

# Common Foot Problems in Diabetic Foot Clinic

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**Objective:** To study common foot problems presented in diabetic foot clinic.

**Material and Method:** A retrospectively review of out patient department records and diabetic foot evaluation forms of patients who visited the diabetic foot clinic at King Chulalongkorn Memorial Hospital between 2004 and 2006.

**Results:** Of all diabetic patients, 70 men and 80 women with the average age of 63.8 years were included in this study. About 32% of all reported cases had lower extremity amputation in which the toe was the most common level. Foot problems were evaluated and categorized in four aspects, dermatological, neurological, musculoskeletal, and vascular, which were 67.30%, 79.3%, 74.0%, and 39.3% respectively. More than half of the patients had skin dryness, nail problem and callus formation. Fifty six percent had the abnormal plantar pressure area, which was presented as callus. The great toe was the most common site of callus formation, which was correlated with gait cycle. The current ulcer was 18.8%, which was presented mostly at heel and great toe. Three-fourth of the patients (75.3%) had lost protective sensation, measured by the 5.07 monofilament testing. The most common problem found in musculoskeletal system was limited motion of the joint (44.0%). Claw toe or hammer toe were reported as 32.0% whereas the other deformities were bunion (12.0%), charcot joint (6.0%) and flat feet (5.3%). The authors classified patients based on category risk to further lower extremity amputation into four groups. Forty-seven percent had highest risk for having further amputation because they had lost protective sensation from monofilament testing, previous current ulcer, or history of amputation. Only half of the patients had previous foot care education.

**Conclusion:** Multidisciplinary diabetic foot care including patient education (proper foot care and footwear), early detection, effective management of foot problems, and scheduled follow-up must be emphasized to prevent diabetes-related lower extremities amputation.

**Keywords:** Diabetic foot problems, Diabetic foot ulcer, Non-traumatic lower extremity amputation

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Diabetic foot ulcer is the leading cause of non-traumatic lower extremity amputation. About 80% of amputation had foot ulcer<sup>(1-3)</sup>. Contra-lateral limb amputations within 5 years were 15-50%. The incidence of amputation could be decreased up to 80% by multidisciplinary diabetic foot care including patient education (proper foot care and foot wear), early detection and effective management of foot problems, and scheduled follow-up<sup>(4-5)</sup>. Diabetic foot clinic was set up in the division of rehabilitation medicine, King

Chulalongkorn Memorial Hospital for 2 years with the main purpose for prevention of lower extremities amputations. The authors would like to study common foot problems in order to improve the quality of care of diabetic patients.

## Material and Method

The data were retrospectively collected from out patient department records and diabetic foot evaluation forms of all patients who visited the diabetic foot clinic at King Chulalongkorn Memorial Hospital between 2004 and 2006. Diabetic foot evaluation form contained the patients' general data, related

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history, and foot evaluation for risks of amputation. Foot problems were evaluated and categorized into four aspects, dermatological, neurological, musculoskeletal, and vascular problems<sup>(6)</sup>. The data were analyzed and reported as frequency, mean, and standard deviation (SD).

## Results

Seventy men and 80 women with the average age of  $63.8 \pm 10.35$  years were included in this study. Body mass index (BMI) was recorded from 87 cases. The average BMI was  $26.84 \pm 4.89$ . Sixty-nine cases were classified as overweight to obesity (BMI above  $23.0 \text{ mg/m}^2$ )<sup>(7)</sup>. Duration of diabetes was varied from less than 1 year to 45 years ( $14.9 \pm 10.8$  years). Fifty-eight point three percent of patients received oral hypoglycemic medications whereas 41.3% received insulin to control their blood sugar. About 30% of all patients had a history of smoking and 27% of the

smokers were still smoking. About 32% of the patients had lower extremity amputations. Most common level was toe amputation as shown in Table 1. Great toe was the most common site of toe amputation (28.9%). Foot problems were evaluated and categorized into four aspects, dermatological, neurological, musculoskeletal, and vascular, which were 67.30%, 79.3%, 74.0%, and 39.3% respectively. Each system is demonstrated in detail in Table 2<sup>(5)</sup>. The authors evaluated three sensory modalities that were pinprick sensation, joint proprioception, and protective sensation. Two degrees of sensory deficit was stratified, impaired (ability to perceive sensation but not equal to the other examined areas) and loss (inability to perceive sensation in the examined area).

Calluses were found in 56% of patients. Common areas of callus formation were presented at the great toe (40%), first metatarsal head (14%) and fifth toe (12.6%). Current ulcers were found in 18.8% of patients. Most common area of ulcer was at heel (6%), great toe (5.33%), and midfoot (3.33%). Callus and ulcers sites are shown in Table 3.

The authors have used clinical feature to categorize patients based on risk to future lower extremities amputation into four groups as shown in Table 4<sup>(5)</sup>. The authors used 10-gram Semmes-Weinstein filament to determine the protective sensation in ten areas of each foot and defined loss of protective sensation as the inability to feel the 10-gram

**Table 1.** Level of lower extremities amputation (n = 150)

Level of amputation	Frequency [cases (%)]
Toe	18 (12.0)
Below knee	17 (11.3)
Mid foot	2 (1.3)
Above knee	1 (0.7)

**Table 2.** Prevalence of foot problems categorized into 4 main systems

System [cases (%)]	Details [cases (%)]
Dermatological 101(67.3)	1. Skin problem 87 (58): Dryness 74 (49.3), Fragile 26 (17.3), Tinea pedis 1 (0.7) 2. Nail problem 81 (54): Thick nail 47 (31.3), Onychomycosis 21 (14.0), Atrophic nail 11 (7.33), Too long 10 (6.67), Ingrown 8 (5.3) 3. Callus 84 (56) 4. Current ulcer 36 (24)
Neurological 119(79.3)	1. Weakness: Great toe dorsiflexors 44 (29.3), Ankle evertors 22 (14.6), Ankle dorsiflexors 19 (12.67), Ankle invertors 17 (11.3), Ankle plantarflexor 8 (12) 2. Sensory deficit: a. Pinprick sensation; impair 69 (46) and loss 21 (14) b. Joint proprioception; impair 55 (36.7) and loss 25 (16.7) c. Loss protective sensation 113 (75.3)
Musculoskeletal 111 (74)	1. Limit range of motion 67 (44.7): Ankle eversion 27 (18), Ankle dorsiflexion 24 (16), Ankle inversion 22 (14.6), Great toe dorsiflexion 21 (14), Ankle plantarflexion 12 (8) 2. Claw toe or hammer toe 48 (32) 3. Bunion / Hallux valgus 18 (12) 4. Charcot joint at mid foot 9 (6) 5. Flat feet 8 (5.3)
Vascular 59 (39.3)	Absence posterior tibial pulse 55 (36.7), Absence dorsalis pedis pulse 40 (26.7)

**Table 3.** Location of callus and current ulcer

Location	Callus [cases (%)]	Current ulcer [cases (%)]
Great toe	60 (40.0)*	8 (5.33)*
2 <sup>nd</sup> toe	15 (10.0)	1 (0.67)
3 <sup>rd</sup> toe	11 (7.3)	-
4 <sup>th</sup> toe	14 (9.3)	4 (2.67)
5 <sup>th</sup> toe	19 (12.6)	4 (2.67)
1 <sup>st</sup> metatarsal head	21 (14.0)*	1 (0.67)
2 <sup>nd</sup> metatarsal head	17 (11.3)	2 (1.33)
3 <sup>rd</sup> metatarsal head	2 (1.33)	2 (1.33)
4 <sup>th</sup> metatarsal head	-	2 (1.33)
5 <sup>th</sup> metatarsal head	12 (8.0)	4 (2.67)
Midfoot	7 (4.67)	5 (3.33)*
Heel	5 (3.33)	9 (6)*
Malleolus	1 (0.7)	4 (2.67)
Lateral aspect of foot	-	1 (0.67)

\* The most common sites

Semmes-Weinstein filament at 1 or more locations on the foot<sup>(8)</sup>. Seventy-five point three percent had high-risk, among these, 47.3% were defined as the highest risk group. About 54.7% of all patients had previous foot care education. Seventy-nine point five percent of all patients regularly checked their feet by themselves, whereas 20.5% had a member of the family to check them. About 68% reported that they walked barefoot especially indoors and only 28% who wore shoes both indoor and outdoor.

### Discussion

The authors found that the most common level of lower extremity amputation was toe level. The finding differs from the previous study in Thailand which indicated that the below knee was the most common level<sup>(9,10)</sup>. This must be due to improving foot care, vascular management, and surgical technique so surgeons can preserve the foot more than in the past. However, partial foot amputation needs special foot orthosis and footwear.

More than half of the patients had dermatological problems. Skin dryness was the most common skin problem. Dry skin can progress to skin crack and fissuring, which is a good entry of bacteria and leads to infection. Half of the patients had nail problems including thick nail and onychomycosis. Skin and nail care are problems of elderly patients due to eye problems, sensory deficits or physical limitation. Education to patient and caregiver is important. The prevalence of callus and foot ulcer was 56.6% and 18.8% respectively. The callus formation indicates increasing plantar pressure of that area and need intervention to relieve this abnormal pressure<sup>(8,11)</sup>. High plantar pressure was associated with an increased risk of skin breakdown<sup>(12,13)</sup>. The common area of callus was presented at the forefoot in which the great toe was the most common site. This area is correlated with the dynamic plantar foot pressure occurred during walking, which is risk to foot ulceration<sup>(14)</sup>. Current ulcers were presented in forefoot; especially great toe, and hind foot which were correlated with weight bearing area on the feet during walking<sup>(12)</sup>. Off-loading with proper shoes and foot orthoses are one of the keys for ulcer healing.

Peripheral neuropathy is common in diabetic patients. The callus and ulcer sometimes are found among diabetic patients who denied foot numbness. The reason is that diabetic patients often do not recognize plantar pressure while walking or abnormal pressure from inappropriate footwear. The authors preferred to increase sensitivity for protective sensation testing by defining the absence of protective sensation as the inability to feel monofilament at least one or more locations on the foot. The present study showed that most common sensory deficit was loss of protective sensation (75.3%), which was considered as one of the risk factors to develop foot ulceration and future limb amputation<sup>(15)</sup>.

The limitation of range of motion was the most common musculoskeletal problems, which were

**Table 4.** Group of patients categorized by using risk to further lower extremities amputation

Category	Risk profile	Frequency [cases (%)]
0	No loss of protective sensation	37 (24.7)
1	Loss of protective sensation	19 (12.7)
2	Loss of protective sensation and evidence of high foot pressure (callus, deformity) or poor circulation	23 (15.3)
3	History of plantar ulceration ,amputation or Charcot fracture	71 (47.3)

presented especially in the ankle and great toe. Claw toe or hammer toe, which contributed to plantar ulcer, were reported as 32.0%. The other deformities were bunion (12.0%), charcot joint (6.0%), and flat feet (5.3%). Although the joint immobility is not directly related to foot ulcer risk, it may contribute with increasing plantar foot pressure<sup>(15,16)</sup>.

Peripheral vascular disease (PVD) is the risk for ulceration and interferes with ulcer healing. Smoking is a risk factor for PVD. There was 27% of patients who were still smoking. Pedal pulse palpation is the good screening. The present study showed 26.7% absence of dorsalis pedis and 36.7% absence of posterior tibial pulse. These patients had an indication for ankle-brachial index and further vascular evaluation.

The authors classified patients into four groups based on category risk for amputation by presence of protective sensation, high-pressure area on the feet and history of amputation, ulcer, or neuropathic fracture. Seventy-five point three percent had loss of protective sensation and 47.3% of patients were classified as highest risk group for amputation. The high prevalence of neuropathy may be due to the referring system, which tends to receive the patients who have obvious foot problems.

Sixty-eight percent of the patients reported experience of walking barefoot especially indoors. The interesting point was that, in Thai culture, people are used to walk barefoot in their accommodations. Protective footwear especially indoor footwear should be strongly recommended. The support insole, reducing the plantar foot pressure, should be considered in high-risk groups. The risk of foot ulceration and amputation can be reduced by careful screening and patient education<sup>(5)</sup>. Unfortunately, only half of diabetic patients had previous foot care education.

### Conclusion

About 70% of all diabetes had neurological, dermatological and musculoskeletal problems. Vascular abnormality was found in about 40% of cases. More than half of the patients had skin dryness, nail problems, and callus formation. Three-fourth of the patients had a high-risk of further lower extremity amputations. About 70% of diabetic patients walked barefoot. Only half of the patients had previous foot care education. Multidisciplinary diabetic foot care including patient education (proper foot care and foot wear), early detection and effective management of foot problems, and scheduled follow-up must be emphasized to prevent diabetes related lower extremity amputations.

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## ปัญหาเท้าที่พบบ่อยในคลินิกเท้าเบาหวาน

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**วัตถุประสงค์:** เพื่อศึกษาถึงปัญหาเท้าที่พบบ่อยในผู้ป่วยคลินิกเท้าเบาหวาน

**วิธีการศึกษา:** เก็บข้อมูลย้อนหลังจากเวชระเบียนผู้ป่วยนอกและแบบบันทึกการตรวจคัดกรองของผู้ป่วยคลินิกเท้าเบาหวานโรงพยาบาลจุฬาลงกรณ์ ตั้งแต่ปี พ.ศ. 2548-2549

**ผลการศึกษา:** พบเพศชาย 70 ราย และเพศหญิง 80 รายซึ่งมีอายุเฉลี่ย 63.8 ปี ประมาณร้อยละ 32 มีประวัติการถูกตัดขาโดยนิ้วเท้าเป็นระดับที่ถูกตัดมากที่สุด ปัญหาเท้าถูกประเมินและแบ่งเป็น 4 กลุ่มดังนี้ ผิวหนัง (ร้อยละ 67.3) ระบบประสาท (ร้อยละ 79.3) กระดูกและกล้ามเนื้อ (ร้อยละ 74.0) และหลอดเลือด (ร้อยละ 39.3) ร้อยละ 56 มีผิวหนังที่หนาขึ้นจากแรงกดที่ผิดปกติบริเวณฝ่าเท้าโดยนิ้วหัวแม่เท้าเป็นตำแหน่งที่หนังแข็งดงกล่าวมากที่สุด ผู้ป่วยที่ยังมีแผลเรื้อรังที่เท้าคิดเป็นร้อยละ 18 ซึ่งบริเวณสันและนิ้วหัวแม่เท้าเป็นตำแหน่งที่เกิดแผลเรื้อรังมากที่สุด ผู้ป่วยจำนวนมากกว่าครึ่ง (ร้อยละ 75.3) สูญเสียความรู้สึกป้องกันของเท้า ปัญหาทางกระดูกและข้อที่พบบ่อยที่สุดคือ การเคลื่อนไหวของข้อที่ลดลง (ร้อยละ 44.0) พบนิ้วเท้าผิดรูปชนิด claw toe หรือ hammer toe คิดเป็นร้อยละ 32.0 ขณะที่ลักษณะผิดรูปอื่น ๆ ที่ถูกพบคือ bunion (ร้อยละ 12.0), charcot joint (ร้อยละ 6.0) และเท้าแบน (ร้อยละ 5.3) ผู้นิพนธ์ได้แบ่งกลุ่มผู้ป่วยตามความเสี่ยงต่อการถูกตัดขาครั้งต่อไปเป็น 4 ระดับ พบว่าร้อยละ 47.3 ของผู้ป่วยทั้งหมดมีความเสี่ยงสูงเนื่องจากสูญเสียการรับความรู้สึกป้องกันอันตรายที่เท้ารวมถึงมีประวัติการเกิดแผลเรื้อรังหรือการถูกตัดขามาก่อน **สรุป:** ร้อยละ 70 ของผู้ป่วยเบาหวานมีปัญหาของเท้าในด้านผิวหนัง ระบบประสาท กระดูกกล้ามเนื้อมากกว่าครึ่งของผู้ป่วยมีผิวหนังแห้ง เล็บผิดปกติ และผิวหนังหนา พบตำแหน่งหนังหนาและแผลเรื้อรังมากที่สุดที่บริเวณนิ้วหัวแม่เท้า ซึ่งสัมพันธ์กับการเดิน ประมาณสามในสี่ของผู้ป่วยมีความเสี่ยงต่อการถูกตัดขาเนื่องจากสูญเสียความรู้สึกป้องกันอันตรายที่เท้า แต่มีผู้ป่วยเพียงครึ่งหนึ่งที่ได้รับความรู้ในการดูแลเท้า ดังนั้นการดูแลผู้ป่วยแบบองค์รวมซึ่งประกอบด้วย การให้ความรู้ในการดูแลเท้าและเลือกรองเท้าที่เหมาะสม ร่วมกับการดูแลรักษาปัญหาของเท้าอย่างมีประสิทธิภาพ และการติดตามผลการรักษาอย่างต่อเนื่องจะช่วยป้องกันไม่ให้ผู้ป่วยเบาหวานถูกตัดขาได้