Behavior in Self-care of the Foot and Foot Ulcers in Thai Non-insulin Dependent Diabetes Mellitus

SUTIN SRIUSSADAPORN, M.D.*, SIRIRAT PLOYBUTR, M.Sc.*,
WANNEE NITIYANANT, M.D.*, SATHIT VANNASAENG, M.D.*,
APICHATI VICHAYANRAT, M.D.*

Abstract

A cross sectional study was conducted to examine behavior in self-care of the foot and foot ulcers in Thai non-insulin dependent diabetic patients. Fifty-five patients with foot ulcers (ulcer group; 42 females and 13 males) and 110 patients without foot ulcers (control group; 83 females and 27 males) were evaluated for self foot-care behavior using a questionnaire consisting of questions about foot inspection, foot cleaning, nail-care, and the use of footwear which possessed a total score of 20. The results showed that a mean total self foot-care score of the ulcer group was significantly lower than that of the control group (14.50 ± 3.35 *vs* 15.74 ± 2.31; $p < 0.01$). The patients with foot ulcers had lower mean scores in all of the four self foot-care categories than did those without foot ulcers. However, only the difference in foot cleaning score was statistically significant (7.35 ± 0.21 *vs* 7.88 ± 0.11; $p < 0.05$). A univariate analysis has shown that the risk of developing foot ulcers was significantly associated with a total self foot-care score of less than 15 with an odd ratio of 2.6 and a 95 per cent confidence interval of 1.3 - 5.6. Regarding the behavior in self foot ulcer-care, 45.5 per cent of the diabetic patients with foot ulcers had neglected them and 54.5 per cent had inappropriately cared for their ulcers. In conclusion, Thai non-insulin dependent diabetic patients with foot ulcers understood less about self foot-care practice than did those without foot ulcers. Incorrect self foot-care behavior particularly foot cleaning is associated with an increased risk of foot ulceration. In addition, diabetic patients should be advised about the correct self-care of their feet and foot ulcers in order to prevent foot ulceration and its complications.

Foot ulceration is a fundamental condition that commonly leads to lower extremity amputation in diabetic patients[1]. In the United States, more than half of lower extremity amputations were performed in diabetic patients[1,2]. In Thailand, Vichayanrat et al have observed that the amputation and mortality rates in diabetic patients with foot ulcers admitted to Siriraj Hospital were 25 and 20 per cent, respectively[3]. These life-threatening and prolonged disabling consequences of

* Division of Endocrinology and Metabolism, Department of Medicine, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

foot ulcers contribute not only to the economic[4] but also psycho-social problems. Therefore, understanding the factors associated with the development of foot ulcers is essential in the prevention of foot ulceration in diabetic patients at risk.

Current evidence indicates that foot ulceration in diabetic patients results from combinations of a number of factors, including peripheral neuropathy, resulting in insensitive and deformed foot and painless trauma[5,6], peripheral vascular diseases of both large and small blood vessels leading to inadequate blood supply, delayed ulcer healing and gangrene[7-10], and visual impairment, resulting in inadequate foot inspection[11,12]. Furthermore, lack of knowledge in diabetes and incorrect self foot-care behavior[14-16] have been reported to be additional factors which make the diabetic foot vulnerable to serious skin injury, infection and ultimately lower limb amputation[1, 17-20]. As far as we know, however, the association between self foot-care behavior and the development of foot ulcers has never been systematically examined in Thai diabetic patients who might have health beliefs and self-care attitudes different from other ethnic populations. This cross sectional study was, therefore, conducted to examine behavior in self-care of the foot and foot ulcers in Thai non-insulin dependent diabetic patients. We also examined the association between self foot-care behavior and diabetic foot ulceration.

PATIENTS AND METHOD

Fifty-five non-insulin dependent (Type 2) diabetic patients with foot ulcers (42 females and 13 males) recruited from the diabetic clinic of Siriraj Hospital were studied (ulcer group). During the same period of time, 110 Type 2 diabetic patients without foot ulcers (83 females and 27 males) randomly recruited from the same diabetic clinic were also studied as a control group. The diagnosis of diabetes mellitus was established according to the World Health Organization criteria[21]. The foot ulcers eligible for this study were defined as full-thickness disruption of skin below mid-calf level with one or more of the following features: duration of the ulcer longer than 14 days, presence of severe infection, necrosis or gangrene. The diabetic patients who had a past history of foot ulcer as defined by the above criteria or lower limb amputation were not included in this study.

Assessment of self foot-care behavior

All patients included in this study were assessed for behavior in self foot-care, using a questionnaire which was designed based on a standard foot-care management[22]. The questionnaire consisting of 11 multiple choice questions with a total score of 20, was divided into 4 categories: foot inspection, foot cleaning, nail-care and use of footwear (see appendix). The patients with foot ulcers were also assessed for the behavior in caring for their ulcers.

Statistical analyses

Results were demonstrated as mean ± standard deviation (SD) or per cent (%) as appropriate. Students' *t* - test, chi-square test and Mann-Whitney test were used to compare the continuous data, categorical data and ordinal number data between the ulcer and control groups, respectively. A univariate analysis was performed in order to assess the potential risk of foot-care behavior in the development of foot ulcers. A p-value of < 0.05 was considered statistically significant. The degree of association between foot ulceration and each variable was determined by odds ratio (OR).

RESULTS

The patients' backgrounds are shown in Table 1. There were no differences in age and sex distribution, educational status, economic status, types of occupation, and living areas between the ulcer and control groups. Among the patients with foot ulcers, 92.7 per cent had one ulcer, 7.3 per cent had two ulcers or more, 89.1 per cent had concomitant infections, and 24.5 per cent had gangrene. The ulcers occurred on the right leg more commonly than on the left leg (54.5% *vs* 45.5%). The sites at which ulcers developed were first toe and first metatarsal head (25.4%), lateral malleolus (18.4%), sole (16.4%), pretibial area (12.8%), and fifth toe (12.7%). The duration of ulcers ranged from 9 - 360 days with a mean of 36.4 ± 50.2 and a median of 22 days. The antecedent events or causes of foot ulcers are listed in Table 2. The majority of the patients (61.7%) did not notice the definite antecedent events precipitating the ulcers.

A mean total self foot-care behavior score of the ulcer group was significantly lower than that of the control group (14.50 ± 3.35 *vs* 15.74 ± 2.31; $p < 0.01$) as shown in Table 3. The patients with

Table 1. Background of the diabetic patients with and without foot ulcers.

	With foot ulcers		Without foot ulcer		p-value
	Cases	(%)	Cases	(%)	
Total cases	55		110		
Sex					
males	13	(23.6)	27	(24.5)	
females	42	(76.4)	83	(75.5)	0.95 *
Education					
none	20	(36.4)	20	(18.2)	
primary school	23	(41.8)	71	(64.5)	
secondary - high school	8	(14.5)	12	(10.9)	
college - university	4	(7.3)	7	(6.4)	0.18 **
Economic status					
low	22	(40.0)	30	(27.3)	
moderate	19	(34.5)	69	(62.7)	
high	14	(25.5)	11	(10.0)	0.98 **
Occupation					
Home-based	40	(72.2)	69	(62.7)	
Non-manual work	12	(22.2)	31	(28.2)	
Manual work	3	(5.6)	10	(9.1)	0.42 *

* Value obtained from chi-square test
** Value obtained from Mann-Whitney test

Table 2. Antecedent events of foot ulceration.

	Cases	%
Unknown	34	61.7
Excoriation	6	10.9
Penetrating or cut injury	5	9.1
Unfitted shoes	3	5.5
Thermal burn	3	5.5
Blunt injury	3	5.5
Pressure	1	1.8

foot ulcers had lower mean scores in all of the four self foot-care categories than did the patients without foot ulcers. However, only the difference in foot cleaning score was statistically significant (7.35 ± 0.21 *vs* 7.88 ± 0.11; $p < 0.05$). Considering self foot-care behavior as a risk factor of foot ulceration, the risk of developing foot ulcers significantly increased by 2.5 fold with a total self foot-care behavior score of less than 15 with an odd ratio of 2.6 and a 95 per cent confidence interval of 1.3 - 5.6 (Table 4).

Regarding the behavior in ulcer care of the patients with foot ulcers, 25 out of 55 cases (45.5%) neglected their ulcers, 22 (40%) used antiseptics followed by local dressings, 5 (9.0%) used antiseptics only, and 3 (5.5%) used only local dressing for their ulcers. The types of antiseptics and topical dressings are shown in Table 5.

DISCUSSION

This report is the first study which aimed to examine the association between self foot-care behavior and risk of developing foot ulcers in Thai Type 2 diabetic patients. The results showed that diabetic patients with foot ulcers had a mean total self foot-care behavior score significantly lower than did the control group, suggesting that the diabetic patients who had foot ulcers understood less about self foot-care practice than those without foot ulcers. In addition, the risk of developing foot ulcers increased by 2.5 fold in those with a foot-care score of less than 15 according to the results of univariate analysis. Our observation in Thailand was similar to that of others in Western countries[1,14]. Delbridge et al[14] have demonstrated that the level of patients' understanding in diabetes and its complications as well as foot-care significantly related to the development of foot lesions. In addition, Pecoraro et al[1] have shown that lack of knowledge in appropriate foot-care was a major factor contributing to lower limb amputations. Though the knowledge in self

Table 3. Foot-care score of diabetic patients with and without foot ulcers.

	With foot ulcers		Without foot ulcer		p-value*
	cases	score	cases	score	
Total score	51	14.50 ± 3.35	101	15.74 ± 2.31	< 0.01
Foot inspection	52	2.35 ± 1.06	103	2.49 ± 0.77	0.35
Foot cleaning	52	7.35 ± 0.21	103	7.88 ± 0.11	< 0.05
Nail-care	53	0.76 ± 0.70	101	0.93 ± 0.78	0.19
Use of footwear	53	4.36 ± 1.80	101	4.76 ± 1.47	1.36

* value obtained from Students' *t*-test

Table 4. Foot-care behavior score and risk of developing foot ulcers.

Foot-care score	Cases (n)	Controls (n)	Odds ratio	95% CI	p-value
< 12	11	9	2.70	0.94 - 7.69	< 0.05
< 13	19	20	2.27	1.01 - 5.00	< 0.05
< 14	27	30	2.43	1.17 - 5.56	< 0.05
< 15	35	43	2.63	1.25 - 5.56	< 0.01
< 16	39	62	1.75	0.82 - 3.85	0.16
< 17	43	77	1.54	0.65 - 3.85	0.39

Table 5. Types of antiseptics and local dressings used for ulcer-care.

Antiseptics	Cases	Local dressings	Cases
70% alcohol	16	Betadine	8
Hydrogen peroxide	6	Mercurochrome	6
Normal saline	3	Topical antibiotic	4
Potassium permanganate	1	Tincture iodine	2
Burnol	1	Sofra tulle	2
		Acriflavin	1
		70% alcohol	1
		Herbs	1

foot-care practice was associated with foot ulceration in our diabetic patients, the risk of developing foot ulcers did not, however, increase with the further decrease in total self foot-care behavior score. This might be due to two reasons. Firstly, foot ulceration is the result not only from incorrect foot-care practice but also from other factors which principally contribute to foot ulceration such as neuropathy[5,6], angiopathy[7-10], and visual impairment[11,12]. Secondly, the patients who had foot ulcers might be able to answer some questions about self foot-care practice correctly by their past experience.

This study has shown that the patients with foot ulcers had lower mean scores in all of the four categories of foot-care practice compared to those without foot ulcers. However, only the foot cleaning score was significantly different, suggesting that foot cleaning is the most important foot-care practice among the four categories in determining the risk of developing foot ulcers in our patients. Adequate cleaning of the feet might decrease the amount of skin flora and bacterial contaminations which in turn results in decreased

risk of serious foot infections. The lack of statistically significant differences in the mean scores of the other three foot-care categories: foot inspection, nail-care and the use of footwear did not indicate that these foot-care practices were not clinically significant in determining the risk of foot ulceration. We suggest that a combination of the minor incorrect foot-care practice in each category could contribute to a significantly increased risk of developing foot ulcers.

Correct self foot-care practice is essential in the prevention of foot ulceration and lower limb amputation[1,14,17-20]. In addition, intensive foot-care education can effectively decrease the number of amputations, frequency of hospital admissions as well as medical expense for diabetic foot problems[18-20,23,24]. Davidson et al[18] have demonstrated that an intensified program in foot-care reduced amputations by 50 per cent per year and produced a saving of $700,000 over a 3-year period. Edmonds et al[20] as well as Assal et al[19] have also reported that the amputation rate decreased by 50 per cent and 83 per cent, respectively. Miller et al[23] and Barth et al[24] have shown that intensive foot-care education program could reduce the number of foot problems requiring treatment and hospitalization.

An interesting observation in our study was that less than half (38%) of the patients with foot ulcers were able to recognize the antecedent events of foot ulceration. Among the known events, excoriation and traumatic cut or punctured wound were commonly noticed. Unfitted shoe which is acclaimed to be a common cause of foot ulceration and lower limb amputation in Western countries[1,20,25] was found in only a few cases in our study. This might be because the majority of the diabetic patients in this study were home-based and most of them wore sandals in most of their everyday life.

Negligent self foot-care is a major factor contributing to lower limb amputation[1]. Appropriate management of diabetic foot ulcers including adequate assessment, adequate debridement of nonviable tissue, proper wound dressing, appropriate antibiotics, and good glycaemic control is important in the promotion of ulcer healing and prevention of amputation[26-28]. Our study has shown that all of the diabetic patients with foot ulcers had either neglected (45.5%) or inappropriately cared for (54.5%) their ulcers. This incorrect behavior in ulcer care might contribute to a delay in consulting diabetes specialists and poor therapeutic outcome in our patients. In patients who had cared for their foot ulcers by themselves, the common antiseptics and topical agents used for dressing the ulcers were 70 per cent ethanol, hydrogen peroxide, betadine solution, tincture iodine and mercurochrome which were either dangerous to subcutaneous tissues or not useful in the promotion of ulcer healing.

In conclusion, the present cross-sectional study has shown that self foot-care behavior is associated with foot ulceration in Thai diabetic patients. The patients who understand less about self foot-care practice have an increased risk of developing foot ulcers. An intensive foot-care education program and efficient diabetes care team are essential in the prevention of foot-ulceration and lower limb amputation in diabetic patients.

ACKNOWLEDGEMENTS

This study was supported by The National Epidemiology Board of Thailand. We wish to thank Mrs. Praneet Watanakejorn and Ms. Monchaya Tanlakij for their great help in collecting the data.

(Received for publication on June 3, 1997)

Appendix

Questionnaire for assessment of foot-care practice behaviour (total score 20)

	score
Category 1: Foot inspection	
How often do you inspect your feet?	
a) more than 5 times/week	3
b) 2-4 times/week	2
c) once a week or less	1
d) never	0
Category 2: Foot cleaning	
How often do you clean your feet?	
a) twice a day	2
b) once a day	1
c) never	0
What material(s) do you use for cleaning your feet?	
a) water and soap	1
b) water only	0
Do you clean the skin between toes?	
a) yes	1
b) no	0
Do you dry your feet immediately after foot cleaning?	
a) yes	1
b) no	0
What do you do when your feet are dirty?	
a) clean them at once	2
b) ignore	0
Category 3: Nail-care	
What instrument(s) do you use for cutting your toenails?	
a) straight end nail clipper or blunt scissors	2
b) curve end nail clipper	1
c) sharp scissors or knife	0
How do you cut your toenails?	
a) keep nail tip along the tip of toes	1
b) cut the nail as much as possible	0
Do you cut or dig the corner of nails and nail folds?	
a) no	2
b) yes	0
Category 4: Use of footwear	
How often do you wear shoes or sandals when walking outdoor?	
a) always	2
b) most of the time	1
c) occasionally - never	0
Do you wear slippers when walking in your house?	
a) yes, in every areas of the house	3
b) yes, only on the first floor and in bath room	2
c) yes, only in bath room	1
d) no	0

REFERENCES

1. Pecoraro RE, Reiber GE, Burgess EM. Pathways to diabetic limb amputation: Basis for prevention. Diabetes Care 1990; 13: 513-21.
2. Most RS, Sinnock P. The epidemiology of lower extremity amputations in diabetic individuals. Diabetes Care 1983; 6: 87-91.
3. Vichayanrat A, Lueseangdang L, Pitimanaaree S, Vannasaeng S, Inthuprapa M, Tandhanand S. Diabetic foot ulcer. Siriraj Hosp Gaz 1979; 31: 883-97.
4. Reiber GE. Diabetic foot care: Financial implications and practice guidelines. Diabetes Care 1992; 15: Suppl 1: 29-31.
5. Boulton AJM. The diabetic foot: Neuropathic in aetiology? Diabetic Med 1990; 7: 850-8.
6. Boulton AJM. Clinical presentation and management of diabetic neuropathy and foot ulceration. Diabetic Med 1991; 8 symposium; S52-S57.
7. Flynn MD, Tooke JE. Aetiology of diabetic foot ulceration: A role for the microcirculation? Diabetic Med 1992; 8: 320-9.
8. Ward JD. Vascular and neural damage in the diabetic foot. In: Andreani D, Crepaldi G, Di Mario U, Pozza G, eds. Diabetic complications: Early diagnosis and treatment. Chichester: John Wiley& Sons, 1987: 177-83.
9. LoGerfo FW, Coffman JD. Vascular and microvascular disease of the foot in diabetes: Implications for foot care. N Engl J Med 1984; 311: 1615-8.
10. Christensen NJ. Circulation in lower extremities and sympathetic function in diabetic patients: Significance of age. Diabetes Care 1990; 13: 30-3.
11. Walsh CH, Soler NG, FitzGerald MG, Malins JM. Association of foot lesions with retinopathy in patients with newly diagnosed diabetes. Lancet 1975; i: 878-80.
12. Crausaz FM, Clavel S, Liniger C, Albeanu A, Assal JP. Additional factors associated with plantar ulcers in diabetic neuropathy. Diabetic Med 1988; 5: 771-5.
13. Fernando DJS, Hutchison A, Veves A, Gokal R, Boulton AJM. Risk factors for non-ischaemic foot ulceration in diabetic nephropathy. Diabetic Med 1991; 8: 223-5.
14. Delbridge L, Appleberg M, Reeve TS. Factors associated with development of foot lesions in the diabetic. Surgery 1983; 93: 78-82.
15. Samal KC, Dey AB, Tripathy BB, Mohanty PC, Misra G, Misra NC. Obervations on diabetic foot. In: Bajaj JS, ed. Diabetes mellitus in developing countries. New Delhi: Interprint, 1984: 241-5.
16. Mustaffa BE, Ngan A. The foot at risk: Problems in developing countries. In: Larkins R, Zimmet P, Chisholm D, eds. Diabetes 1988. Excerpta Medica. Amsterdam: Elsevier, 1989: 1051-6.
17. Levin ME. Pathophysiology of diabetic foot lesions. In: Davidson JK, ed. Clinical diabetes mellitus. New York, Thieme, 1991: 504-20.
18. Davidson JK, Alogna M, Goldsmith M, et al. Assessment of program effectiveness at Grady Memorial Hospital, Atlanta, Georgia. In: Steiner G, Lawrence PA, eds. Educating diabetic patients. New York, Springer-Verlag, 1981: 329-42.
19. Assal JP, Muhlhauser I, Pernat A, Gfeller R, Jorges V, Berger M. Patient education as the basis for diabetes care in clinical practice. Diabetologia 1985; 28: 602-13.
20. Edmonds ME, Blundell MP, Morris ME, Cotton LT, Watkins PJ. Improved survival of the diabetic foot: the role of a specialized foot clinic. Q J Med 1986; 60: 763-71.
21. WHO Expert Committee on Diabetes Mellitus. Second report. WHO Technical report series 646. World Health Organization, Geneva 1980.
22. The Joslin clinic diabetes teaching guide, 1983. In: Kozak GP, Hoar CS Jr, Rowbotham JL, Wheelock FC Jr, Gibbons GW, Campbell D, eds. Management of diabetic foot problems. Philadelphia: WB Saunders, 1984: 229-32.
23. Miller LV, Goldstein J. More efficient care of diabetic patients in a county hospital setting. N Engl J Med 1972; 286: 1388-91.
24. Barth R, Campbell LV, Allen S, Jupp JJ, Chisholm DJ. Intensive education improves knowledge, compliance, and foot problems in type 2 diabetes. Diabetic Med 1991; 8: 111-7.
25. Miller J. Custom-made shoe: Therapy for diabetic foot. In: Brenner MA, ed. Management of the diabetic foot. Baltimore, Williams & Wilkins, 1987: 167-73.
26. Lippard OL. Podiatry. In: Levin ME, O' Neal LW, eds. The diabetic foot. St.Louis, CV Mosby, 1983: 330-59.
27. Rowbotham JL, Gibbons GW, Gray M, Frasca J. Local treatment of the diabetic foot. In: Kozak GP, Hoar CS Jr, Rowbotham JL, Wheelock FC Jr, Gibbons GW, Campbell D, eds. Management of diabetic foot problems. Philadelphia: WB Saunders, 1984: 113-21.
28. Brenner MA. Debridement, local care and management of diabetic lesions. In: Brenner MA, ed. Management of the diabetic foot. Baltimore, Williams & Wilkins, 1987: 110-9.

พฤติกรรมการดูแลเท้าและแผลที่เท้าด้วยตนเองในผู้ป่วยเบาหวานไม่พึ่งอินสุลิน

สุทิน ศรีอัษฎาพร, พ.บ., ศิริรัตน์ พลอยบุตร, ว.ทม.*,*
วรรณี นิธิยานันท์, พ.บ., สาธิต วรรณแสง, พ.บ.*, อภิชาติ วิชญาณรัตน์, พ.บ.**

คณะผู้วิจัยได้ศึกษาพฤติกรรมการดูแลเท้าของผู้ป่วยเบาหวานไม่พึ่งอินสุลินที่มีแผลที่เท้า 55 ราย (หญิง 42 ราย, ชาย 13 ราย) และ ที่ไม่มีแผลที่เท้า 110 ราย (หญิง 83 ราย, ชาย 27 ราย) โดยใช้แบบสอบถามเกี่ยวกับพฤติกรรมการดูแลเท้าซึ่งประกอบด้วย การสำรวจเท้า, การทำความสะอาดเท้า, การตัดเล็บ และ การสวมรองเท้า โดยมีคะแนนเต็ม 20 คะแนน. จากการศึกษาพบว่าผู้ป่วยเบาหวานกลุ่มที่มีแผลที่เท้ามีคะแนนการดูแลเท้ารวมเฉลี่ย (14.50 $\pm$ 3.35 คะแนน) น้อยกว่ากลุ่มที่ไม่มีแผลที่เท้า (15.74 $\pm$ 2.31 คะแนน) อย่างมีนัยสำคัญทางสถิติโดยมีค่า พี น้อยกว่า 0.01. นอกจากนี้ ผู้ป่วยเบาหวานกลุ่มที่มีแผลที่เท้ามีคะแนนการทำความสะอาดเท้า (7.35 $\pm$ 0.21 คะแนน) น้อยกว่ากลุ่มที่ไม่มีแผลที่เท้า (7.88 $\pm$ 0.11 คะแนน) อย่างมีนัยสำคัญทางสถิติโดยมีค่า พี น้อยกว่า 0.05. ผู้ป่วยเบาหวานที่มีคะแนนการดูแลเท้ารวมต่ำกว่า 15 คะแนนจะมีความเสี่ยงต่อการเกิดแผลที่เท้า 2.6 เท่าโดยมีค่าช่วงความเชื่อมั่นที่ร้อยละ 95 ระหว่าง 1.3 – 5.6. ในกลุ่มผู้ป่วยเบาหวานที่มีแผลที่เท้า ร้อยละ 45.5 ละเลยแผลที่เท้า และ ร้อยละ 54.5 มีพฤติกรรมการดูแลแผลที่เท้าด้วยตนเองไม่ถูกต้อง. โดยสรุปผู้ป่วยเบาหวานที่มีแผลที่เท้ามีความรู้และความเข้าใจเกี่ยวกับการดูแลเท้าน้อยกว่าผู้ป่วยเบาหวานที่ไม่มีแผลที่เท้า. พฤติกรรมการดูแลเท้าที่ไม่ถูกต้องโดยเฉพาะที่เกี่ยวกับการทำความสะอาดเท้ามีความสัมพันธ์กับการเพิ่มความเสี่ยงต่อการเกิดแผลที่เท้า. ผู้ป่วยเบาหวานควรได้รับการสอนเกี่ยวกับวิธีการดูแลเท้าที่ถูกต้องเพื่อป้องกันการเกิดแผลที่เท้าและควรได้รับการแนะนำเกี่ยวกับการปฏิบัติที่ถูกวิธีเมื่อมีแผลที่เท้าเกิดขึ้นเพื่อป้องกันหรือลดความรุนแรงของภาวะแทรกซ้อนของแผลที่เท้าซึ่งอาจเกิดขึ้นตามมา.

* ภาควิชาอายุรศาสตร์, คณะแพทยศาสตร์ศิริราชพยาบาล, มหาวิทยาลัยมหิดล, กรุงเทพ 10700