



MANAGEMENT OF DIABETIC FOOT ULCERS - PLASTIC SURGEON'S PERSPECTIVE

Jiten Kulkarni*

Associate Professor Plastic Surgery. *Corresponding Author

Anuradha J Patil

Associate Professor Plastic Surgery.

Dr Gurmohan Sethi

Resident Plastic Surgery Department MGM.

Dr Prathmesh Mishra

Resident Plastic Surgery Department MGM.

ABSTRACT

Background: The treatment of diabetic foot ulceration is complex with multiple considerations and requires a multidisciplinary approach. **Aims:** Objective of this study was to highlight the role of plastic surgeon in the multidisciplinary approach to treat the diabetic foot ulcers. **Methods:** Retrospective study was conducted in department of Plastic surgery MGM medical college & hospital, Chhatrapati Sambhaji Nagar, Maharashtra over 2 years from Jan 2022 to Jan 2023. 74 patients with diabetic foot ulcers were included. The various modalities of treatment used in the management from topical agents to skin grafts, flaps, fillet procedures which would give a reconstruction horizon available to treat a particular ulcer and rehabilitate the patient at the earliest. The critically ill patients who underwent above knee /below knee amputation as a life saving measure were excluded from the study. Also, patients with Charcot's foot were excluded from this study. **Results:** There were 37 patients in Wagner's Grade I, 23 patients in Grade II, 6 in Grade III, patients in Grade 4. 68% of patients were male (50), 32% were female (24), M:F 2:1. Majority of patients were of 41-50 yrs. age group, 27%. Right foot was involved in 45 patients (61%), left foot was involved in 21 patients (28%) and 11% had bilateral involvement. Most common treatment modality in 37 patients out of 74 patients was conservative with various ointments. 18 patients, (24%) underwent debridement with split thickness skin graft, 3 patients (4%) decompression, 6 toe amputations, 8 underwent fillet of toe and forefoot, 2 underwent distally based sural flap for heel defect. **Conclusion:** Regarding treatment, we propose a multidisciplinary approach prioritizing invasive infection drainage, necrosis debridement, and the prompt start of empirical antibiotic therapy, followed by appropriate reconstruction.

KEYWORDS : ulcers, diabetic foot, amputations

INTRODUCTION:

The worldwide prevalence of Diabetes mellitus which is a chronic, debilitating non-communicable disease affecting multiple organs, including the heart, kidney, eye, and nerves, leading to complications such as heart attack, stroke, blindness, kidney failure, and lower limb amputation, is on rise projected to affect 439 million people by the year 2030 [1-6]. Diabetic foot ulcer (DFU) is a frequent and distressing complication that occurs in approximately 6.3% of patients with DM globally [7]. The high incidence of DFU contribute to reasons for hospitalization and the associated mortality and morbidity of diabetes patients.

Optimal management of diabetic foot ulceration is complex and requires a multidisciplinary approach these may include internal medicine, diabetology, infectious disease, medical microbiology, podiatry, plastic surgery, emergency medicine, nursing, prosthetics/orthotics, and physical therapy.[8]

Various classifications exist for diabetic foot ulcers like Wagner's Classification, University of Texas classification, PEDIS classification etc. Numerous studies have been done on them [9-13].

Wagner classification is most commonly used, assesses ulcer depth and presence of osteomyelitis or gangrene. Objective of this study was to highlight the role of plastic surgeon in the multidisciplinary approach to treat the diabetic foot ulcers.

MATERIAL AND METHODS:

Retrospective study was conducted in department of Plastic surgery MGM medical college & hospital, Chhatrapati Sambhaji Nagar, Maharashtra over 2 years from Jan 2022 to Jan 2023. 74 patients with diabetic foot ulcers were included. The critically ill patients who underwent above knee /below knee amputation as a life saving measure were excluded from the study. Also, patients with Charcot's foot were excluded from this study.

RESULTS:

The 74 patients were evaluated and managed by classifying their disease according to Wagner's classification for diabetic foot. [Figure 1] There were 37 patients in Grade I (Localized, superficial ulcer), 23 patients in Grade II (Deep Ulcer to bone, ligament, or joint), 6 in Grade III (Deep abscess, osteomyelitis), patients in Grade 4 (Gangrene of toes, forefoot).

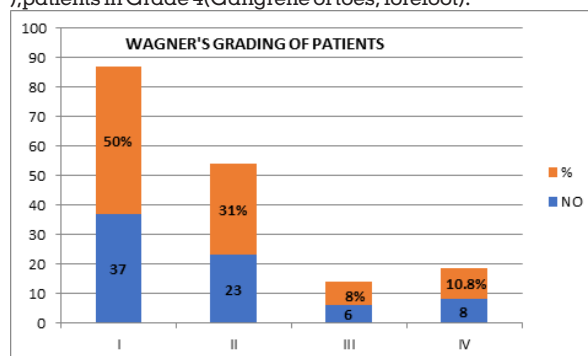


Figure 1 – Wagner's grading of the patients

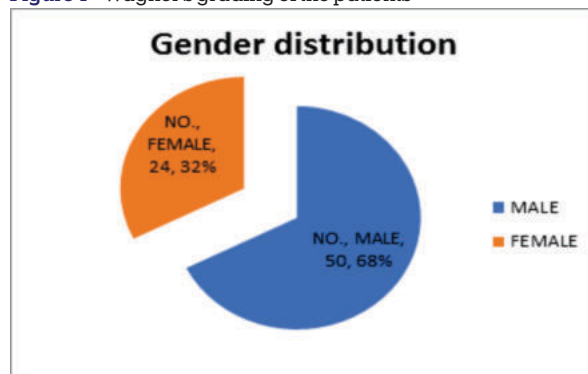


Figure 2 – Gender distribution

Color Doppler and x ray foot was performed in all patients who underwent surgical procedure to evaluate vascular status and bony involvement.

68% of patients were male (50), 32% were female (24), M:F 2:1 [Figure 2].

Majority of patients were of 41-50 yrs age group, 27%. [Figure 3].

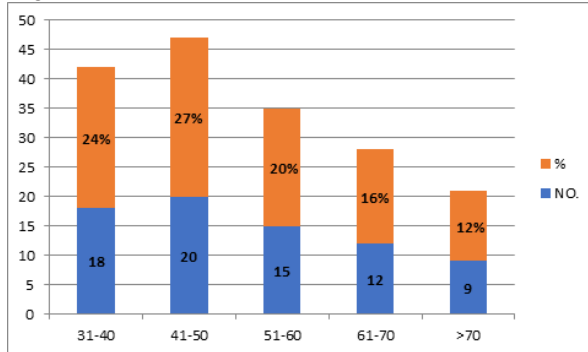


Figure 3- Age wise distribution

Right foot was involved in 45 patients (61%), left foot was involved in 21 patients (28%) and 11% had bilateral involvement [Figure 4].

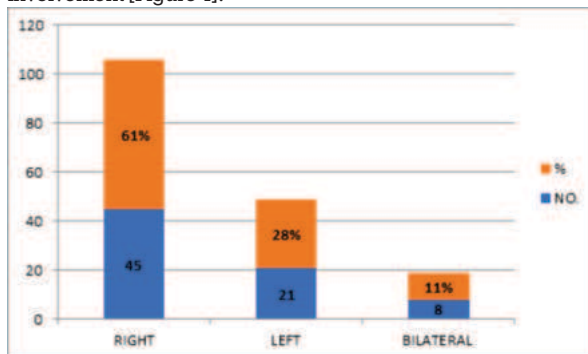


Figure 4- Side Involved

Majority of patients (56%) had diabetes of duration 10-20 years. 11% had diabetes of more than 20 years [Figure 5].

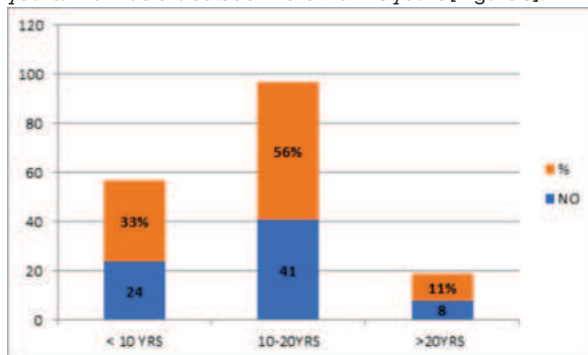


Figure 5- Duration of diabetes

40 patients (54.05%) had associated co morbidities. Hypertension was commonest co morbidity affecting 45%, 33 cases and 16%, 12 cases had ischemic heart disease.

Most common treatment modality of in 37 patients out of 74 patients was conservative with various ointments. 18 patients (24%) underwent debridement with split thickness skin graft, 3 patients (4%) decompression, 6 toe amputations, 8 underwent fillet of toe and forefoot, 2 underwent distally based sural flap for heel defect. [Figure 6]

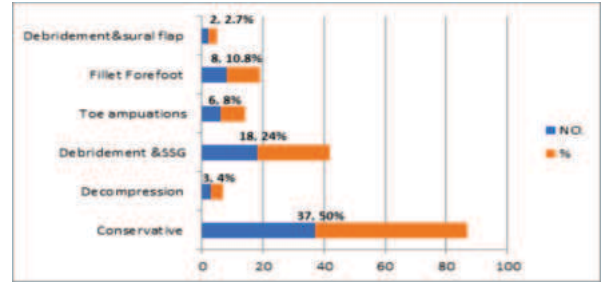


Figure 6- Treatment modality

Modified footwear was recommended for all patients postoperatively. Offloading was advised in cases treated conservatively.

Negative suction wound therapy was used in 2 patients followed by split thickness skin grafting.

Dressings included wide spectrum of papain based, hydrogels, alginates, hydrocolloids.

DISCUSSION:

Management of diabetic foot ulcers is complex and poses challenges particularly of recurrence. Studies have shown that 2% of diabetic patients will develop new foot ulcers every year. [6] 60-80% of foot ulcers will heal and 10-15% remain active [14].

The existing management systems for diabetic foot ulcers are based on the basis of the three principles established by Treves [15], namely, sharp debridement, offloading, and education.

Diabetic foot ulcers have been studied through various classifications and many of them attempt to encompass different characteristics like site of ulcer, depth, infection, ischemia, etc. These classifications have their own merits and demerits.

The results of the current study are in accordance with the study of Ali SM et al. [16] as there were 68% males and 32% females. Duration of diabetes was greater than ten years in 56%. Eleven percent had ulcers on both feet. 47 percent patients were in the age group between 40-60 years. Right foot was more commonly involved (61%).

In Smith et al. series [17], it was seen that 36.2% had undergone some form of amputation due to ulcer. In our study, 18.8% had undergone some form of amputation, less number attributed to the fact that grade 5 patients were excluded from the study.

Patient education for foot care education and self-examination assisted by attender or relatives represent the cornerstone and the primary protective factor in ulcer prevention [18]. It is simple, feasible, and strongly effective for prevention [19, 20]. Self-management should include multiple aspects like foot hygiene instruction, proper footwear use, skin lesion self-examination, and foot sensation self-evaluation, keeping feet clean and dry, and inspecting the condition and checking the color of foot skin can help effectively avoid cracks.

No single wound dressing is ideal for all wound types. It is generally agreed that the goal of the dressing should be to create a moist environment that promotes autolytic process and granulation and rapid migration of epidermal cells across the wound base to facilitate healing. Hydrogels are made of insoluble polymers that bind large volume of water, it can absorb exudate. Moist environment provides optimal

conditions for cells and facilitates autolytic debridement which enhances breakdown of necrotic tissue through endogenous proteolytic enzymes. In view of global emergence of antimicrobial resistance, judicious use of topical antibiotics is encouraged also the benefit is small. Dressing must be made soaking wet with normal saline in granulating wound to prevent oozing. Silver dressing have shown good result in healing diabetic ulcers. Acetic acid 1% are effective against pseudomonas. Povidine iodine has been found toxic to human cells as well as bacteria, fungi at high doses. Also it should not be used on granulating /epithelizing wound since it slows down healing process as it is cytotoxic to keratinocytes, fibroblasts. Tulle dressing is best used in granulating epithelizing wound and for skin grafts. They not only prevent trauma to new and delicate epithelium but also provide moist environment.

Surgical debridement can be performed to remove nonviable or devitalized tissue from the wound bed to accelerate granulation tissue formation and re-epithelialization, which promote wound healing [21]. The surgical removal of superficial necrotic/ osteomyelitic / infected and hyperkeratotic tissue caused by repeated pressure on the foot is essential for wound healing, and it is necessary for deep wounds with bone and soft tissue involvement. We need to lay open the entire tract in case of discharging sinus along the toes or sole.

The main objective and a significant prerequisite for promoting the healing effect and preventing ulcer is reducing high foot pressure (i.e., offloading) [22;23] this process involves offloading the affected area of the foot by redistributing extra pressure to other regions [24]. The majority of offloading device interventions are available for DFU and are divided into four categories: Casting, bracing, footwear, and walking aids [25]. We have used footwear modification in all of our patients.

The flap for reconstruction of diabetic foot should provide a well vascularized tissue to control infection, adequate contour for footwear, durability, and solid anchorage to resist shearing forces. Controversy still remains which flap, whether muscle flaps with skin grafts, fasciocutaneous flaps and recently added perforator flaps, offers the optimal solution to reconstruct the foot especially the weight bearing surface.

The main limitation in our study is that we did not have a long follow-up regarding healing of the ulcer and our sample size was small. We also did not assess the culture and sensitivity report as many were not in place.

CONCLUSION

Diabetic foot disease usually presents in 4th and 5th decades and is source of great morbidity. We stress the need for a clinical diagnosis of diabetic foot ulcers. Regarding treatment, we propose a multidisciplinary approach prioritizing invasive infection drainage, necrosis debridement, and the prompt start of empirical antibiotic therapy, followed by appropriate reconstruction. The management options in diabetic foot was tailored for the individual patient depending upon the extent of vascularity of foot, sensory involvement associated comorbidities, underlying bony involvement. Customized footwear and lifelong care are emphasized to prevent future catastrophic events.

REFERENCES:

1. Carracher AM, Marathe PH, Close KL. International Diabetes Federation 2017. *J Diabetes* 2018; 10: 353-356 [PMID: 29345068 DOI: 10.1111/1753-0407.12644]
2. Somayaji R, Elliott JA, Persaud R *et al.* The impact of team based interprofessional comprehensive assessments on the diagnosis and management of diabetic foot ulcers: A retrospective cohort study. *PLoS ONE*, 2017, 12(9).e0185251.
3. Batista F, Magalhães A, Gamba M, Nery C, Cardoso C. Ten years of a

- multidisciplinary diabetic foot team approach in Sao Paulo, Brazil. *Diabetic foot and Ankle*. 2010; 1:5203.
4. Kotru S, Kotru B, Joshi K. Intervention of diabetes foot care practices on the prevention of new diabetic foot ulcers in patients with type 2 diabetes mellitus. *J Diabetes Metab*. 2015; 6(2):494.
5. Singh S, Pai DR, Yuhui C. Diabetic ulcer Diagnosis and management. *Clin Res Foot Ankle*. 2013; 1(3):120.
6. Pemayun TG, Naibaho RM. Clinical profile and outcome of diabetic foot ulcer, a view from tertiary care hospital in Semarang, Indonesia. *Diabetic Foot and Ankle*. 2017; 8(1):1312974.
7. Zhang P, Lu J, Jing Y, Tang S, Zhu D, Bi Y. Global epidemiology of diabetic foot ulceration: a systematic review and meta-analysis. *Ann Med* 2017; 49: 106-116 [PMID: 27585063 DOI: 10.1080/07853890.2016.1231932].
8. PR. Wright, S.M. Lawrence, D.A. Campbell, PG. Colman, Creation of a multidisciplinary, evidence based, clinical guideline for the assessment, investigation and management of acute diabetes related foot complications, *Diabetes. Med*. 22 (2) (2005) 127–136.
9. Jain AKC. A simple new classification for Diabetic foot ulcers. *Medicine Science*. 2015; 4(2):2109-20.
10. Chalya PL, Mahula JB, Dass RM, Kabangila R *et al.* Surgical management of diabetic foot ulcers: A Tanzanian university teaching hospital experience *Research Notes*. 2011; 4:365.
11. Oyibo SO, Jude EB, Tarawneh I, *et al.* A comparison of two diabetic foot ulcer classifications system. *Diabetic Care*. 2001; 24:84-88.
12. Jain AKC. A new classification of diabetic foot complication: A simple and effective teaching tool. *J Diab Foot Comp*. 2012; 4(1):1-5.
13. Jain AKC, Joshi S. Diabetic foot classifications: Review of literature. *Medicine Science*. 2013; 2(3):715-71.
14. Alexiadou K, Doupis J. Management of diabetic Foot ulcers. *Diabetes Ther*. 2012; 3:4.
15. Treves F. Treatment of perforating ulcer of the foot. *The Lancet* 1884; 124: 949-51 [DOI: 10.1016/S0140-6736(02)28929-1].
16. Ali SM1, Basit A, Sheikh T, Mumtaz S, Hydrie MZ. Diabetic foot ulcer-a prospective study. *J Pak Med Assoc*. 2001; 51(2):78-81.
17. Smith SH, Iversen MM, Iglund J, Ostbye T, *et al.* Severity and duration of diabetic foot ulcer (DFU) before seeking care as predictors of healing time: A retrospective Cohort study. *Plos ONE*. 2017; 12(5):0177176.
18. Ren M, Yang C, Lin DZ, Xiao HS, Mai LF, Guo YC, Yan L. Effect of intensive nursing education on the prevention of diabetic foot ulceration among patients with high-risk diabetic foot: a follow-up analysis. *Diabetes Technol Ther* 2014; 16:576-581 [PMID: 25004241 DOI: 10.1089/dia.2014.0004]
19. Siegel KR, Ali MK, Zhou X, Ng BP, Jawanda S, Proia K, Zhang X, Gregg EW, Albright AL, Zhang P. Cost-effectiveness of Interventions to Manage Diabetes: Has the Evidence Changed Since 2008? *Diabetes Care* 2020; 43: 1557-1592 [PMID: 33534729 DOI: 10.2337/dci20-0017]
20. American Diabetes Association. Standards of Medical Care in Diabetes-2020. *Abridged for Primary Care Providers. ClinDiabetes* 2020; 38: 10-38 [PMID: 31975748 DOI: 10.2337/cd20-as01]
21. Lipsky BA, Berendt AR, Cornia PB, Pile JC, Peters EJ, Armstrong DG, Deery HG, Embil JM, Joseph WS, KarchmerAW, Pinzur MS, Senneville E. 2012 infectious diseases society of America clinical practice guideline for the diagnosis and treatment of diabetic foot infections. *J Am Podiatry Med Assoc* 2013; 103: 2-7 [PMID: 23328846 DOI: 10.7547/1030002].
22. Robinson C, Major MJ, Kuffel C, Hines K, Cole P. Orthotic management of the neuropathic foot: an interdisciplinary care perspective. *Prosthet Orthot Int* 2015; 39: 73-81 [PMID: 25614503 DOI: 10.1177/0309364614545422]
23. Bus SA. Priorities in offloading the diabetic foot. *Diabetes Metab Res Rev* 2012; 28 Suppl 1: 54-59 [PMID: 22271724 DOI: 10.1002/dmrr.2240]
24. Bus SA, van Deursen RW, Kanade RV, Wissink M, Manning EA, van Baal JG, Harding KG. Plantar pressure relief in the diabetic foot using forefoot offloading shoes. *Gait Posture* 2009; 29: 618-622 [PMID: 19217785 DOI: 10.1016/j.gaitpost.2009.01.003]
25. Lung CW, Wu FL, Liao F, Pu F, Fan Y, Jan YK. Emerging technologies for the prevention and management of diabetic foot ulcers. *J Tissue Viability* 2020; 29: 61-68 [PMID: 32197948 DOI: 10.1016/j.jtv.2020.03.003]