

Education for diabetic foot

Educação em pé diabético

Fabio Batista¹, Michael Pinzur², Augusto Monteiro³, Raul Taira⁴

ABSTRACT

Objective: The purpose of this investigation was to stratify the risk in a consecutive group of diabetic patients presenting, for the first time, in a diabetic foot clinic. Additional aims were to investigate the preventive measures in the local health system and to evaluate the level of patient's awareness about diabetic foot-associated morbidity. **Methods:** Fifty consecutive adult diabetic patients referred to a Diabetic Foot Clinic of a Municipal Public Hospital comprised the sample for this observational study. The enrollment visit was considered as the first health-system intervention for potential foot morbidity. The average time elapsed since a diagnosis of diabetes among patients was five years. **Results:** At the time of presentation, 94% of sample was not using appropriate footwear. Pedal pulses (*dorsalis pedis* and/or posterior tibial arteries) were palpable in 76% of patients. Thirty subjects (60%) had signs of peripheral neuropathy. Twenty-one subjects (42%) had clinical deformity. There was a positive correlation between a history of foot ulcer, the presence of peripheral neuropathy, and the presence of foot deformity ($p < 0.004$ in each correlation). **Conclusions:** Informing and educating the patients and those interested in this subject and these problems is essential for favorable outcomes in this scenario.

Keywords: Diabetic foot/prevention & control; Health education; Foot ulcer/ prevention & control; Shoes/adverse effects

RESUMO

Objetivo: O objetivo desta investigação foi determinar a estratificação de risco em um grupo de pacientes diabéticos apresentando-se pela primeira vez em uma clínica para pé diabético, determinar as medidas preventivas tomadas pela equipe de saúde local e avaliar o nível de conscientização dos pacientes em relação à morbidade associada ao pé diabético. **Métodos:** Cinquenta pacientes diabéticos adultos foram encaminhados a uma Clínica para Pé Diabético de um Hospital Público Municipal para este estudo observacional. A consulta inicial foi considerada como a primeira intervenção relacionada ao envolvimento desses pacientes em relação ao potencial desenvolvimento de morbidades. Os pacientes haviam sido diagnosticados como sendo

diabéticos, em média, há cinco anos. **Resultados:** No momento da consulta, 94% do grupo não estava usando sapatos apropriados. Os pulsos pediosos (*dorsalis pedis* e/ou tibial posterior) foram palpados em 76% dos pacientes. Trinta indivíduos (60%) apresentavam evidências de neuropatia periférica. Vinte e um deles (42%) tinham deformidade clínica. Houve correlação positiva entre história de úlcera no pé, a presença de neuropatia periférica e a presença de deformidade do pé ($p < 0.004$ em cada correlação). **Conclusões:** A informação e a educação, não apenas dos pacientes, como também de todos os interessados no assunto e nesses problemas, tornam-se pontos básicos nos resultados favoráveis neste cenário.

Descritores: Pé diabético/prevenção & controle; Educação em saúde; Úlcera do pé/prevenção & controle; Sapatos/efeitos adversos

INTRODUCTION

There are an estimated ten to twelve million adult diabetic patients in Brazil, and probably just as many as yet undiagnosed⁽¹⁾. Ninety percent are diagnosed as adults⁽²⁾. One in four has evidence of peripheral neuropathy⁽³⁻⁴⁾. The incidence of peripheral neuropathy increases after ten years of diagnosis, if control of blood glucose is sub-optimal^(3,5-6). Pecoraro showed that peripheral neuropathy was a contributing factor in 61% of diabetes-associated lower extremity amputations; this author estimated that 86% of these could be avoided⁽⁴⁻¹⁴⁾. A comprehensive foot-specific patient education, skin and nail care, and therapeutic footwear program has been shown to substantially decrease that risk^(2,8-9,15-25). Government-initiated programs have been shown to decrease foot-associated morbidity and the rate of lower extremity amputation in countries with underserved patient populations^(13-14,20-22,26-28). Therapeutic footwear appears to play an important role in potentially reducing the morbidity^(8,11,13,18).

Study carried out at Hospital Carmino Caricchio – São Paulo (SP), Brazil.

¹ MD; Assistant physician of the Department of Orthopedics and Trauma at Universidade Federal de São Paulo – UNIFESP, São Paulo (SP), Brazil.

² Lecturer at Loyola University Chicago – Chicago (IL), United States of America.

³ MD at Hospital Carmino Caricchio – São Paulo (SP), Brazil.

⁴ MD at Hospital Carmino Caricchio – São Paulo (SP), Brazil.

Corresponding author: Fabio Batista – Rua Cantagalo, 1.426 – Tatuapé – CEP 03319-001 – São Paulo (SP), Brasil – Tel.: 11 2225-1475 – e-mail: dr.fabiobat@terra.com.br

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OBJECTIVE

The purpose of this observational study was to objectively evaluate the risk status and risk factors in a consecutive series of indigent public hospital adult diabetic patients receiving their first specific health system intervention for potential diabetic foot morbidity.

METHODS

Following approval by the local Committee of Research on Humans, this observational study was started after a concerted educational plan to promote awareness in primary care physicians about potential foot-associated morbidity in adult diabetic individuals. The cohort group consisted of 50 consecutive adult-onset diabetic individuals referred to a public hospital diabetic foot clinic. There were 21 males and 29 females. The mean age was 60.5 years (range 22 to 97 years). The average time elapsed from date of diagnosis of diabetes was 10.3 years (range 4 months to 30 years).

All subjects were asked whether medical instruction about the potential for and avoidance of foot morbidity had been provided. A history of previous foot-associated morbidity was recorded. A clinical examination evaluated the *dorsalis pedis* and posterior tibial pulses. The presence of deformity was recorded simply as present or absent. The presence of peripheral neuropathy was determined by applying 10 g of force with the Semmes-Weinstein 5.07 monofilament⁽¹⁹⁾ (Figure 1). A diagnosis of peripheral neuropathy was made when patients were unable to perceive pressure from the monofilament in a minimum of four of ten testing sites⁽²⁰⁾.

Risk grading is shown in Table 1. A subjective evaluation of footwear adequacy was based on risk

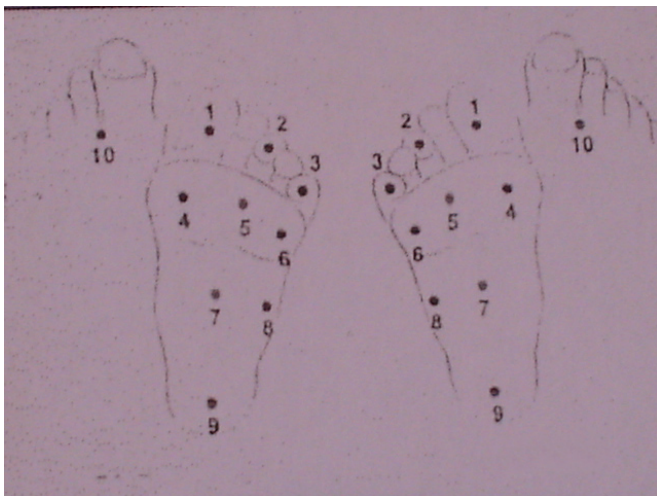


Figure 1. These ten sites were tested for the presence of peripheral neuropathy, that is, loss of protective sensations. Ten grams of pressure was applied using the Semmes-Weinstein 5.07 monofilament. Patients were considered insensitive when there was no perception of pressure in a minimum of four of ten sites

Table 1. Grading of risk status for developing a foot ulcer

Grade	History of DFU	Appearance	Pedal pulses	Sensation	Deformity
0	No	Normal	Palpable	+	None
1	No	Normal	Palpable	-	None
2	No	Normal	Diminished or absent	-	±
3	Yes	±	Absent	-	+

DFU = diabetic foot ulcer

status. Subject graded 0 required only soft leather shoes with a reasonable toe box. Risk grade 1 subjects required soft leather shoes, an adequate toe box, and cushioned soles or insoles. Risk grade 2 subjects required soft leather oxford lace shoes, an adequate toe box, and accommodative insoles. High risk (grade 3) subjects required all of these items and a custom-made accommodative insole⁽²⁹⁾.

Statistical analysis

Descriptive statistics were used to establish the relative frequencies of negative events. The Wilcoxon signed rank test was used to establish right and left feet differences. Spearman's linear correlation test was used to analyze the effects of age and duration of diabetes, and illustrated by dispersion diagrams. The Mann-Whitney test was used to assess the relation between qualitative (categorical) variables and sensitivity⁽³⁰⁻³¹⁾. The SPSS for Windows version 11.0 software was used for processing.

RESULTS

Descriptive data

Six of the 50 subjects (12%) had a now healed previous foot ulcer. Four subjects (8%) had been given some form of foot-specific care education. According to the recommended standards of the American Orthopaedic Foot & Ankle Society⁽²⁹⁾, only three of the subjects used appropriate footwear (two of the three were risk grade 0). Pedal pulses (*dorsalis pedis* and/or posterior tibial) were palpable in 38 subjects (76%). Thirty subjects (60%) had evidence of peripheral neuropathy. Twenty-one subjects (42%) had clinical deformity. There were 14 forefoot deformities. Nine had lesser toe deformities, four had hallux valgus, and one had a splayed foot. Four subjects had *pes cavus* with prominent metatarsal heads, and three subjects had Charcot's midfoot deformity. Risk stratification is shown in Table 2.

Figure 2 shows an example of inappropriate footwear.

Table 2. Risk stratification

Risk category	Number	(%)
0	20	40
1	14	28
2	11	22
3	5	10



Figure 2. Examples of inappropriate footwear for at risk patients. The forefoot is tight; there is undue pressure on the toes (a site with a high probability for deformity). The shoe does not adjust to daily volume fluctuations that are common in patients with peripheral neuropathy. Socks are thin and made of synthetic materials. These socks do not cushion against pressure from shoes, and do not absorb perspiration, which may cause skin maceration

Correlations

There was no statistical difference in right and left foot sensitivity ($p = 0.414$). Only one patient among risk grade 1 or higher subjects used appropriate footwear. There was a positive – albeit not statistically significant – trend between increasing age and the presence of peripheral neuropathy ($R = -0.179$; $p < 0.215$). There was a positive correlation between the time elapsed since a diagnosis of diabetes and the presence of peripheral neuropathy ($R = 0.035$; $p < 0.808$). There was a positive correlation between a history of foot ulcer and the presence of peripheral neuropathy and foot deformity ($p < 0.004$ for each correlation). There was no correlation between foot-specific patient education and the presence of patient education ($p < 0.853$).

DISCUSSION

It is well accepted that diabetic foot ulcers have a strong negative effect on health-related quality of life. A significant share of healthcare resources is used on these patients; lower extremities are often amputated, walking is impaired, independence is compromised, and death may ensue in some cases. Experts have classified foot ulcers in two categories: ischemic ulcers caused by peripheral vascular disease, and neuropathic ulcers

initiated by local trauma in the presence of peripheral neuropathy. Notwithstanding technological advances in the treatment of symptomatic peripheral vascular disease, there are no current interventions to be used before patients develop non-healing wounds or present ischemic pain. On the other hand, a combination of foot-specific patient education, skin and nail care, and therapeutic footwear, has been shown to successfully decrease the development of diabetic foot ulcers and the initiation of this pathologic process⁽³²⁻³³⁾.

In spite of such information, few diabetic patients appear to be adequately educated on the potential morbidity of diabetic foot ulcers or possible preventive measures to avoid foot-specific morbidity^(15,18,26). The present data supports the growing consensus that coordinated programs combining preventive foot-specific patient education, skin and nail care and therapeutic footwear may decrease significantly the diabetic foot disease epidemic.

This cohort of patients receiving healthcare in a public healthcare setting had poor level of preventive interventions at the time of entry into a government-sponsored program; few had foot-specific patient education. Only one of 50 at risk subjects used appropriate footwear, an apparently simple intervention. As shown in previous studies, patients which develop foot morbidity may easily be identified by investigating the presence of peripheral neuropathy and obvious deformity.

CONCLUSIONS

This study provides solid additional evidence that diabetic patients at risk for developing foot ulcers and foot infection may be easily identified by simple and inexpensive screening methods. Once identified, low-technology interventions offer the opportunity of avoiding the negative effects on health-related quality of life, decreasing resource-consuming patient morbidities, and ultimately decreasing the risk of lower limb amputations and early mortality in a patient population with many associated risk factors.

REFERENCES

1. Batista F. Prevenção, diagnóstico e tratamento do pé diabético e da amputação de membros. *Revista Nacional de Reabilitação*. 2004;26:8-10.
2. Batista F, Pinzur MS. Disease knowledge in patients attending a diabetic foot clinic. *Foot Ankle Int*. 2005;26(1):38-41.
3. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. *Lancet*. 1998;352(9131):837-53.
4. Batista F, Pinzur MS, Nery CA. Cutaneous thermal sensitivity in diabetic neuropathy. *Foot Ankle Int*. 2005;26(11):927-31.

5. Laing P. Diabetic foot ulcers. *Am J Surg.* 1994;167(1A):31S-36S.
6. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med.* 1993;329(14):977-86.
7. Pecoraro RE, Reiber GE, Burgess EM. Pathways to diabetic limb amputation. Basis for prevention. *Diabetes Care.* 1990;13(5):513-21.
8. Meijer JW, Links TP, Smit AJ, Groothoff JW, Eisma WH. Evaluation of a screening and prevention programme for diabetic foot complications. *Prosthet Orthot Int.* 2001;25(2):132-8.
9. Apelqvist J, Larsson J. What is the most effective way to reduce incidence of amputation in the diabetic foot? *Diabetes Metab Res Rev.* 2000;16 Suppl 1:S75-83.
10. Mayfield JA, Reiber GE, Nelson RG, Greene T. Do foot examinations reduce the risk of diabetic amputation? *J Fam Pract.* 2000;49(6):499-504.
11. Umeh L, Wallhagen M, Nicoloff N. Identifying diabetic patients at high risk for amputation. *Nurse Pract.* 1999;24(8):56,60,63-6,70.
12. Walrond ER, Ramesh J. Quality of care of patients with diabetic foot problems in Barbados. *West Indian Med J.* 1998;47(3):98-101.
13. Boulton AJ. Why bother educating the multi-disciplinary team and the patient—the example of prevention of lower extremity amputation in diabetes. *Patient Educ Couns.* 1995;26(1-3):183-8.
14. Batista F, Monteiro AC. Tratamento cirúrgico da neuro-artropatia de Charcot: apresentação de técnicas e resultados preliminares. *Diabetes Clínica.* 2003;7(5):358-66.
15. Chin MH, Cook S, Jin L, Drum ML, Harrison JF, Koppert J, et al. Barriers to providing diabetes care in community health centers. *Diabetes Care.* 2001;24(2):268-74.
16. Mottini G, D'Avola D, Dimbelolo JC, Lumu R, Gallizioli E, Nisita J, et al. A hospital survey of the clinical features of diabetes in Congo. *Diabetes Nutr Metab.* 2003;16(4):236-42.
17. Matwa P, Chabeli MM, Muller M, Levitt NS; Working Group of the National Diabetes Advisory Board; European IDDM Policy Group. Experiences and guidelines for footcare practices of patients with diabetes mellitus. *Curationis.* 2003;26(1):11-21.
18. Wooldridge J, Bergeron J, Thornton C. Preventing diabetic foot disease: lessons from the Medicare therapeutic shoe demonstration. *Am J Public Health.* 1996;86(7):935-8.
19. Mayfield JA, Sugarman JR. The use of the Semmes-Weinstein monofilament and other threshold tests for preventing foot ulceration and amputation in persons with diabetes. *J Fam Pract.* 2000;49(11 Suppl): S17-29.
20. Vijay V, Narasimham DV, Seena R, Snehalatha C, Ramachandran A. Clinical profile of diabetic foot infections in south India – a retrospective study. *Diabet Med.* 2000;17(3):215-8.
21. Bruckner M, Mangan M, Godin S, Pogach L. Project LEAP of New Jersey: lower extremity amputation prevention in persons with type 2 diabetes. *Am J Manag Care.* 1999;5(5):609-16.
22. Batista F, Monteiro AC, Miranda Jr F, Lopes AD. The quality of life in diabetic amputee: a pilot study. [Internet]. In: Proceedings of the 3rd World Congress of the International Society of Physical Rehabilitation and Medicine – ISPRM; 2005 Apr 10-15; Sao Paulo; [cited 2005 May 18]. Available from: http://www.medimond.com/proceedings/moreinfo/20050410_index.pdf
23. Watson J, Obersteller EA, Rennie L, Whitbread C. Diabetic foot care: developing culturally appropriate educational tools for Aboriginal and Torres Strait Islander peoples in the Northern Territory, Australia. *Aust J Rural Health.* 2001;9(3):121-6.
24. Viswanathan V, Shobhana R, Snehalatha C, Seena R, Ramachandran A. Need for education on footcare in diabetic patients in India. *J Assoc Physicians India.* 1999;47(11):1083-5.
25. Corbett CF. A randomized pilot study of improving foot care in home health patients with diabetes. *Diabetes Educ.* 2003;29(2):273-82.
26. Valk GD, Kriegsman DM, Assendelft WJ. Patient education for preventing diabetic foot ulceration. A systematic review. *Endocrinol Metab Clin North Am.* 2002;31(3):633-58.
27. Borssén B, Bergenheim T, Lithner F. Preventive treatment of foot deformities in type I diabetic patients aged 15-50 years: an epidemiological and prospective study. *J Intern Med.* 1996;240(4):219-25.
28. Pinzur MS, Pinto MA, Saltzman M, Batista F, Gottschalk F, Juknelis D. Health-related quality of life in patients with transtibial amputation and reconstruction with bone bridging of the distal tibia and fibula. *Foot Ankle Int.* 2006;27(11):907-12.
29. Pinzur MS, Slovenkai MP, Trepman E. Guidelines for diabetic foot care. The Diabetes Committee of the American Orthopaedic Foot and Ankle Society. *Foot Ankle Int.* 1999;20(11):695-702.
30. Vieira S. *Introdução à Bioestatística.* 3a ed. Rio de Janeiro: Campus; 1998.
31. Conover WJ. *Practical nonparametric statistics.* 2nd ed. New York: John Wiley & Sons; 1980.
32. Overland JE, Hoskins PL, McGill MJ, Yue DK. Low literacy: a problem in diabetes education. *Diabet Med.* 1993;10(9):847-50.
33. O'Brien KE, Chandramohan V, Nelson DA, Fischer JR Jr, Stevens G, Poremba JA. Effect of a physician-directed educational campaign on performance of proper diabetic foot exams in an outpatient setting. *J Gen Intern Med.* 2003;18(4):258-65.