

Secondary Prevention of Diabetic Foot Infections in a Caribbean Nation: A Call for Improved Patient Education

The International Journal of Lower
Extremity Wounds
12(3) 234–238
© The Author(s) 2013
Reprints and permissions:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/1534734613486151
ijl.sagepub.com



Shariful Islam, MBBS¹, Patrick Harnarayan, MBBS, FRCS¹,
Shamir Cawich, DM, FACS², Vijai Mahabir, MBBS¹,
Steve Budhooam, MBBS, FRCS¹, Vinoo Bheem, MBBS¹,
Shivaa Ramsewak, MBBS² and Vijay Naraynsingh, MBBS, FRCS²

Abstract

Most countries have instituted measures to limit the complications of diabetes. We evaluate secondary prevention strategies for diabetic foot infections in a Caribbean country. We performed a prospective questionnaire study evaluating all patients admitted to tertiary care hospitals across Trinidad and Tobago from July 2011 to June 2012. Primary study end points were the number of patient-detected injuries and the time interval between injury and presentation. Secondary end points included the practice of regular foot inspection (≥ 2 foot examinations per week) for early detection and the use of self-directed nonmedical therapies to treat foot infections. There were 446 patients admitted with diabetic foot infections at an average age of 56.9 ± 12.4 years. Three hundred and fifty-six (80%) were previously hospitalized with foot infections and 226 (51%) had already sustained end organ injury from diabetes. There were 163 (36.6%) patients walking barefoot at the time of injury and 189 (42.4%) had footwear-related injuries. In 257 (57.6%) cases, patients identified their foot injury shortly after the event. Despite early detection, they presented to hospital after a mean interval of 6.2 ± 5.03 days, with 78 (30.4%) having tried some form of home therapy first. Overall, 190 (42.6%) patients did not practice regular foot examinations. There is room for improvement in secondary preventative measures for diabetic foot infections in this setting. Educational campaigns may be beneficial to educate diabetics on the dangers of walking barefoot, the importance of appropriate footwear, regular foot inspection, and the importance of seeking immediate medical attention instead of experimenting with home remedies.

Keywords

diabetes, foot infection, epidemiology

Background

Patients with diabetes mellitus are predisposed to foot infections that may result in disastrous complications including limb loss and mortality. In response to the negative consequences on their populations, most governments in the Caribbean have instituted preventative measures to limit the consequences of diabetic foot infections.¹⁻⁴

Generally, there are 2 approaches: primary prevention aims to avert infections by promoting healthy lifestyles, controlling glucose levels, and screening for predisposing pathology (vasculopathy, neuropathy, and foot deformities). Secondary prevention focuses on early diagnosis and treatment of foot infections, when they do occur, in order to limit its consequences. This may be achieved through active mechanisms (requiring continued patient activity) such as regular foot inspection and seeking early surgical consultation. Passive mechanisms (requiring no patient activity)

include educational campaigns to publicize the dangers of foot infections.

Unfortunately, it has been repeatedly documented in the medical literature that the prevalence of diabetic foot infections remains high across the globe^{5,6} and particularly in the Anglophone Caribbean.¹⁻³ In Trinidad and Tobago, anecdotal evidence suggests that diabetic patients tend to present late with advanced foot infections, suggesting that secondary prevention strategies in this setting are not fully

¹San Fernando General Hospital, Trinidad and Tobago, West Indies

²University of the West Indies, St Augustine Campus, Trinidad and Tobago, West Indies

Corresponding Author:

Shamir O. Cawich, Department of Clinical Surgical Sciences, University of the West Indies, St. Augustine Campus, Trinidad and Tobago, West Indies.

Email: socawich@hotmail.com

effective. This study was carried out to evaluate the strategies for secondary prevention of diabetic foot infections in Trinidad and Tobago.

Methods

In Trinidad and Tobago, all residents are offered free health care through health centers and public hospitals across the island. Patients with diabetes who present with foot infections are routinely referred to public tertiary care centers for specialist assessment. Patients with mild, superficial infections that do not require urgent investigation or treatment are discharged for continued outpatient care. Patients are admitted to hospital if any of the following are present: systemic signs of infection, evidence of deep tissue infection (osteomyelitis, gangrene, deep seated collections); leukocytosis; metabolic derangements; critical limb ischemia; limited outpatient support; or any social circumstance that renders patients unable to adequately care for themselves.

All public tertiary care hospitals across the island maintain admission registers documenting the demographics of all patients admitted. We secured ethical approval from the local institutional review board to access these databases and perform questionnaire studies targeting all patients with diabetic foot infections who were admitted to tertiary care hospitals between July 2011 and June 2012. The study targeted all patients with diabetes and foot infections from the general population across the island.

After obtaining informed consent, an independent investigator interviewed inpatients to collect data for this study within 36 hours of hospital admission. This was a patient-based questionnaire study that collected data on patient demographics, type of diabetes, preexisting complications, injury details, interval between injury and presentation, and the use nonconventional therapies.

The aim of this study was to evaluate secondary prevention strategies. Therefore, the end points studied were the number of patient-detected injuries and the time interval between injury and presentation. Secondary end points of the study included the practice of regular foot inspection (≥ 2 foot examinations per week) for early detection and the use of self-directed nonmedical therapies to treat foot infections.

The data were entered into a Microsoft Excel spreadsheet and analyzed with the Statistical Package for Social Sciences (SPSS) version 12.0. Descriptive statistics were generated as appropriate. Chi-squared and Fisher's exact tests were used to assess associations as well as *t* tests used to compare means between variables of interest.

Results

Over the study period, there were 446 patients (241 males and 205 females) admitted with diabetic foot infections. The patients presented at an average age of 56.9 years

Table 1. Types of Home Remedies Used (N = 134).

Type of Home Remedy Used	n (%)
Soft candle application	36 (26.9%)
Topical iodex	29 (21.6%)
Woder of world leaves	22 (16.4%)
Undisclosed	13 (9.7%)
Herb tea	6 (4.5%)
Vaseline	5 (3.7%)
Aloe vera extract	5 (3.7%)
Bengay	4 (3.0%)
Alcohol (topical)	3 (2.2%)
Grease	2 (1.5%)
Guava tea soaks	3 (2.2%)
Handiplast	3 (2.2%)
Epson salt soaks	3 (2.2%)
Methylated spirits	3 (2.2%)
Plaster	2 (1.5%)
Papaya	1 (0.1%)
Powder	1 (0.1%)
Hydrogen peroxide	1 (0.1%)
Warm water	1 (0.1%)

(SD ± 12.4 ; range 24-93; mode 49; median 56). The majority were type II diabetics (93.3%). There were 219 (49.1%) patients of Indian descent while the remainder were of Afro-Caribbean (41.7%), Chinese (1.1%), or mixed race (8.1%) descent.

The patients in this study were diagnosed with infected ischemic (wet) gangrene (110), soft tissue infections/cellulitis (105), deep-seated foot abscesses (78), infected neuropathic ulcers (64), infected puncture wounds (55), osteomyelitis (18), paronychia (8), and web-space infections (8).

Three hundred and fifty-six (80%) patients were previously hospitalized with foot infections. Two hundred and twenty-six (51%) patients had already sustained end organ injury as a complication of diabetes (ischemic heart disease, renal impairment, and/or retinopathy). There were 334 (75%) patients with HbA1c levels $>7.1\%$ on admission.

Common causes of diabetic foot infections were the following: trauma during ambulation (212, 47.5%), footwear-related injuries (189, 42.4%), crush injuries (14, 3.1%), lacerations (10, 2.2%), and burns (7, 1.6%). One hundred and sixty-three (36.6%) patients were walking barefoot at the time of injury.

In 257 (57.6%) cases, patients identified their foot injury shortly after the event. Despite early detection, these patients presented to hospital after an average interval of 6.2 days (SD ± 5.03 ; range 0-30; median 5; mode 7), with 78 (30.4%) having tried some form of home therapy before coming for medical care (Table 1).

The remaining 189 (42.4%) patients had their injuries detected after consultations with health care workers. Since

this group did not recognize the injury when it occurred, it was not possible to determine the interval between injury and presentation among them.

Overall, 256 (57.4%) patients were aware of foot care techniques and reported regular examination of their feet. The remaining 190 (42.6%) patients did not examine their feet regularly.

To achieve control of these infections, the patients required 61 (13.7%) major amputations and 135 (30.3%) minor amputations. An amputation was avoided altogether in 250 patients, with infection control achieved through soft tissue debridement in 225 (50.5%) and antibiotics/supportive care only in 16 (3.6%) cases. There were 9 (0.2%) cases in which operative revascularization avoided a major amputation.

Discussion

Diabetes mellitus affects between 10.9%⁵ and 13.4%⁷ of adults in the Caribbean and is a leading cause of morbidity and mortality across the region.¹⁻¹⁰ Foot infections are the second common complication requiring hospitalization in Caribbean countries.^{1,2,8}

The treatment of diabetic foot infections imposes a heavy financial burden on the already ailing health care systems in this region. Barcelo and Rajpathak estimated that countries of the Anglophone Caribbean collectively spend US\$218 million every year to treat diabetic complications.⁶

Apart from sheer cost, diabetic foot infections also have a negative impact on the productive sector since the majority of patients are still active in the workforce (mean age 56.9 ± 12.4 years). The society loses numerous man-hours of work from affected individuals and many have permanent disability or functional dependence after treatment of severe infections.

The overall impact of diabetic foot infections on the social, economic, and health care sectors throughout the Caribbean is enormous. Therefore, most governments have incorporated preventative strategies into their health care delivery systems. These strategies were addressed at a governmental level when health ministers from CARICOM countries collaborated to develop the "Declaration of Port of Spain" in 2007 to guide resource mobilization in the regional.⁴

Despite this, there is still an increasing incidence of complications of diabetes, including diabetic foot infections, across the globe^{5,6} and in the Anglophone Caribbean.^{1-4,7-9} Many have explained the high prevalence of foot infections by suggesting that Caribbean countries may not have the resources to dedicate to preventative measures. Therefore, we chose to carry out this study in Trinidad and Tobago, which is one of the countries in the Anglophone Caribbean with the highest GDP in the region.¹¹

In Trinidad and Tobago, there are several preventative strategies to combat complications of diabetes.¹¹⁻¹⁴ Specifically for early detection and treatment of foot disease, dedicated diabetic foot clinics were incorporated into the health care delivery system in 2006.¹¹ These diabetic foot clinics are located in the community, usually aligned with community health centers. They offer free basic health care to patients with diabetes and are aligned with tertiary referral centers for continuity of care.¹³ Therefore, these patients have unimpeded access to medical care to encourage early presentation. The Ministry of Health has facilitated training for diabetes educators who host regular foot care workshops and deliver educational lectures in the diabetic foot clinics.¹¹

Nevertheless, this study has demonstrated that secondary prevention strategies are still not yet optimized. Despite 80% of patients giving a history of prior hospitalization for foot infections (and therefore being acutely aware of the dangers of foot infection), many continued high-risk behavior such as walking barefoot (37%) and refraining from regular foot inspection (43%). There is a need for us to use the patients' hospitalizations as an opportunity to emphasize foot care and trauma prevention since a large number (80%) are repeat admissions.

Although 57% of patients claimed to perform regular foot inspections, we are cognizant that this may be overestimated due to the self-reporting study methodology. In these types of questionnaire surveys, many participants may overreport their compliance with what they perceive to be "ideal" responses.¹⁵

There was also a long delay for patients to seek medical attention, despite the injury being recognized. It is well known that early medical intervention is an independent predictor of limb salvage.^{16,17} Therefore, a mean delay of 6.2 ± 5 days is unacceptably long for presentation to specialist services. It would appear that even though patients understand the need for early detection, they do not appreciate the gravity of the diagnosis. The use of self-directed nonmedical therapy may have accounted for the late presentation where patients believe that this would be sufficient to avert complications. Again, we believe that it is unacceptable for 30% of the patients to delay presentation in favor of home remedies. The absence of pain due to neuropathy and poor vision due to diabetic eye disease may contribute to patients not appreciating the gravity of their foot sepsis, thus contributing to late presentation.

It may be time to increase the use of educational campaigns targeting the high-risk population in this setting. Educational campaigns have been shown to reduce the risk of limb loss and foot ulceration.¹⁷⁻¹⁹ At the very least, patients' foot care knowledge and behavior are positively influenced by educational campaigns.²⁰

In the Caribbean, it is common cultural practice to walk barefoot or to use "flip flops," which do not afford foot

protection. Similar practices exist in other developing nations, where complicated foot infections are common.²¹⁻²⁶ The propensity for these patients to sustain foot trauma is well recognized and has even prompted description of the slipping slipper sign.²⁷ This is one area in which educational campaigns should be modified to suit the target population. Patients should be educated on the dangers of walking barefoot, the importance of proper footwear, and the need for regular foot inspection.²¹⁻²⁶ Since 48% of injuries were sustained during walking, diabetics have to be educated to be vigilant for a slipping slipper sign while ambulating. Moreover, utilization of appropriate footwear at all times must be emphasized since more than one third of our patients were walking barefooted at the time of injury.

Another peculiarity of the Caribbean population is the high prevalence of "home remedies," as evidenced in this study. Our campaign messages should convey the need for diabetics to treat foot infections with the appropriate gravity, seeking immediate medical attention instead of home remedies.

Of course, it must be emphasized that secondary prevention is only one aspect of the public health strategy to reduce diabetic foot infections. Primary prevention strategies are equally important and are proven to reduce foot infections in diabetics.

Conclusion

There is room for improvement of secondary preventative measures for foot infections in patients with diabetes in this setting. This can be achieved by educating diabetic patients about the dangers of walking barefoot, the importance of appropriate footwear, regular foot inspection, and the need to seek immediate medical attention instead of experimenting with home remedies when injuries are detected.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

1. Boyne MS. Diabetes in the Caribbean: Trouble in paradise. *Insulin*. 2009;4:94-105.
2. Ferguson TS, Tulloch-Reid MK, Wilks RJ. Epidemiology of diabetes mellitus in Jamaica and the Caribbean: a historical review. *West Indian Med J*. 2010;59:259-264.
3. Hennis A, Wu SY, Nemesure B, Li X, Leske MC. Diabetes in a Caribbean population: epidemiological profile and implications. *Int J Epidemiol*. 2002;31:234-239.
4. Samuels TA, Hospedales CJ. From Port-of-Spain summit to United Nations High Level Meeting CARICOM and the global non-communicable disease agenda. *West Indian Med J*. 2011;60:387-391.
5. Barcelo A, Rajpathak S. Incidence and prevalence of diabetes mellitus in the Americas. *Pan Am J Public Health*. 2001;10:300-308.
6. Barcelo A, Aedo C, Rajpathak S, Robles S. The cost of diabetes in Latin America and the Caribbean. *Bull World Health Org*. 2003;81:19-27.
7. Wilks RJ, Rotimi C, Bennett F, et al. Diabetes in the Caribbean: results of a population survey from Spanish Town, Jamaica. *Diabet Med*. 1999;16:875-883.
8. Abdulkadri A, Cunningham-Myrie C, Forrester T. Economic burden of diabetes and hypertension in CARICOM states. *Soc Econ Stud*. 2010;58:175-197.
9. Hennis AJ, Frazer HS, Jonnalagadda R, Fuler J, Chaturvedi N. Explanations for the high risk of diabetes related amputation in a Caribbean population of black African descent and potential for prevention. *Diabetes Care*. 2004;27:2636-2641.
10. Theodore K. Chronic non-communicable diseases and the economy. *West Indian Med J*. 2011;60:392-396.
11. Singh H, Rahaman MA, Maharaj AR, Armour B. Diabetic Foot Care Management Programme in County St. George Central, Trinidad and Tobago (PAHO Health Surveillance and Disease Management. Non-Communicable Diseases). <http://www.paho.org/english/ad/dpc/nc/trt-abstracts-2007-cmn-mtg.htm>. Accessed November 14, 2012.
12. Central Statistical Office. Ministry of Planning and Development. Government of the Republic of Trinidad & Tobago. Population statistics 2000-2010. <http://www.cso.gov.tt/statistics/statistics/-in-statistics/statistics/population-statistics>. Accessed September 25, 2012.
13. Government of the Republic of Trinidad and Tobago, Ministry of Health; Services. <http://www.health.gov.tt/>. Accessed October 1, 2012.
14. Gulliford MC, Ariyanayagam-Baksh SM, Bickram L, Picou D, Mahabir D. Counting the cost of diabetic hospital admissions from a multi-ethnic population in Trinidad. *Diabet Med*. 1995;12:1077-1085.
15. Brener ND, Billy JOG, Grady WR. Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: evidence from the scientific literature. *J Adolesc Health*. 2003;33:436-457.
16. Solomon S, Affan AM, Gopie P, et al. Taking the next step in 2005, the year of the diabetic foot. *Prim Care Diabetes*. 2008;2:175-180.
17. Valk GD, Kriegsman DM, Assendelft WJ. Patient education for preventing diabetic foot ulceration: a systematic review. *Endocrinol Metab Clin North Am*. 2002;31:633-658.
18. Mason J, O'Keeffe C, Hutchinson A, McIntosh A, Young R, Booth A. A systematic review of foot ulcer in patients with type 2 diabetes mellitus. II: treatment. *Diabet Med*. 1999;16:889-909.
19. Fujiwara Y, Kishida K, Terao M, et al. Beneficial effects of foot care nursing for people with diabetes mellitus: an uncontrolled before and after intervention study. *J Adv Nurs*. 2011;67:1952-1962.

20. Dorresteijn JA, Kreigsmann DM, Assendelft WJ, Valk GD. Patient education for preventing diabetic foot ulceration. *Cochrane Database Syst Rev*. 2012;(10):CD001488. doi:10.1002/14651858.CD001488.pub4.
21. Chandalia HB, Singh D, Kapoor V, Chandalia SH, Lamba PS. Footwear and foot care knowledge as risk factors for foot problems in Indian diabetics. *Int J Diabetes Dev Ctries*. 2008;28(4):109-113.
22. Jayasinghe SA, Atukorala I, Gunethilleke B, Siriwardena V, Herath SC, De Abrew K. Is walking barefoot a risk factor for diabetic foot disease in developing countries? *Rural Remote Health*. 2007;7(2):692.
23. Viswanathan V. The diabetic foot: perspectives from Chennai, South India. *Int J Low Extrem Wounds*. 2007;6:34-36.
24. Tyrrell W. Orthotic intervention in patients with diabetic foot ulceration. *J Wound Care*. 1999;8:530-532.
25. Cavanagh PR, Boulton AJ, Sheehan P, Ulbrecht JS, Caputo GM, Armstrong DG. Therapeutic footwear in patients with diabetes. *JAMA*. 2002;288:1231-1232.
26. Reiber GE, Smith DG, Wallace CM, et al. Footwear used by individuals with diabetes and a history of foot ulcer. *J Rehabil Res Dev*. 2002;39:615-622.
27. Teelucksingh S, Ramdass MJ, Charan A, Mungalsingh C, Seemungal T, Naraynsingh V. The slipping slipper sign: a marker of severe peripheral diabetic neuropathy and foot sepsis. *Postgrad Med J*. 2009;85:288-291.