

# Enhanced diabetic foot examination in lower-limb injuries presenting to the emergency department

Andrew Peace, Joanne Mitchell and Nicholas Barwell

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## Article points

1. People with diabetes presenting to the emergency department (ED) with traumatic foot and ankle injuries should be examined with the suspicion that they may have developed diabetic complications, such as neuropathy.
2. Using a simple examination tool, such as the Touch the Toes Test, can improve the detection of neuropathy in diabetic people in the acute setting.
3. Simple training and awareness measures can improve the quality of diabetic foot examinations carried out in the ED, which may, in turn, affect future management.

## Key words

- Audit
- Enhanced examination
- Neuropathy
- Staff Training

## Authors

Andrew Peace is Clinical Development Fellow, Emergency Department, Forth Valley Royal Hospital; Joanne Mitchell is Emergency Medicine Consultant, Emergency Department, Forth Valley Royal Hospital; Nicholas Barwell is Consultant Physician, Department of Diabetes & Endocrinology, Forth Valley Royal Hospital, Scotland

**Appropriate foot care is essential for people living with diabetes, particularly after sustaining an injury. Ankle and foot injuries are among the most common presentations to the Emergency Department (ED), however, in the acute setting, factors such as pre-existing diabetic neuropathy are often under recognised or missed. The authors aimed to introduce a validated tool to screen people with diabetes who present with lower-limb injuries for the presence of neuropathy. In performing a test that is validated in detecting a sensory diabetic neuropathy that can be easily adapted for use in the ED (the Ipswich Touch Test), these people can undergo a more comprehensive assessment. Importantly, the test is fast, easy to perform and does not require additional equipment. Although the authors did not specifically measure the detection of occult Charcot neuroarthropathy as an outcome, the detection of diabetic neuropathy may alter clinical management by lowering the threshold for use of radiography.**

**I**dentification of diabetic neuropathy is imperative for good patient care, regardless of context and is perhaps the most important risk factor for developing complications, such as a diabetic foot ulcer (DFU) and arthropathy (Boulton, 2014; Young et al, 1994). As such, a national foot screening programme is embedded in primary and secondary care systems, with evidence that these services ultimately reduce the risk of amputation (Gibson et al, 2014).

In the emergency department (ED), formal examination for diabetic neuropathy is rarely performed in the context of trauma. Furthermore, chronic issues, such as diabetes mellitus and associated complications, can often be overlooked in an ED environment. For example, the assessment of lower-limb injuries frequently include use of Ottawa ankle rules as evidence-based decision aids as to whether X-rays are required (Stiell et al, 1994). However, these rules may not apply to patients with impaired distal sensation (McLaughlin et al, 1998). Notably, in its most recent iteration the

guidance includes the recommendation that clinical judgement should prevail over the rules in certain circumstances, including reduced sensation in lower limbs (Stiell, 2018).

In order to improve the investigation and care of people with diabetes presenting to the ED with lower-limb trauma, the authors aimed to implement the Ipswich Touch Test (Rayman et al, 2011), also known nationally as the ‘Touch the Toes Test’ (TTT) as part of the routine examination of diabetic ankle and foot trauma. The authors expected that use of this validated screening tool would increase the detection of neuropathy, thus lowering the threshold for both radiography and onward specialty referral (e.g. podiatry, orthotics etc).

In addition, people with diabetes may present after a minor traumatic event as an index presentation for a more insidious inflammatory or degenerative process, such as Charcot neuroarthropathy. Detection and documentation of neuropathy status in these patients has the potential

to alter management and may have an important influence on long-term outcomes (Elyas et al, 2005).

**Aims**

The authors aimed to implement enhanced examinations of diabetic feet using a validated tool (TTT) in patients with diabetes presenting to ED with lower-limb trauma, achieving documentation of TTT use in 50% of patients. To facilitate this, the number of patients in this cohort presenting to ED were audited and a teaching programme instituted to support all clinical staff to increase their awareness and understanding of diabetic neuropathy.

**Methods**

The TTT was identified as an appropriate tool for enhanced examination (Rayman et al, 2011). This test involves the examiner lightly touching the tips of the first, third and fifth toes (alternating between both feet), seeking a verbal response to physical stimulation while the subject keeps their eyes closed. The results of the original study showed that the test had excellent concordance when compared with the other methods of sensory testing, particularly the use of a 10-g monofilament. Following the publication of the paper by Rayman et al (2011), Diabetes UK adopted this method of sensory testing for non-specialist groups, including lay people, renaming it the ‘Touch the Toes Test’ (Diabetes UK, 2016).

A quality improvement approach was undertaken, using rapid cycle audit (every 2 weeks). In the initial phase, multiple approaches to raise awareness of the TTT were undertaken, followed by single interventions every 2-week cycle to gauge response. Initial pre-intervention data was collected in a two-week period in October 2017, followed by a rolling 2-week audit cycle between February and May 2018. Data were gathered over a total of 14 consecutive weeks.

Interventions included multidisciplinary group teaching, TTT test updates at the ED safety briefing, regular departmental emails and liaison with the diabetes team, including feedback to ED staff (Figure 1).

Patients were identified using a combination of the Emergency Department Information System (iSoft plc, Banbury, Oxfordshire, UK) and the Emergency Care Summary IT system (Atos corp, Bezons, France). Patients with diagnoses entered as

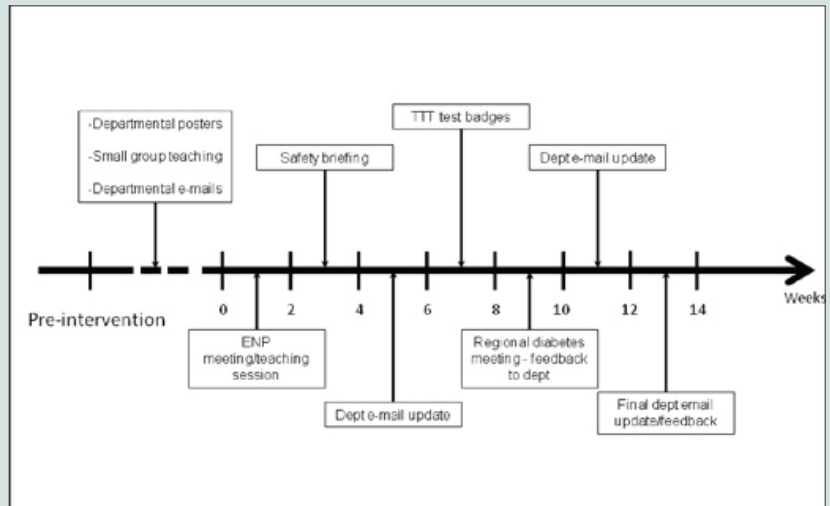


Figure 1. Timeline of interventions from 0–14 weeks. ENP – Emergency nurse practitioner, TTT – Touch the Toes.

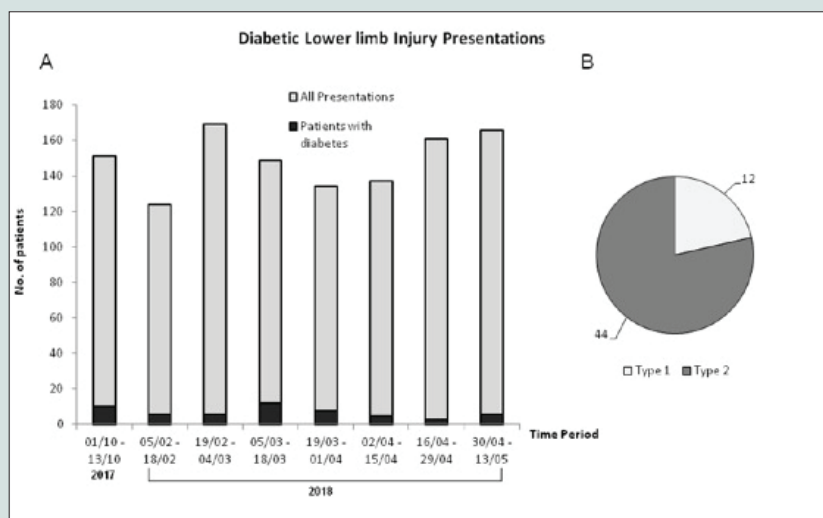


Figure 2. (a) Total emergency department presentations of ankle/foot/toe injuries displayed as total number of presentations/patients with diabetes mellitus (b) Total number of diabetic presentations throughout audit period by classification.

“ankle”, “foot” or “toe” injuries were used as search criteria. Patients concurrently receiving a prescription for anti-hyperglycaemic medication were selected for paper note review and confirmation of a diagnosis of type 1 or type 2 diabetes.

Documentation of the TTT being performed was counted as a primary outcome and documentation of any neurological exam (any form of documented neurological assessment was accepted) was counted as a secondary outcome. Patients who were judged to have suffered severe trauma were superseded by a formal neurological examination and not included

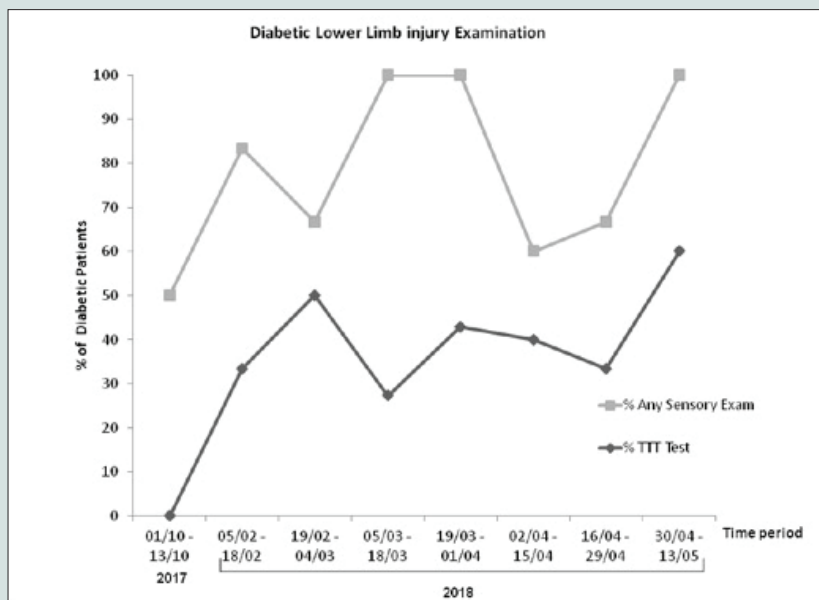


Figure 3. Documented neurological examination of lower limb (ankle/foot/toe) injuries in diabetic patients presenting throughout audit period (Touch the Toes).



Figure 4. Example of TTT test badges (www.respond2pressure.com) handed out to ED staff. The Check-Protect-Refer algorithm was devised by Duncan Stang (NHS Scotland, 2017).

in the primary or secondary outcome data, but were included in the “All presentations” audit data.

### Results

Over the duration of the measurement period, an average of 149 presentations over each 2-week cycle presented with a primary diagnosis of ankle, foot or toe injury; a total of 1,191 presentations (Figure 2a). Of these, 44 had a diagnosis of type 2 diabetes and 12 of type 1 (Figure 2b). Thus, 4.7% of all presentations had an established diagnosis of diabetes.

Baseline data were gained during a 2-week period in October 2017, at which point no validated tool was being used to record sensation in diabetic foot injuries. Some 50% of presentations had a documented sensory exam of any description (5 of 10; Figure 3). After 8 weeks of interventions (19/03–01/04), 100% of patients (6 of 6) had a documented sensory examination, with the number of TTT tests documented increasing from 0% to 50% (3 of 6). Documentation of diabetic foot exams subsequently declined following this, during a period of junior medical staff changeover (April 4th). By the end of the audit period, TTT test

documentation had improved to 60% (3 of 5) with all presentations having some form of sensory examination (5 of 5; Figure 3).

Excluding the initial pre-intervention data, throughout the 14-week period, 39.5% of presentations had a documented TTT test (17 of 43) and 86% had a sensory exam of any kind documented (37 of 43).

### Discussion

We found that 4.7% of presentations of lower-limb trauma to the ED have an established diagnosis of diabetes. This is reflective of the prevalence of diabetes in the Scottish population, recorded at 5.4% in the latest available publication of Scottish Diabetes Survey (NHS Scotland, 2016). Interestingly, there was minimal variation in terms of total number of injury presentations throughout the audit period, despite significant adverse winter weather conditions during February and March.

Approximately 21% of presentations (12 of 56) in this study had type 1 diabetes, which is almost double the prevalence of type 1 diabetes seen nationally. This is likely to be due to the relatively small number of presentations measured.

In terms of primary outcome data, the authors found that after initial efforts to raise awareness and promote the education of the multidisciplinary team in the ED, the TTT test was documented consistently in almost half the number of presentations measured; albeit with some expected variation (*Figure 3*). For example, medical staff changeover on the April 4th resulted in a decline in the standard of diabetic foot exams.

As a secondary outcome, documentation of any sensory examination of diabetic feet was recorded. Interestingly, this seemed to improve compared to the pre-intervention rates, with 100% of patients having a documented sensory exam in several audit cycles (*Figure 3*).

There are significant barriers to a change in healthcare practice, which include; awareness and knowledge, motivation, beliefs, attitudes and skills (van der Goot et al, 2018). The authors have attempted to address these issues by raising awareness through small group teaching sessions, stressing the scale of diabetic foot problems and highlighting the relevance of diabetic neuropathy in the ED through the use of local case examples.

In addition, staff awareness of diabetic foot exams was improved by introducing departmental posters, with further information conveyed at the morning safety brief for a week. In doing this, a large proportion of both medical and nursing were introduced to the basic concepts of improving care of diabetic foot problems. To act as an *aide-memoire*, TTT test badges (developed by Christian Pankhurst, specialist orthotist, King's College Hospital, London and Duncan Stang, specialist podiatrist, Hairmyres Hospital, East Kilbride) were also distributed to staff in order to aid concordance and help remind staff of the practicalities of carrying out the TTT test (*Figure 4*) (NHS Scotland, 2017).

The emergency nurse practitioners (ENPs), who see a large proportion of the minor injuries coming through the department, were specifically targeted by way of an organised teaching session and regular feedback. A temporary deterioration in the rate of enhanced assessment was noted around the time of the junior doctor changeover. As a relatively stable population of practitioners, ENPs are a useful group to support the sustained

use of enhanced assessment and to role-model practice for new colleagues.

In performing an enhanced examination for neuropathy, the authors assume that either the patient had been found to have a suspected neuropathy, and thus had been more likely to require radiography to evaluate the injury, or they had been found unlikely to have a neuropathy and thus managed as any other patient. Whether performing the TTT test is making a difference in terms of patient investigation, management and final outcome could form the basis of a future evaluation.

During this small project, numerous interventions were implemented between the 2-week audit periods. With the limited data, it is difficult to extrapolate exactly which interventions were more successful than others. The number of recorded foot exams was highest at the end of the study period, suggesting that perhaps the cumulative effect of numerous approaches to improvement, increased overall numbers. Future projects could attempt to examine which intervention is most effective in promoting a change in practitioner behaviour. It would also be interesting to assess the impact of increased use of radiography in the context of detected neuropathy with respect to the diagnosis of subclinical fractures or Charcot neuroarthropathy.

## Conclusion

Peripheral neuropathy assessment in the context of diabetic feet is an important component of examination. In the ED, often the timely evaluation of only the most acute presenting issue is considered relevant. From a different perspective, the ED sees presentations from a huge cross-section of the population, many of whom may not routinely engage with healthcare services. The opportunity to pick up a previously unknown neuropathy could be hugely beneficial, both in the context of the presenting injury and in the future long-term care and follow up of the patient. It could be argued that the ED should take this opportunity and screen these common presentations of ankle and foot injuries in people with diabetes; particularly given the brevity, validity and overall usefulness of the TTT test.

In this study, the authors demonstrated that very simple interventions can result in an

improvement in the documentation of neurological exams in diabetic foot injuries within the ED. This can be used as a platform for further improvement within the authors' unit and, in combination with other, very similar studies (Charlton et al, 2017), may provide encouragement for other hospital departments to follow suit. ■

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- Boulton AJ (2014) Diabetic neuropathy and foot complications. *Handb Clin Neurol* 126: 97–107
- Charlton R, Murchison R, Gooday C, Dhatariya KK (2017) Implementation of a new assessment tool for people with diabetes in hospital. *The Diabetic Foot Journal* 20(1): 24–8
- Diabetes UK (2016) *Testing for Sensitivity in Your Feet*. Diabetes UK, London. Available at: <https://bit.ly/2C2vGzj>

- (accessed 08.10.2018)
- NHS Scotland (2017) CPR for Feet Training. Scottish Diabetes Group, Edinburgh. Available at: <https://bit.ly/2PioOlj> (accessed 08.10.2018).
- Elyas S, Cooper N, Mandour O (2005) Cellulitis or charcot neuropathy in diabetes? *Acute Med* 4(1): 28–9
- Gibson TB, Driver VR, Wrobel JS et al (2014) Podiatrist care and outcomes for patients with diabetes and foot ulcer. *Int Wound J*, 11, 641-8.
- McLaughlin SA, Binder DS, Sklar DP (1998) Ottawa ankle rules and the diabetic foot. *Ann Emerg Med* 32(4): 518
- NHS Scotland (2016) *Scottish Diabetes Survey 2016*. NHS Scotland. Available: <https://bit.ly/2wLd4Ce> (accessed 08.10.2018)
- Rayman G, Vas PR, Baker N et al (2011) The Ipswich Touch Test: a simple and novel method to identify inpatients with diabetes at risk of foot ulceration. *Diabetes Care* 34(7): 1517–8
- Stiell IG (2018) *The Ottawa Ankle Rules*. The Ottawa Hospital Research Institute and the University of Ottawa. Available at: <https://bit.ly/2RAwota> (accessed 08.10.2018)
- Stiell IG, McKnight RD, Greenberg GH et al (1994) Implementation of the Ottawa ankle rules. *JAMA* 271(11): 827–32
- Van Der Goot WE, Keers JC, Kuipers R et al (2018) The effect of a multifaceted evidence-based practice programme for nurses on knowledge, skills, attitudes, and perceived barriers: A cohort study. *Nurse Educ Today* 63: 6–11
- Young MJ, Breddy JL, Veves A, Boulton AJ (1994) The prediction of diabetic neuropathic foot ulceration using vibration perception thresholds. A prospective study. *Diabetes Care* 17(6): 557–60

## Online CPD activity

Visit [www.diabetesonthenet.com/cpd](http://www.diabetesonthenet.com/cpd) to record your answers and gain a certificate of participation

Participants should read the preceding article before answering the multiple choice questions below. There is ONE correct answer to each question. After submitting your answers online, you will be immediately notified of your score. A pass mark of 70% is required to obtain a certificate of successful participation; however, it is possible to take the test a maximum of three times. A short explanation of the correct answer is provided. Before accessing your certificate, you will be given the opportunity to evaluate the activity and reflect on the module, stating how you will use what you have learnt in practice. The new CPD centre keeps a record of your CPD activities and provides the option to add items to an action plan, which will help you to collate evidence for your annual appraisal.

- According to Boulton, 2014, which one of the following is the SINGLE MOST important risk factor for the subsequent development of diabetic foot ulcers? Select ONE option only.
  - Cerebrovascular disease
  - Heart failure
  - Hypertension
  - Peripheral neuropathy
  - Retinopathy
- An Emergency Department (ED) introduces a proforma to be used in the assessment of all ankle injuries, in order to highlight the need to formally test foot sensation.
 

According to Peace et al, 2018, which is the SINGLE MOST likely expected outcome? Select ONE option only.

  - Increased rapid home discharge
  - Increased radiography requests
  - Reduced admissions
  - Reduced referrals to diabetes specialists
  - Reduced waiting times in ED
- A 65-year-old woman has type 2 diabetes, CKD4 and peripheral diabetic neuropathy. She has fallen over and twisted her left ankle, which is now swollen and bruised below the lateral malleolus. She can weight bear.
 

Which is the SINGLE MOST appropriate INITIAL investigation? Select ONE option only.

  - CT scan
  - Ottawa ankle rules assessment
  - Ipswich Touch Test
  - MRI scan
  - X-ray
- A 57-year-old man with type 2 diabetes has sustained an inversion injury of his right ankle. He can weight bear, but attends an Emergency Department the following day due to the presence of swelling.
 

According to Peace et al, 2018, which is the SINGLE MOST appropriate screening test to assess for diabetic neuropathy in this situation? Select ONE option only.

  - Clinical judgement
  - Monofilament testing
  - Pinprick sensation
  - Proprioception assessment
  - Touch the Toes Test
- Which is the SINGLE MOST important implement to use when undertaking the 'Touch the Toes Test'? Select ONE option only.
  - Blue needle
  - Cotton bud
  - Cotton wool
  - Finger tip
  - Tuning fork
- Which is the SINGLE MOST appropriate statement about the practical undertaking of an Ipswich Touch Test? Select ONE option only.
  - Ask the patient to wave their hand when they feel touch
  - Test one foot at a time
  - Test the inner and outer aspect of both halluces
  - The patient keeps their eyes open
  - Touch the first, third and fifth toes
- According to the Scottish Diabetes Survey, 2016, what is the APPROXIMATE prevalence of diabetes? Select ONE option only.
  - 2.5%
  - 5%
  - 7.5%
  - 10%
  - 15%
- According to Peace et al, 2018, which is the SINGLE MOST likely explanation for the drop off in sensory testing of lower-limb injuries 6 months into the programme? Select ONE option only.
  - Lack of direct feedback
  - Lack of regular audit
  - Medical staff change over
  - Publication of poor initial outcomes
  - Reduced incidence of lower-limb injuries
- According to Peace et al, 2018, which group of healthcare professionals should be specifically targeted to use the Ipswich Touch Test? Select ONE option only.
  - Emergency nurse practitioners
  - Healthcare assistants
  - Junior doctors
  - Paramedics
  - Registered general nurses
- According to Peace et al, 2018, which was the SINGLE MOST successful intervention used which ENHANCED sensory foot testing in the Emergency Department, if any? Select ONE option only.
  - Displaying results in poster format in the department
  - Outcome data is unclear
  - Targeting specific groups of healthcare professionals
  - Two-weekly rapid audit cycles
  - Wearing of TTT reminder badges