the diabetic foot based on the PEDIS scoring with factors like uncontrolled blood glucose level, grossly increased white blood cell count, additional co-morbidities and previous history of surgery in the same foot. All of the factors and management of diabetic foot ulcer showed p value of less than 0.05 expect the conservative management. Khalid Al-Rubeaan et al suggested that diabetic foot ulcer patients with poorly controlled blood glucose level and the presence of infection affects the prognosis of the diabetic foot. [27] In our study also, patients with low score, high glucose level and elevated WBC count underwent amputation. Armstrong et al observed recurrence of ulcer in DFU patients and they recommended proper counselling of the patient and selfcare to reduce the recurrence rate. [28] So as our study also showed association

between high score and complications in diabetic foot ulcer. [29]

Conclusion

In our study, PEDIS score helped us in identifying the severity of the diabetic foot ulcer. Patients with higher score needed amputation. Majority of the patients with low score were managed successfully with debridement alone and the outcome was good. Debridement and bone curettage along with long term antibiotic therapy helped in treating DFU patients with early stage of osteomyelitis avoiding the necessity of amputation. From our study we have come to a conclusion that PEDIS scoring helps in predicting complications in diabetic foot ulcer and its management.

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