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Original Research

Outcomes Following Advanced Wound Care for Diabetic Foot Ulcers: A Canadian Study



Ivana Roth-Albin CCRA, MSc, BSc^a, Safiah H.C. Mai PhD, HBSc^b, Zeeshan Ahmed MD, BSc^c, Ji Cheng PhD, MS, BSc^d, Karen Choong MB, BCh, MSc, FRCPC^e, Perry V. Mayer MB, BCh, BAO^{a,*}

^a The Mayer Institute, Hamilton, Ontario, Canada^b Faculty of Health Science, McMaster University, Hamilton, Ontario, Canada^c Department of Internal Medicine, McMaster University, Hamilton, Ontario, Canada^d Biostatistics Unit, St. Joseph's Healthcare Hamilton and Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ontario, Canada^e Department of Pediatrics, Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ontario, Canada

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ABSTRACT

Objectives: Data concerning outcomes of Canadian patients with diabetic foot ulcers (DFUs) are limited. The objectives of this study were to evaluate the healing rates and identify the predictors of poor outcomes following advanced wound care in patients presenting with DFUs.

Methods: We conducted retrospective cohort study of adult patients who had DFUs and were referred to a single Canadian advanced diabetic foot and wound care centre between January 1, 2010, and December 31, 2010. The primary outcome was the healing rate at 52 weeks. The generalized estimating equation model was used to identify potential risk factors associated with delayed healing of DFUs.

Results: Of the 40 patients for whom there were complete follow ups, 35 (87.5%) had healing of all DFUs by 52 weeks. Predictors of poor healing were the presence of chronic ulcers, ulcer sizes >1 cm², peripheral vascular disease and multiple ulcers at first presentation. Of the patients, 7.1% required amputation, and 8.9% of patients receiving our treatment died before 52 weeks. At 52 weeks of follow up, 16 of 17 recurrent ulcers and 68 of 108 pre-existing ulcers had healed. Compared to the unadjusted healing rate of preexisting ulcers (63.0%), the unadjusted healing rate of recurrent ulcers (94.1%) was significantly higher (p=0.01).

Conclusions: Our findings demonstrate that patients with DFUs in Canada who receive early and continued care from specialized, outpatient, advanced wound care centres experience significantly improved rates of healing of recurrent DFUs compared to pre-existing DFUs.

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RÉSUMÉ

Objectifs : Les données sur les résultats cliniques des patients canadiens souffrant d'ulcères du pied diabétique (UPD) sont limitées. Les objectifs de la présente étude étaient d'évaluer les taux de cicatrisation et de déterminer les prédicteurs des résultats cliniques à la suite des soins de plaies complexes chez les patients présentant des UPD.

Méthodes : Nous avons réalisé une étude de cohorte rétrospective de patients adultes qui avaient des UPD et étaient orientés vers un centre canadien du pied diabétique et de soins de plaies complexes entre le 1^{er} janvier et le 31 décembre 2010. Le principal résultat clinique était le taux de cicatrisation à la 52^e semaine. Le modèle d'équations d'estimation généralisées était utilisé pour déterminer les facteurs de risque potentiels associés à la cicatrisation tardive des UPD.

Résultats : Parmi les 40 patients dont le suivi était complet, 35 (87,5%) avaient obtenu une cicatrisation de tous les ulcères du pied diabétique à la 52^e semaine. Les prédicteurs d'une cicatrisation médiocre étaient la présence d'ulcères chroniques, la taille des ulcères >1 cm², les maladies vasculaires périphériques et les nombreux ulcères lors de la première visite. Parmi les patients, 7,1% avaient besoin d'une amputation, et 8,9% des patients qui recevaient nos traitements mouraient avant la 52^e semaine. À la 52^e semaine du suivi, 16 des 17 ulcères récurrents et 68 des 108 ulcères préexistants s'étaient cicatrisés. Comparativement au taux de cicatrisation non ajusté des ulcères préexistants (63,0%), le taux de cicatrisation non ajusté des ulcères récurrents (94,1%) était significativement plus élevé (p=0,01).

Mots clés :

soins des plaies complexes
ulcères du pied diabétique
soins multidisciplinaires

* Address for correspondence: Perry V. Mayer, MB, BCh, BAO, 20 Railway Street, Hamilton, Ontario L8R 2R3, Canada.

E-mail address: drpvmayer@themayerinstitute.ca

Conclusions : Nos résultats démontrent que les patients du Canada qui reçoivent des soins précoces et continus de centres de consultation externe spécialisés en soins de plaies complexes pour des UPD expérimentent des taux de cicatrisation significativement plus élevés pour les UPD récurrents que ceux des UPD préexistants.

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Introduction

Diabetic foot ulcers (DFUs) are a common, costly and potentially lethal complication of diabetes (1–3). An estimated 25% of patients with diabetes in the United States will develop DFUs during their lifetimes (4,5). The burden of illness from DFUs is unacceptable; the risk for mortality following a single DFU after 5 years is between 43% and 55% (6). Up to 80% of DFUs are complicated by infections (7) and result in significant limitations in mobility, function and quality of life (8,9). DFUs are the leading cause of lower-extremity amputation in people with diabetes (10–12). The presence of DFUs in hospitalized patients with diabetes is associated with a 59% increase in hospital length of stay (12) and contributes to a substantial economic burden. In Canada, the annual cost of DFU-related care is approximately CAN\$39 000 per incident case (1). The prevention and management of DFUs are, therefore, priorities in the care of patients with diabetes.

Current national and international diabetes treatment guidelines focus on DFU prevention and recommend routine inspection, examination and identification of at-risk feet; education of the patients, families and healthcare providers; appropriate footwear; and treatment of nonulcerative pathology (7,13,14). The principles of DFU treatment include 1) local wound management (i.e. control of exudate and moisture and advanced wound treatment modalities); 2) treatment of infected wounds with debridement, surgical drainage and antibiotic therapy; 3) mechanical off-loading; 4) restoration of regional perfusion through revascularization procedures, when indicated and 5) systemic metabolic control and treatment of comorbidities (7,13,15,16). Published practice guidelines for DFU management and prevention, therefore, highlight the importance of a multidisciplinary healthcare team that possesses expertise in advanced wound care (13,16). Multidisciplinary healthcare centres in East Asia, Europe and the United States report that the use of this approach reduces amputation rates by 49% to 85% (15,17–22), but there is a paucity of Canada-specific data reporting the impact of multidisciplinary, advanced wound-care management on outcomes in patients with DFUs (23). Additionally, data are lacking on patients with DFUs and comorbidities that compromise healing, such as peripheral vascular disease (PVD), signs of infection and multiple ulcers (24,25).

The objectives of this observational study were to evaluate DFU healing rates and clinically relevant outcomes in patients following advanced wound care in a Canadian setting and to examine predictors of these outcomes.

Methods

Data source and study population

This retrospective cohort study was approved by Hamilton Health Sciences Research Ethics Board and conducted at The Mayer Institute (TMI) in Hamilton, Ontario, Canada. This institute is a multidisciplinary medical clinic that specializes in outpatient advanced diabetic foot and wound care. New male and female patients over 18 years of age who were assessed and received advanced wound care for DFU at TMI between January 1, 2010, and December 31, 2010, were included in the study. A DFU was defined as a full-thickness break in the skin occurring on or below the malleoli of

either foot. Wounds above the ankle were not considered foot ulcers and were, therefore, excluded.

Advanced wound care of DFUs

Patients were managed in accordance with the best-practice guidelines established by the International Working Group on the Diabetic Foot (16) and the Registered Nurses Association of Ontario (26). These practices consisted of 1) detailed medical histories and focused physical examinations at presentation, followed by 2) non-invasive vascular studies and 3) advanced wound treatment that included surgical debridement of nonviable tissue to the extent of bone resection, as indicated, moisture balance and strict off-loading. Off-loading in patients was accomplished through the directed recommendation and guidance by nursing staff on the use of removable cast walkers, Össur offloading walkers (West Deptford, New Jersey, USA), DARCO MedSurg postoperative shoes and kneeling scooters (Huntington, West Virginia, USA).

Patients with DFUs complicated by PVD were referred to vascular surgeons for possible revascularization. Infected wounds were treated according to the Infectious Disease Society of America guidelines (24). Patients were referred to infectious-disease specialists, dermatologists, endocrinologists, orthopedic surgeons, plastic surgeons and podiatrists, as indicated, throughout their ongoing care. Patients returned for regular follow-up visits for wound treatment and evaluation of wound-healing progress. At each visit, patients received personalized health education to optimize diabetes management and ulcer care by a multidisciplinary team composed of a counselor, a diabetes nurse educator, a wound-care nurse and a physician. Patients with fully healed DFUs continued to be evaluated on ongoing bases and received preventive wound care to diminish the risk factors leading to ulcer recurrence.

The clinic provides integrated, people-centred care with 3 key pillars of care. First, DFU management is comprehensive and holistic and is given by primary care providers, as opposed to specialists to whom patients might be referred. Second, patient engagement is encouraged by an open clinic layout (i.e. treatment bays arranged in a semicircular manner (Figure 1; patient consent provided). This allows for consenting patients and families to see and communicate with each other, benefitting from hearing the advice, education and instructions given to other patients. Patients are engaged in their own care and observe both the benefits of good care and the adverse effects and morbidities of noncompliance, a powerful educational tool. Last, patients receive around-the-clock on-call service all days of the week and care by community wound care nurses. The holistic care provided to patients involves the management of the entire patient rather than focusing specifically on the wound, assuming “the whole patient, not just the hole in the patient” model (25). This treatment model enables increased understanding of patients’ needs, fosters strong relationships and, consequently, motivates patients to be invested in improving their own outcomes.

Ulcer characteristics

Sensation and ischemia were evaluated noninvasively (27,28). All DFUs were assessed and graded in a standardized manner according to the University of Texas Wound Classification System (29). Sizes were determined using VISITRAK, a digital measurement device (Smith & Nephew, Tampa, Florida, USA), and were categorized as

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