

# Early signs of peripheral neuropathy in diabetes



## EARLY SIGNS OF PERIPHERAL NEUROPATHY AMONG THOSE LIVING WITH DIABETES MELLITUS1

Update on Foot Care: Identifying Early signs of Peripheral Neuropathy among Patients Living with Diabetes Mellitus

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### Abstract

This integrative review of the literature was compiled from research within allied health literature (i. e., nursing, medicine and podiatry).

Primary objective: Develop a best practice algorithm as a prevention tool for health care providers (HCPs) to identify the early signs of peripheral neuropathy among persons living with diabetes mellitus. Secondly, this literature review also sought to determine if there were any other better testing methods than the monofilament test to detect diabetes related peripheral neuropathy at the various stages of the disease process.

Objective: Determine the most efficacious evidence based interventions for the detection of the early signs of peripheral neuropathy and thus prevent diabetes related foot ulcers among patients living with diabetes.

Methods: A substantive review of research of literature was implemented by reviewing the PubMed, Cinahl and Cochrane databases. Searched terms: “diabetes mellitus”, “ self-management”, “ education” , “ prevention”, “ foot ulcers”, and covered the period from 2000-2014.

Findings: Clinical information the HCP gathers from their assessment such as risk for diabetes related neuropathy and foot infections are important predictors of future foot ulcers. The best tools to prevent diabetes related foot ulcers was the temperature guided avoidance therapy (TGAT). The tuning fork which the HCPs can be used at the bedside is also highly sensitive in diagnosing diabetes related peripheral neuropathy. Nurse led diabetes related educational programs were also found to be valuable in the prevention of foot ulcers.

Implications for practice: An overall better understanding of interventions used to detect peripheral neuropathy in the goal to prevent foot ulcers will guide HCPs to prescribe early treatment and provide optimal methods of examining for diabetes related peripheral neuropathy.

Conclusion: Patient education is important in the prevention of diabetes related foot ulcers. Once neuropathy is diagnosed, the monofilament test is not useful in predicting diabetes related foot ulcers. The HCP should introduce and teach the patient about temperature-guided avoidance therapy to assess for diabetes related peripheral neuropathy at home. The HCPs can use clinical information predictors to assist patients in the prevention of foot ulcers. Temperature guided avoidance therapy and tuning forks are valuable tools in diagnosing diabetes related peripheral neuropathy and are more sensitive than the monofilament test.

Update on Foot Care: Identifying Early signs of Peripheral Neuropathy among Patients Living with Diabetes Mellitus

Introduction

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Type 2 Diabetes Mellitus (T2DM) is a serious illness that can affect people of all ages worldwide (Dorresteyn, Kriegsman, & Valk, 2011). Type 2 diabetes has risen in greater scales over the past years in the United States (US) especially among minority groups (i. e., Latinos, African Americans, Asians and American Indians). (CDC; 2012). It is predicted that by 2030, around 366 million people will be diagnosed with diabetes and will increase in numbers from 2. 8% in 2000 to 4. 4% in 2030 (Dorresteyn & et al., 2011). According to the Centers for Disease Control and Prevention (CDC; 2012) the number of adults aged 18-79 in the U S with newly diagnosed diabetes has tripled from 1980 to 2011, from 5. 6 million to 20. 9 million. The data provided by the CDC shows that T2DM is a major problem affecting people of all cultures and further interventions need to be focused to prevent complications from diabetes.

Diabetes related foot lesions occur as a result of two or more risk factors (Bakker, Apelqvist & Schaper, 2012). Diabetes related peripheral neuropathy plays a central role in leading to foot lesions, as it affects about 50% of people living with diabetes (Bakker & et al., 2012). Diabetes related peripheral neuropathy not only leads to foot ulceration, but is one of the most common reasons that lead to amputations, therefore requiring hospital admissions and rising medical costs (Meaney, 2012). People living with diabetes are at an increased risk for getting a foot ulcer than those without diabetes (Meaney, 2012). Foot and lower extremity amputations are among the various complications afflicting those living with diabetes. It can be noted that 60% of lower-limb amputations occur in people living with diabetes (CDC, 2012). The CDC (2012) shows that in 2006 about 65, 700 non-

traumatic lower-limb amputations were performed among people living with diabetes.

The leading cause of lower extremity amputations occurs due to foot ulcers (Sheridan, 2012). This is because lesions of the foot are commonly mismanaged and considered to be minor by patients and sometimes even HCPs, impacting patients' health in a very negative way (Broersma, 2004). Diabetes can cause major complications such as vasculopathy, nephropathy and retinopathy, and more emphasis has been placed on preventing these complications (Broersma, 2004). Early foot complications may be disregarded by the patient as the complications may not seem to be imminent or serious (Broersma, 2004). This can lead to further complications if foot infections are missed, leading to foot ulcers and amputations. Treatment of foot ulcers have a low success rate because of factors like slow wound healing, history of peripheral vascular disease, increased risk of infections and diabetes related neuropathy (Sheridan, 2012).

Of all the complications of diabetes, foot complications can most easily be prevented. Therefore preventative methods must be in place to ensure HCPs are taking steps to educate their clients regarding peripheral neuropathy, foot lesions and ulcers. HCPs should focus on the prevention of foot ulcers by identifying the early signs of peripheral neuropathy, providing education to the patient and family and having a multidisciplinary treatment approach of foot ulcers, doing this will likely reduce amputation rates by 49-85% (Bakker & et al., 2012).

Most HCPs are familiar with the Semmes-Weinstein Monofilament testing that is used at the bedside to assess for peripheral neuropathy, but it is important to investigate if there are any other methods and tools that are better and more accurate in detecting peripheral neuropathy to prevent foot ulcers. The creation of a foot exam preventative tool for diabetes that can be utilized with each office visit will help HCPs to assess patients for foot lesions and prevent further complications from this disabling condition.

### Statement of the Problem

According to Boyko, Gerstein, Mohan, Yusuf, Sheridan, Anand, & Shaw (2010), even though Type 2 diabetes mellitus (T2DM) has risen over the years in the United States and globally, the diagnosis of the condition varies by ethnicity. Research shows that there is a higher incidence of T2DM amongst Latinos, Asians and African Americans, compared to Caucasians (Boyko & et al., 2010). Research has shown it is primarily due to insulin resistance which is a result of genetic, environmental and cultural factors placing these minority groups at an increased risk (Boyko & et al., 2010).

Persons living with diabetes are at an increased risk for complications and end-organ damage that can lead to blindness, nephropathy and neuropathy. Peripheral neuropathy is the major cause of foot ulcers leading to amputations of toes, feet and ultimately limbs. Lack of access to health care and education are barriers to effective management of diabetes which prevent adoption of self-management behaviors. Limited knowledge of HCPs to utilize a variety of techniques to assess for early signs of neuropathy is also another major barrier. There are also language, cultural and

transportation barriers to effective diabetes management among minority groups.

It should be emphasized that a disabling complication of T2DM is foot ulceration (Dorresteijn, & et al., 2011). About 15% and 25% of patients diagnosed with diabetes are affected by foot ulceration during their lifetime (Dorresteijn & et al., 2011). The slow healing process among patients diagnosed with diabetes causes them to be more susceptible to non-healing foot ulcers. Intensive treatment methods may not be sufficient to heal the diabetes related wounds and ulcers (Dorresteijn & et al., 2011). Diabetes related foot ulcers not only cause further physical disability, it also reduces the quality of life and increases the risks of lower extremity amputations (Dorresteijn & et al., 2011). It is also costly to treat diabetes related foot ulcers as the treatment duration is long and requires multiple antibiotics, topical medications, dressing changes and inpatient care (Dorresteijn & et al., 2011). This adds to the physical and financial burden one has to endure.

Much research has been carried out on the treating diabetes related foot ulcers but little research has been conducted on identifying the early signs of peripheral neuropathy. The main purpose of this study is to evaluate the methods and tools that can be utilized to help diagnose peripheral neuropathy in order to prevent foot ulcers. Also, diabetes related foot lesion risk assessment tool will be created to assist HCP with this process. This tool will assist HCPs in identifying foot lesions that could potentially lead to foot ulcers among persons living with diabetes. The final purpose of this study is to help increase awareness among HCPs to provide education to their clients regarding peripheral neuropathy and the prevention of foot ulcers.

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## Goals of the Project

- To design or adapt an evidence-based protocol on the best practices such as the tools and methods used to assess for peripheral neuropathy and thus prevent foot ulcers.
- To present a risk assessment tool in the prevention of foot ulcers for HCP to utilize during office visits for all patients living with diabetes.
- To investigate if there are better tests than monofilament testing to detect peripheral neuropathy

## Evidence of the Problem

The incidence of diabetes related foot ulcers has risen in the recent years (Eddy & Price, 2009). It is predicted that at least 15% of people out of the 23.5 million living with diabetes will develop a foot ulcer (Eddy & Price, 2009). Even though there has been a decline in recent limb amputations due to advanced treatment guidelines on foot ulcers, 7% of those affected with T2DM will still develop foot ulcers that require amputations (Eddy & Price, 2009). Low income populations are at increased risk of diabetic foot ulcers due to knowledge deficit, cultural barriers, low finances, and lack of education or decreased accessibility to health care. It is important to understand that the longer an individual lives with high or uncontrolled blood glucose they are more likely to get peripheral neuropathy (Eddy & Price, 2009). Also, individuals that have a history of foot ulcers, are at 13 times the risk of developing another foot ulcer compared to those who have never had this condition (Eddy & Price, 2009). Factors that lead to foot ulceration put the foot at risk by breaking of the skin, which leads to impaired healing of the lesion (Nagoba, Gandhi Wadher, Rao, Hartalkar & Selkar, 2010). Foot

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lesions are less likely to heal due to vascular insufficiency and diabetes associated neuropathy (Nagoba & et al., 2010).

Most HCPs have the basic knowledge that yearly foot exams need to be done and the monofilament test is the most popular test used to detect peripheral neuropathy. The American Diabetic Association (ADA, 2013) recommends that “ all individuals with diabetes should receive a thorough foot exam at least once yearly”. In addition, persons with DM and with one or more risk factors need more frequent assessments of their feet during office visits (Broersma, 2004). HCPs should assess the feet of the patient every office visit. Persons with DM should also

see the podiatrist at least every 3-6 months. It is also important for the patient or caregiver to look at the patient’s feet daily (Sheridan, 2012). HCPs tend to focus on other risks of diabetes such as renal nephropathy and cardiovascular effects and may unconsciously neglect foot care therefore delaying patients’ awareness of diabetes related foot ulcers.

#### Box 1

##### Clinical predictors of foot ulcers

poor vision

History of  
foot ulcers

History of

amputation

monofilamen

t

insensitivity

tinea pedis

onychomyco

sis

*Adapted from: Boyko, Ahroni, Cohen, Nelson & Heagerty (2006)*

A review of existing literature supports preventive methods such as accurate foot assessments in preventing foot ulcers. A study done by Boyko, Ahroni, Cohen, Nelson & Heagerty (2006) showed that there were significant clinical predictors of foot ulcers. These predictors were “ impaired vision, prior foot ulcers, prior amputation, monofilament insensitivity, tinea pedis and onychomycosis.” As seen in Box 1, when HCPs have available clinical information that can help to predict the development of diabetes related foot ulcers, patients will have better outcomes (Boyko & et al., 2006). These predictors were found to be helpful in accurately targeting clients with high risks of contracting foot ulcers for preventative interventions. The use of proper footwear such as diabetes specialized shoes with proper diabetes foot insoles will also be reviewed.

Tools that can be used to predict peripheral neuropathy among persons with DM were also evaluated in this review. The use of the tuning fork versus the

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electronic neurothesiometer was studied as a valid test in predicting peripheral neuropathy (Kästenbauer, Sauseng, Brath, Abrahamian, & Irsigler, 2004). A systematic review by Mayfield and Sugarman, (2000) the use of the Semmes-Weinstein Monofilament test is a useful tool in the primary care office for HCPs to assess their clients for onset of peripheral neuropathy. Other instruments that will be evaluated are the reflex hammer, temperature guidance avoidance therapy and the new indicator testing.