

Diabetic Foot Management: A Review of Current Knowledge

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Abstract

In recent years, Diabetes Mellitus (DM) has become more common. This issue will become critical throughout Asia, including Thailand, because the prevalence increase in type 2 DM shows no sign of reaching a plateau. As is well known, the most common cause of leg amputation in non-traumatic patients is DM foot. This is because DM patients have neuropathy, angiopathy, and immunopathy. The aim of the present review is to briefly update information on DM foot management, in particular on ulcer prevention, foot infection management, off-loading technique, footwear, revascularization, and prognosis. At the end of this review, we report our research on the strikingly poor prognosis of Asian DM patients with peripheral arterial disease observed during a six-month period.

Keywords: Diabetes, foot ulcer, update, management

Diabetes Mellitus (DM) is becoming increasingly common. Worldwide, there are expected to be 300 million diabetics by 2025, and 360 million by 2030¹. This issue is critical in Asia, including Thailand, as the prevalence of type 2 DM and obesity continues to increase, with no sign of reaching a plateau². More importantly, Asians seem to develop DM at a younger age, suffer longer with complications, and die sooner than people in other continents. DM, which can lead

to neuropathy, angiopathy and immunopathy, is the most common cause of non-traumatic leg amputation. Also, DM is associated with poor wound healing due to various cell-level dysfunctions, such as impaired fibroblast proliferation/collagen production, impaired release of growth factors, and impaired phagocytosis and macrophage function³. Foot ulcers are common in DM patients, and are not only dangerous, but also impact tremendously the quality of life⁴. As treatment

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of DM foot ulcers is a heavy burden on the medical system, prevention is the key. This brief review summarizes the current state of knowledge on DM foot management.

Prevention

Prevention is the key. This includes self-care education, glycemic control, off-loading technique and early ulcer treatment. Our previous study showed that a multidisciplinary approach could reduce the major amputation rate from 14 % to 4 %, compared with conventional treatment (non-multidisciplinary team approach)⁵. This remains true today⁶. The multidisciplinary approach can also improve quality of life, including physical and emotional health⁷, as well as reduce treatment costs.

Infection

DM foot infection is a major risk factor for limb loss⁸. Prior to 2012, many different classification systems were used for DM foot infections, such as Wagner's Classification and the University of Texas San Antonio's Classification⁹. In 2012, the Infectious Disease Society of America (IDSA) proposed a new classification system which was easy to apply, and it has become the most popular. The IDSA guidelines cover the whole range of management in DM foot infections, including "when to suspect infection", "how to send specimen for culture" and "how to use proper systemic antibiotics".

One of the severe forms of DM foot infection is osteomyelitis. It is controversial whether treatment should begin with microbial therapy, or operation. However, it had long been recognized by most surgeons that excision of infected and necrotic bone, followed by systemic antibiotics, was the most effective treatment¹⁰. This is because in the past, antimicrobial therapy alone presents disappointing outcomes, and 20 to 30% of the cases may worsen during treatment. Also, the recurrence rate is as high as 30% within 2 to 3 years¹¹. In 2014, a randomized controlled trial (around 50 patients each arm) reported that there was no significant difference between antimicrobial therapy and conservative surgery in the effectiveness of treating osteomyelitis¹². Also last year, a randomized controlled trial showed no significant difference in outcome between 6 and 12 weeks of antimicrobial therapy¹³.

Off-loading technique

Off-loading technique is a fundamental component of neuropathic wound treatment. Many off-loading technique options exist, e.g., total contact cast (TCC), cast walker, half shoe, therapeutic shoes with custom foot orthoses, shoe with traditional dressing changes, and several types of custom made orthosis¹⁴. The 2014 Cochrane Review indicated that non-removable casts provided the most effective pressure relieving treatment for the healing of DM foot ulcers¹⁵. The consensus recommendation for treating neuropathic ulcers says that "TCC is the ideal method and is supported by the highest level of evidence"¹⁶. TCC works by decreasing pressure in the metatarsal area by 69% and in the heel by 45%. Also, TCC provides intimate contact and pressure redistribution and, of course, ensures 100% compliance¹⁷. However, there is a big gap between theory and practice¹⁸. Based on a wound registry in the USA, off-loading technique is used in only 2.2% of patients. Approximately 96 % of the cases did not receive TCC, although the patients were eligible. This might be due to patient intolerance or non-compliance, lack of clinician endorsement, the long application time, the complicated methodology, and customization issues and/or cost. This study suggests that a new, easier-to-apply TCC method, such as the TCC-EZ, might increase the frequency of use¹⁸.

Footwear

In 2015, the International Working Group on the Diabetic Foot (IWGDF) provided guidance on preventing and managing foot problems in diabetics that is considered the current, evidence-based, global consensus¹⁹. According to the guidelines, inappropriate footwear and walking barefoot with an insensitive foot are the primary causes of foot ulcerations. In addition, patients with loss of protective sensation should have access to appropriate footwear regardless of the patient's ability to pay. All hospitals and medical centers should follow this guidance.

Revascularisation

The comparative role of endovascular treatment versus surgical bypass in severe leg ischemia due to infrainguinal disease was considered settled with the publication of a landmark, randomized controlled trial (the BASIL trial) in 2005²⁰. The results indicated

that bypass surgery-first and balloon-angioplasty-first strategies are associated with similar outcomes in terms of amputation-free survival, although patency remained better in the bypass group²¹. However, recently, physicians supporting endovascular treatment have criticized the BASIL trial as being inapplicable to current endovascular techniques. Today, newer and safer devices for recanalising difficult occlusions, drug coated balloons, and retrograde recanalization techniques are available, whereas at the time of the BASIL trial, only balloon angioplasty existed. Two new trials are underway to resolve this issue. The BASIL 2 trial, conducted in the UK, seeks to compare the clinical and cost-effectiveness of current endovascular technique-first or bypass-first strategies for treating severe limb ischaemia due to infra-popliteal disease²². The BASIL 3 trial is a multi-centre, randomized controlled trial of the clinical and cost-effectiveness of drug coated balloons, drug eluting stents and plain balloon angioplasty with bail-out bare metal stent revascularisation strategies for severe limb ischaemia due to femoro-popliteal disease. Pending the outcomes of these trials, the debate between endovascular-first or bypass-first treatment continues²³.

Prognosis

In 2007, Armstrong suggested that the prognosis of DM neuropathic ulcer is worse than many types of cancer²⁴. The five-year mortality risk of neuropathic ulcer is 45%, similar to that of colon cancer (48%), but much worse than those of breast cancer (18%), and prostate cancer (8%). In Spain, the prognosis is even worse for DM patients with a history of cardiovascular disease and amputation²⁵. By the end of 2015, our group reported a strikingly poor prognosis for Asian DM patients with peripheral artery disease (PAD), as observed within as short as a six-month period²⁶. Briefly, a consecutive cohort of 500 DM patients diagnosed with PAD in Northern Thailand between 2014 and 2015 was followed²⁷. The primary end point was MACE, which encompassed non-fatal myocardial infarction, non-fatal stroke, worsening PAD and death. Sixteen potential clinical predictors were entered into a Cox proportional hazard model and backward stepwise regression was performed. During a mean follow-up period of 5.35 months, 55 MACE events occurred, corresponding to a cumulative incidence of 11%. There were 16 deaths (3.2%). Independent

clinical predictors in the final model were: a history of gangrene or chronic ulcer (hazard ratio (HR), 7.20), male and a current smoker (HR, 3.34), male with a history of smoking (HR, 2.10), chronic kidney disease (HR, 2.00), and a history of taking warfarin (HR, 2.88). The clinical prediction model for MACE in the first six months after the diagnosis of PAD in DM patients may be used to identify high-risk patients, to help optimize medical treatment and control risk factors as part of a secondary prevention program to increase life free from MACE.

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CONFLICT OF INTEREST

None to declare.

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บทคัดย่อ การทบทวนความรู้ด้านการจัดการเท้าเบาหวาน

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ในช่วงหลายปีที่ผ่านมาอุบัติการณ์ของโรคเบาหวานพบบ่อยขึ้นและเป็นปัญหาที่วิกฤต โดยเฉพาะทางเอเชีย รวมถึงประเทศไทย จากสถิติของธนาคารโลกมีการคาดการณ์ว่าความชุกชุมของโรคเบาหวานประเภท 2 และโรคอ้วนจะเพิ่มขึ้นในทวีปเอเชียมากกว่าทางทวีปยุโรปหรือทวีปอเมริกาในอนาคตอันใกล้ และมีแนวโน้มเพิ่มขึ้นเรื่อยๆ และยังไม่พบจุดที่หยุดการเพิ่มหรือลดลง เป็นที่ทราบดีว่านอกจากสาเหตุอุบัติเหตุ เบาหวานเป็นสาเหตุการตัดขาดที่บ่อยที่สุดเพราะโรคเบาหวานก่อให้เกิดเส้นประสาทเสื่อม หลอดเลือดส่วนปลายอุดตัน ภูมิคุ้มกันต่อเชื้อโรคบกพร่อง ในบทความนี้มีจุดประสงค์ต้องการที่จะสรุปทบทวนความรู้ในปีที่ผ่านมาเกี่ยวกับการบริหารรักษาโรคเท้าเบาหวานในด้านการป้องกัน ด้านการลดแรงกดต่อฝ่าเท้า ด้านรองเท้าที่เหมาะสม ด้านเทคนิคการเพิ่มเลือดเลี้ยงขาและการพยากรณ์โรค สุดท้ายบทความนี้ได้สรุปผลงานวิจัยของกลุ่มวิจัยที่พบว่าในผู้ป่วยเบาหวานและมีโรคหลอดเลือดส่วนปลายอุดตันในคนไทยพบว่ามีพยากรณ์โรคที่ไม่ดีมาก พบว่ามีอัตราการเสียชีวิตและโรคหัวใจขาดเลือด โรคสมองขาดเลือดสูง แม้กระทั่งในช่วงระยะเวลา 6 เดือนแรก
