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CASE REPORT

# Adequate standards of offloading for diabetic foot ulcers: a reflective case report of a patient with multimorbidity

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*Abstract*

This case report is related to a 61-year-old man with multimorbidity presenting with a chronic diabetic foot ulcer treated in a sub-rural hospital. The patient was treated according to the standard of care supported by national guidelines including some advanced wound therapies, without result. The interdisciplinary team concluded that the wound could not heal because of the patient's multiple comorbidities. However, against all expectations, the patient finally healed after a strict bed rest. This case emphasises the crucial role of offloading, patient adherence and its difficulty of assessment for wound care practitioners. This is a reflective case report that demonstrates commonly the use of expensive advanced wound care therapies without positive outcomes and then the need to come back to basic treatments. Reflective practice is an important part of evidence-based practice, and a case report is a good way to engage the process.

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Many comorbidities such as end-stage renal disease, chronic obstructive pulmonary disease, obesity and retinopathy are known to impede diabetic foot ulcers (DFUs) healing and contribute to high complication rates.[1,2] Multimorbidity is defined as the cooccurrence of ≥2 chronic conditions.[3,4] In order to foster healing rates, many advanced wound care therapies are available.[1] In fact, the research for new innovative strategies is very dynamic because the treatment of DFU remains one of the biggest clinical concerns in individuals with diabetes.[5,6] The personal, societal and financial burdens of DFU and its related complications highlight the importance to develop and support DFU evidence-based medicine.[7] However, their application in 'real-life context' remains a challenge, particularly regarding offloading.

In this case report, we will present a patient with multimorbidity with a DFU managed by an interdisciplinary team including wound care nurses, family physicians, vascular, plastic and orthopaedic surgeons, infectious disease specialists, podiatrists, physical and occupational therapists and the patient and his wife. The case highlights the use of expensive advanced wound care therapies (e.g. specialised wound dressing, electrostimulation and negative pressure therapy) without positive results despite limited resources within the sub-rural hospital. Sometimes, there is a need to get back to the basics: wound bed preparation including timely and appropriate wound debridement and semi-occlusive dressings to allow healing in a controlled moist environment – especially when there is no infectious and/or ischaemic component to treat *a priori* and the exudate is not abundant – in DFU management for which offloading is the cornerstone.[1] This case is reported with the CARE guideline[8] and is a good opportunity to engage clinicians in a reflective practice process.[9]

## Case report

A 61-year-old man was treated for a mid-foot chronic neuropathic ulcer (Fig. 1a) in a specialised wound clinic in a tertiary hospital, of a sub-rural area in XX. Patient characteristics are presented in Table 1. He was followed up for DFU treatments over a 25-month period. Vascular investigations showed biphasic pulses to both feet and legs and the circulation was not compromised according to clinical observations and vascular labs.

The patient was treated according to the best practice recommendations.[1,11] The interventions are described in a global manner in this case as it is well known that there is intrinsic heterogeneity of interventions in a team approach to DFU.[12] Moreover, a general timeline is provided to support the evolution of the case. The patient underwent sharp debridement every week and different types of

*Figure 1.* (a) DFU presentation at the baseline (initial consultation); (b) DFU with complete epithelisation following 3 weeks of strict bed rest offloading.

absorbent or antimicrobial dressing were applied according to the wound bed preparation for 6 months. Firstly, the DFU was offloaded with a removable cast boot and then a Charcot Restrain Orthotic Walker (CROW) was prescribed as a custom-made modality to enhance offloading. Patient has reported strong adherence to the CROW offloading. Thereafter, the team has applied protease-modulating matrix dressing with the offloading for 1 month. There was no wound size reduction. In addition to previous treatments, electrostimulation was applied to the DFU three times per week for 2 months, also without success to decrease wound size. The DFU was then treated with negative pressure therapy for 3 months, but this treatment also failed. Hyperbaric oxygen therapy (HBOT) was not available in the hospital and the patient did not want HBOT from an urban institution considering his haemodialysis treatments. After 1 year without improvement, this was discouraging for the team and also frustrating for the patient. The team's success was the ability to avoid complications (e.g. hospitalisation, bone infection, surgical debridement and amputation). However, the team has finally decided that the DFU was unhealable because of multimorbidity including haemodialysis and oral corticosteroid medication for COPD. For those reasons, this patient had a 'maintenance wound status' and basic treatments according to patients' preferences were provided.[13] This was maintained for another year with a status quo for his general health and medications and fortunately, no serious DFU complications occurred. Thereafter, the patient experienced a serious fall and then broke his left hip. He was assigned to strict bed rest to heal his fracture. Finally, the DFU that has lasted for 2 years has completely healed within 3 weeks with basic wound care including strict offloading from imposed bed rest (see Fig. 1b).



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*Table 1.* Patient characteristics and DFU presentation at the baseline

| Patient characteristics | Details |
|---|---|
| DFU presentation | • Left foot |
| | • Under the base of the 5th metatarsal bone |
| | • Not infected (either soft tissue or bone) |
| | • WIfI classification: 210 |
| | • Baseline dimension: 5 cm × 3 cm × 1 cm |
| | • 100% Granulation tissue, little maceration |
| | • See DFU presentation in Fig. 1a |
| Comorbidities | • Diabetes type II for 20 years controlled (HbA1c < 6%) |
| | • Obesity (BMI: 41,5) |
| | • ESRD on haemodialysis treatment three times per week |
| | • Distal symmetrical sensitive polyneuropathy |
| | • Retinopathy |
| | • Anaemia |
| | • Hyperparathyroidism |
| | • Hypertension |
| | • Dyslipidaemia |
| | • Hyperuricaemia |
| | • Coronary heart disease |
| | • Ischaemic cardiomyopathy |
| | • COPD |
| | • Sleep apnoea/hypopnoea syndrome |
| | • Benign prostatic hyperplasia |
| Foot deformity | • Left foot Charcot neuroarthropathy |
| Other factors | • Non-smoker, but the history of smoking |
| | • History of alcohol abuse |
| | • Nutrition status was acceptable according to the haemodialysis team |
| | • No history of LEA† |
| | • Microangiopathy suspected but not to impair healing according to vascular team |
| Medications | • Acetaminophen, Warfarin, Magnesium, Vitamin D, Prednisone, Budesconide-formoterol, Fluticasone propionate/Salmeterol, Salbutamol, Tiotropium bromide, Darbepoetin alpha, insulin, nitroglycerin PRN, Tamsulosin, Acetylsalicylic acid, Midodrine, Rosuvastatin, Citalopram, Pantoprazole, Domperidone, Alphacalcidol, Allopurinol, Finasterine, Calcium, Folic acid |

WIfI: Wounds, ischaemia and foot infection classification[10]; HbA1C: Glycated haemoglobin; BMI: Body mass index ESRD: End-stage renal disease; COPD: Chronic obstructive pulmonary disease; DFU: Diabetic Foot Ulcer; LEA: Lower Extremity amputation.
†Before the DFU episode as well as for the entire 25-month history of DFU care highlighted in this case.

The patient was also hospitalised during this time, which also contributed to his wound healing. This patient with multimorbidity may have been frail, and interventions performed during hospitalisation may have promoted wound healing.[3,14] Factors that impede wound healing, such as blood glucose, nephropathy, anaemia, hypoxia while maximising other beneficial healing factors, such as complete offloading, optimal nutritional intakes, daily wound care and self-care, which may be impaired by vision loss and aging, are optimised with hospitalisation.[13,15,16] Although we have only a limited understanding of confounding factors, which is a common limitation of case studies, we focused the reflection on offloading as it was fully implemented with the hospitalisation.

## Discussion

A patient with a typical hard-to-heal chronic DFU that was non-responsive to conventional treatments healed after a strict bed rest. This is an offloading approach that was used historically, but the evidence remains scarce.[17,18] This is an inexpensive and efficient approach to avoid all weight-bearing activities, but this is not the norm because of its negative impact on daily and social activities and its low adherence rate.[17] The patient had some clinical signs of pressure (i.e. callus formation and maceration) but was perceived adherent to offloading by the team. However, there was obviously no adequate offloading.[19] Adherence can be assessed in different ways using e-health technologies (e.g. applications, smart insoles), accelerometers and logbook, and it is worth exploring what can be used in a day-to-day practice.[20,21] However, this may present some challenges in current clinical settings, and this was our case, in a rural in-hospital busy clinic with limited resources. The overuse of numerous advanced wound care therapies without significant outcomes for a long period is unfortunately a path too common, especially in rural and sub-rural area where there is no specialised care center.[22–24] Although data tend to demonstrate their utility, this case presentation illustrates well that inappropriately addressing offloading can lead to expensive and time-consuming therapies.[1]

Overall, adherence to offloading is poor and patients wear their removable devices fewer than 30% of time.[25] Although this patient was highly collaborative, he did not want a total contact cast (according to his own preference in care), which is the gold standard, and it has limited our case report. Yet, irremovable devices are more efficient than removable ones because of their mandatory adherence as a key to address this issue.[19,26] In addition, CROW devices, custom-made with specific modifications to accommodate the DFU's presentation have limitations to offload a midfoot DFU. Nevertheless, the team has failed to identify that even if the patient was not regularly walking on his foot according to his own statement supported by caregivers' testimony, he was certainly stepping enough on it to hinder the healing process. With his fracture treatment, the patient finally had understood the importance and the effect of strict offloading. DFU pressure

management is more complex than the vertical ground reaction force during walking.[27,28] Pressure distribution patterns, shear stress, time, levels of activity and intensity are also other important components of the pressure management.[27,28] Effective DFU care can be easily compromised by a lack of input and comprehension from the patient perspective, reducing treatment adherence and compromising wound outcomes and the overall quality of care. In a fracture context, patients better understand that strict non-weight bearing is mandatory, but it seems to be more complex to engage patients in this mindset for DFU.[29]

## Conclusion

Reflective practice about the offloading clinical challenges, the numerous technologies and products available to support DFU management enhance evidence-based medicine. We hope that this case serves as a reminder to the wound care team not to jump early to conclusions when dealing with 'hard-to-heal wounds' in patients with multimorbidity. There is a shared responsibility for non-healing wounds: the patient's share and the providers' share. The team must question the wound's offloading at each appointment even if the patient reports previously adherence to treatment. Despite many treatment options available, strict offloading remains an essential component of DFU management. Prescribing the offloading modality is a necessity, but this is not enough, the actual offloading is the crucial element of the treatment. How can we, as reflective practitioners, improve patient engagement, adherence, knowledge and shared decision-making in order to achieve highly effective offloading interventions? Patients (and their relative) also have to do their part of responsibility in evidence-based medicine, they need to be engaged and empowered (Fig. 2).[30] Communication is essential between the wound care team and the patient to achieve the best therapeutic relationship, from paternalistic approach to a wound care therapeutic alliance. This will support the team (including the patient) to achieve high quality of care based on what matters to the patient based on values and preferences.[31] Good communication is the key for patient-centered care focused on well-being as well.[32] Hospitalisations with strict bed rest are expensive and certainly not a viable solution either for health care professionals or the patient and its relative. The need to get back to basics in the UPDs management is raised by this case. It is challenging but crucial to fully exploit offloading modalities that maximise wound healing in the first place by maximising therapeutic alliance. This case allowed us to implement better

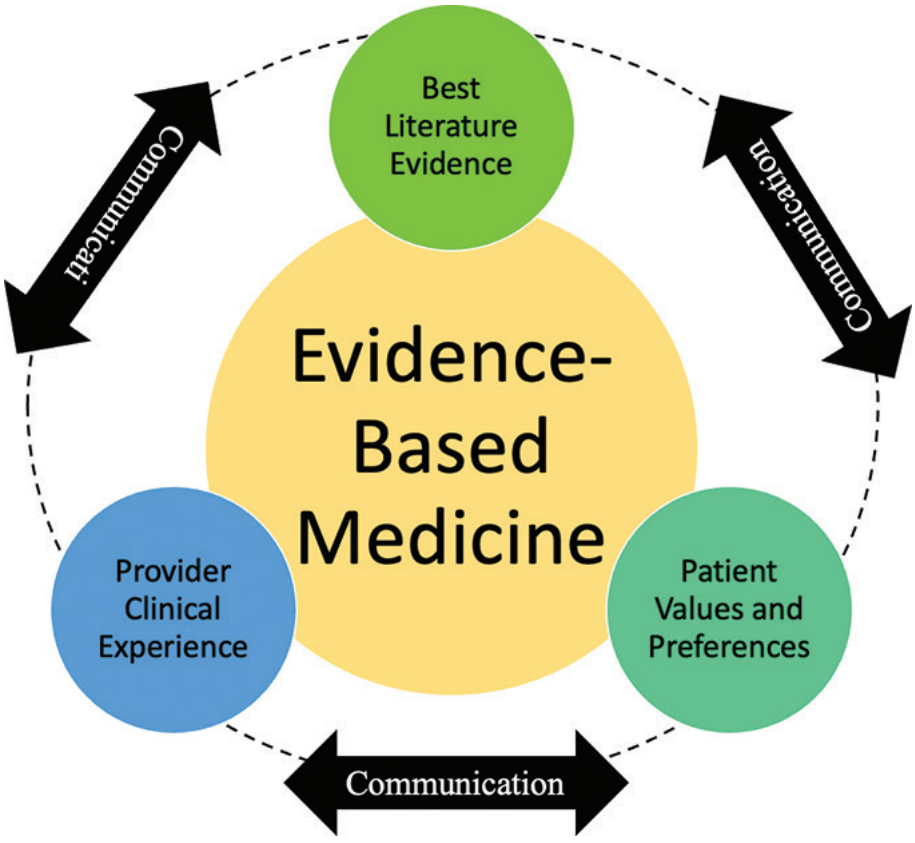


*Figure 2.* Evidence-based medicine with a strong communication between patients and providers.[33]



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management of similar cases within the team. We even used this case to demonstrate the importance of comprehensive management at local and national conferences. We thought it was worth sharing with the international community.

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## Declarations

*Ethics approval and consent to participate*

Consent related to this case report is available (in French) from our institution. Documents (PDF) will be provided on request.

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## Authors' contributions

SH and LM provided clinical care to the patient. SH extracted the data. VB draft the manuscript. All authors contributed to the critical review of the manuscript and approved the final version before VB submitted and revised the manuscript.

## References

1. Schaper NC, van Netten JJ, Apelqvist J, Bus SA, Hinchlife RJ, Lipsky BA; on behalf of the International Working Group on the Diabetic Foot (IWGDF) Editorial Board. Practical guidelines on the prevention and management of diabetic foot disease (IWGDF 2019 update). Available from: https://iwgdfguidelines.org/wp-content/uploads/2021/03/IWGDF-2019-final.pdf [cited 11 May 2021].
2. Bryant R, Nix D. Wound-Helaing physiology and factors that affect the repair process, Acute and chronic wounds: current management concepts. Elsevier Health Sciences, 2015; pp. 63–81.
3. Blanchette V, Armstrong DG, Drudi L, Rizzo M. Upstream comprehensive management of individuals with diabetes with multimorbidity and frailty to act against amputation. J Diabetes Complications 2023; 37(3): 108407. doi: 10.1016/j.jdiacomp.2023.108407
4. Cicek M, Buckley J, Pearson-Stuttard J, Gregg EW. Characterizing multimorbidity from type 2 diabetes: insights from clustering approaches. Endocrinol Metab Clin North Am 2021; 50(3): 531–58. doi: 10.1016/j.ecl.2021.05.012
5. Zha M-L, Cai J-Y, Chen H-L. A bibliometric analysis of global research production pertaining to diabetic foot ulcers in the past ten years. J Foot Ankle Surg 2019; 58(2): 253–9. doi: 10.1053/j.jfas.2018.08.052
6. Lau H-C, Kim A. Pharmaceutical perspectives of impaired wound healing in diabetic foot ulcer. J Pharm Investig 2016; 46(5): 403–23. doi: 10.1007/s40005-016-0268-6
7. Syed MH, Salata K, Hussain MA, Zamzam A, de Mestral C, Wheatcroft M, et al. The economic burden of inpatient diabetic foot ulcers in Toronto, Canada. Vascular 2020: 28(5): 520–9. doi: 10.1177/1708538120923420
8. Riley DS, Barber MS, Kienle GS, Aronson JK, von Schoen-Angerer T, Tugwell P, et al. CARE guidelines for case reports: explanation and elaboration document. J Clin Epidemiol 2017; 89: 218–35. doi: 10.1177/1708538120923420
9. Schön DA. Educating the reflective practitioner: toward a new design for teaching and learning in the professions. San Francisco, CA: Jossey-Bass; 1987.
10. Mills Sr JL, Conte MS, Armstrong DG, Pomposelli FB, Schanzer A, Sidawy AN, et al. The society for vascular surgery lower extremity threatened limb classification system: risk stratification based on wound, ischemia, and foot infection (WIfI). J Vascular Surg 2014; 59(1): 220–34.e2. doi: 10.1016/j.jvs.2013.08.003
11. Botros M, Kuhnke J, Embil J, Goettl K, Morin C, Parsons L, et al. Best practice recommendations for the prevention and management of diabetic foot ulcers. In: Foundations of Best Practice for Skin and Wound Management. A supplement of Wound Care Canada; 2017. p. 68. Availabe from: www.woundscanada.ca/docman/public/health-care-professional/bpr-workshop/895-wc-bpr-prevention-andmanagement-of-diabetic-foot-ulcers-1573r1e-final/file.
12. Blanchette V, Brousseau-Foley M, Cloutier L. Effect of contact with podiatry in a team approach context on diabetic foot ulcer and lower extremity amputation: systematic review and meta-analysis. J Foot Ankle Res 2020; 13(1): 1–12. doi: 10.1186/s13047-020-0380-8
13. Sibbald RG, Elliott JA, Persaud-Jaimangal R, Goodman L, Armstrong DG, Harley C, et al. Wound bed preparation. World Council of Enterostomal Therapists J 2022; 42(1): 16–28. doi: 10.33235/wcet.42.1.16-28
14. Rezaei-Shahsavarloo Z, Atashzadeh-Shoorideh F, Gobbens RJ, Ebadi A, Ghaedamini Harouni G. The impact of interventions on management of frailty in hospitalized frail older adults: a systematic review and meta-analysis. BMC Geriatr 2020; 20(1): 1–17. doi: 10.1186/s12877-020-01935-8
15. Maltese G, Basile G, Meehan H, Fuller M, Cesari M, Fountoulakis N, et al. Frailty is associated with impaired diabetic foot ulcer healing and all-cause re-hospitalization. J Nutr Health Aging 2022; 26(2): 169–73. doi: 10.1007/s12603-022-1726-7
16. Fernando ME, Blanchette V, Mishra R, Zulbaran-Rojas A, Rowe V, Mills JL, et al. Frailty in people with chronic limb threatening ischemia and diabetes-related foot ulcers: a systematic review. Ann Vasc Surg 2022; 89: 322–337. doi: 10.1016/j.avsg.2022.09.057
17. Jarl G, van Netten JJ, Lazzarini PA, Crews RT, Najafi B, Mueller MJ. Should weight-bearing activity be reduced during healing of plantar diabetic foot ulcers, even when using appropriate offloading devices? Diabetes Res Clin Pract 2021; 175: 108733. doi: 10.1016/j.diabres.2021.108733
18. Bus SA, Armstrong DG, Gooday C, Jarl G, Caravaggi C, Viswanathan V, et al. Guidelines on offloading foot ulcers in persons with diabetes (IWGDF 2019 update). Diabetes Metab Res Rev 2020; 36: e3274. doi: 10.1002/dmrr.3274

19. Lazzarini PA, Jarl G, Gooday C, Viswanathan V, Caravaggi CF, Armstrong DG, et al. Effectiveness of offloading interventions to heal foot ulcers in persons with diabetes: a systematic review. Diabetes Metab Res Rev 2020; 36: e3275. doi: 10.1002/dmrr.3275
20. Jarl G. Methodological considerations of investigating adherence to using offloading devices among people with diabetes. Patient Prefer Adherence 2018; 12: 1767. doi: 10.2147/PPA.S175738
21. Jarl G, Lundqvist L-O. Adherence to wearing therapeutic shoes among people with diabetes: a systematic review and reflections. Patient Prefer Adherence 2016; 10: 1521–8. doi: 10.2147/PPA.S112275
22. Gray TA, Rhodes S, Atkinson RA, Rothwell K, Wilson P, Dumville JC, et al. Opportunities for better value wound care: a multiservice, cross-sectional survey of complex wounds and their care in a UK community population. BMJ Open 2018; 8(3): e019440. doi: 10.1136/bmjopen-2017-019440
23. Woods T-J, Tesfay F, Speck P, Kaambwa B. Economic evaluations considering costs and outcomes of diabetic foot ulcer infections: a systematic review. PLoS One 2020; 15(4): e0232395. doi: 10.1371/journal.pone.0232395
24. Cheng Q, Lazzarini PA, Gibb M, Derhy PH, Kinnear EM, Burn E, et al. A cost-effectiveness analysis of optimal care for diabetic foot ulcers in Australia. Int Wound J 2016; 616–28. doi: 10.1111/iwj.12653
25. Armstrong DG, Lavery LA, Kimbriel HR, Nixon BP, Boulton AJ. Activity patterns of patients with diabetic foot ulceration: patients with active ulceration may not adhere to a standard pressure off-loading regimen. Diabetes Care 2003; 26(9): 2595–7. doi: 10.2337/diacare.26.9.2595
26. Crews RT, Shen B-J, Campbell L, Lamont PJ, Boulton AJ, Peyrot M, et al. Role and determinants of adherence to off-loading in diabetic foot ulcer healing: a prospective investigation. Diabetes Care 2016; 39(8): 1371–7. doi: 10.2337/dc15-2373
27. Chatwin KE, Abbott CA, Boulton AJ, Bowling FL, Reeves ND. The role of foot pressure measurement in the prediction and prevention of diabetic foot ulceration – A comprehensive review. Diabetes Metab Res Rev 2020; 36(4): e3258. doi: 10.1002/dmrr.3258
28. Bus, SA. and Ulbrecht, JS. (2020). Biomechanics of the Diabetic Foot for the Uninitiated. In: Boulton AJM, Rayman G, Wukich DK (eds). The Foot in Diabetes, 5th edn. Hoboken: Wiley, 2020; 125–137. doi: 10.1002/9781119445821.ch7
29. Crews RT, King AL, Yalla SV, Rosenblatt NJ. Recent advances and future opportunities to address challenges in offloading diabetic feet: a mini-review. Gerontology 2018; 64: 309–17. doi: 10.1159/000486392
30. Botros M, Kuhnke JL, Costa I, Blanchette V. Empowerment for your patients: is it yours to give? Wounds Care Canada 2021; 19(2): 24–33.
31. Horvath AO. The therapeutic relationship: from transference to alliance. J Clin Psychol 2000; 56(2): 163–73. doi: 10.1002/(SICI)1097-4679(200002)56:2<163::AID-JCLP3>3.0.CO;2-D
32. Fearns N, Heller-Murphy S, Kelly J, Harbour J. Placing the patient at the centre of chronic wound care: a qualitative evidence synthesis. J Tissue Viability 2017; 26(4): 254–9. doi: 10.1016/j.jtv.2017.09.002
33. Sackett DL, Rosenberg WMC, Gray JAM, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't BMJ 1996; 312 :71. doi: 10.1136/bmj.312.7023.71

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