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Research Paper

Outcomes of hospitalized diabetic foot patients in a multi-disciplinary team setting: Thailand's experience☆

Yotsapon Thewjitcharoen, MD*, Sirinate Krittiyawong, MD, Sriurai Porramatikul, MD, Wyn Parksook, MD, Lapakorn Chatapat, MD, Orawan Watchareejirachot, RN, Jeeraphan Sripatpong, PT, Thep Himathongkam, MD, FACP, FACE

Diabetes and Thyroid Center, Theptarin Hospital, 3858 Rama IV Rd, Klong Toey, Bangkok 10110, Thailand

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ABSTRACT

Aims: The aims of this study were to evaluate the outcomes of treatment among hospitalized patients with diabetic foot ulcers, the risk factors for non-healing ulcers, and the rate of major amputation among Thai patients.

Methods: A retrospective study of hospitalized diabetic foot patients treated at Theptarin Hospital during the period of 2009–2013. The complete healing rate was assessed at 12 months after admission.

Results: During the study period, 232 patients (123 males and 109 females) with 262 admissions were included (mean age 65.6 ± 11.9 years, mean duration of diabetes 17.2 ± 9.9 years) with a mean follow-up of 17.5 ± 16.7 months. Major amputations were performed in 4.2% of the patients and peripheral vascular disease (PVD) was a predictive factor (OR 5.25; 95% CI [1.43–19.29]; *p*-value 0.006). Complete healing (including minor amputations) was achieved in 82.1% of the admissions. Only DFU of the heel was a statistically significant (OR 3.34; 95% CI [1.11–10.24]; *p*-value 0.041) predictor of non-healing ulcers. Three patients (1.1%) died during hospitalization.

Conclusions: Management of diabetes-related foot ulcers with a multidisciplinary approach resulted in a limb salvage rate that was greater than 90% and a complete healing rate that was greater than 80%. Successful management of diabetic foot ulcers might be possible in Thailand utilizing this approach.

Introduction

Diabetic foot problems are the most common cause of hospitalization among patients with diabetes and often require long-term hospital admissions. Such problems have been estimated to affect 25% of all diabetic individuals during their lifetime [1]. These problems represent considerable patient morbidity and are associated with substantial health-care costs. Over 85% of lower limb amputations are preceded by foot ulcers and diabetes remains the most common cause of non-traumatic amputation in Western countries [2].

In the developed countries, the amputation rate has been reduced by 50% via proactive management with a multidisciplinary approach [3]. A multidisciplinary approach provides meticulous wound care, debridement, adequate vascular supply, metabolic control, improvement of nutritional status, appropriate antibiotic treatment, and non weight-bearing, which are the cardinal features of the treatment of diabetic foot syndrome. Patient education and, in some cases, assisted self-care for patients provided by family member are also crucial for the prevention of diabetic feet in high-risk patients [4]. Evidence from a tertiary care unit in Thailand revealed that a multidisciplinary approach that focused on clear guidelines and collaboration between specialists resulted in a 70% decrease in the incidence of major amputation and a 60% decrease in the incidence of minor amputation [5].Therefore, diabetic foot ulcers should be managed under the care of a multidisciplinary team with expertise in the many facets of care.

In our center, diabetologists take the lead role in foot care within the multidisciplinary team outlined in Figure 1. The advantage of this system is the emphasis on optimal glycemic control over the course of diabetic foot ulcer treatment. Furthermore, because patients with diabetic foot problems are also likely to harbor other associated complications of diabetes, such as nephropathy, retinopathy, ischemic heart disease, and cerebrovascular disease, the

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* Corresponding author. Tel.: +66 02 3487000.
E-mail address: kamijoa@hotmail.com (Y. Thewjitcharoen).

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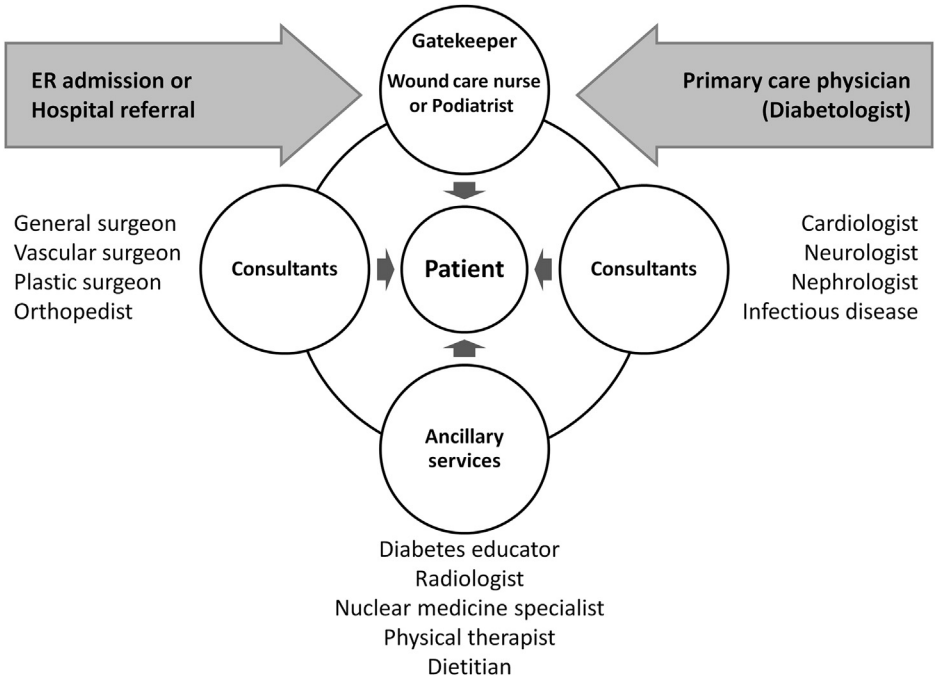

Figure 1. Outline of hospitalize diabetic foot management which diabetologists take the lead role in the foot care multidisciplinary team.

management of foot ulcers should incorporate these associated co-morbidities during the selection of treatment.

A retrospective study from Thailand revealed that a history of foot ulcer among Thai diabetic patients was associated with a three-fold increase in mortality rate compared to those without such history and that the average age of death was earlier than that of Caucasian patients (64.8 years versus 74.2 years) [6]. Unfortunately, there are no national diabetes outcome indicators, particularly outcomes of hospitalized diabetic foot patients, that are routinely collected in Thailand. Therefore, the aim of this study was to evaluate the outcomes of treatment among hospitalized patients with diabetic foot ulcers, the risk factors for non-healing ulcers, and the rate of major amputation in a multi-discipline diabetes center that was facilitated and led by diabetologists.

Materials and methods

This retrospective study was approved by the institutional review board (IRB) committee of Theptarin Hospital, Bangkok, Thailand. The medical histories of all hospitalized diabetic foot patients who were treated at Theptarin Hospital during the period from 2009 to 2013 were analyzed. Theptarin Hospital is one of the most comprehensive diabetes centers in Bangkok, and over 4000 registered diabetic patients were treated at this hospital during the study period.

Diabetic foot ulcer (DFU) was defined as a full thickness wound below the ankle in an individual with diabetes. Acute DFUs were defined by a duration of DFU less than 14 days, and chronic DFUs were defined by a duration of DFU greater than or equal to 14 days. The commonly used Wagner classification defines wounds by the depth of ulceration and the extent of gangrene [7]. However, the University of Texas system (UT classification) grades wounds according to the depth and then stages the wounds according to the presence or absence of infection and ischemia [8]. In this study, the wounds were classified with both systems. The end point of this study was "complete wound healing," which refers to the complete epithelialization of the overlying soft-tissue wound. Non-healing ulcers were defined as wounds that had not healed by 12 months after admission. Amputations were divided into minor (up to below the ankle level) and major amputations (above the ankle level). The limb salvage rate was defined as the percentage of patients who avoided major amputations. Peripheral vascular disease (PVD) was classified according to revised Trans-Atlantic Inter-Society Consensus (TASC II) classification [9].

The patient profiles, types of diabetic wounds, gradings of the DFUs, co-morbidities, methods of treatment, and final outcomes were collected. The complete healing rate was assessed 12 months after admission. The risk factors for non-healing ulcers and major amputations were also determined.

Statistical analyses

Continuous values are given as the mean ± SD and categorical variables are given as proportions. Unpaired *t*-tests were performed to compare the numerical values between two groups when the data were normally distributed. When the data were not normally distributed, Mann–Whitney tests were used for comparisons. The chi-square test was used to compare the factors that were associated with non-healing ulcers and major amputations. *p*-Values <0.05 were considered statistically significant. All statistical analyses were conducted using the Statistical Package for the Social Sciences (version 17.0; SPSS, Chicago, IL, USA).

Results

During the study period, 232 patients (123 males and 109 females) with 262 admissions were included (mean age: 65.6 ± 11.9 years, mean duration of diabetes: 17.2 ± 9.9 years), and the mean follow-up time was 17.5 ± 16.7 months. The median length of stay was 7 (range 1–63) days. The reasons for admissions included uncontrolled infection (38.9%), PVD (17.6%), severe hyperglycemia (15.4%), worsening of renal function (14.3%), co-morbidity (12.2%), and other (1.6%). The mean body mass index (BMI) was 25.4 ± 4.2 kg/m^2, and the average HbA_{1c} was 8.9 ± 2.4% (74 mmol/mol). The