



Contents available at [ScienceDirect](#)

Diabetes Research
and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres



International
Diabetes
Federation



Detecting intrinsic muscle weakness of the hallux as an addition to early-stage screening of the feet in patients with diabetes

R. Mahieu^{a,b}, M.N.O. Coenen^{a,b}, T. van Bommel^a, H.J. van der Zaag-Loonen^c, W.J. Theuvenet^{d,*}

^a Department of Internal Medicine, Gelre Hospital, Albert Schweitzerlaan 31, 7334 DZ Apeldoorn, The Netherlands

^b University of Groningen, University Medical Center Groningen, Hanzeplein 1, 9713 GZ Groningen, The Netherlands

^c Department of Epidemiology, Gelre Hospital, Albert Schweitzerlaan 31, 7334 DZ Apeldoorn, The Netherlands

^d Department of Plastic Surgery, Gelre Hospital, Albert Schweitzerlaan 31, 7334 DZ Apeldoorn, The Netherlands

ARTICLE INFO

Article history:

Received 26 February 2016

Accepted 16 July 2016

Available online 28 July 2016

Keywords:

Paper

Grip

Test

Diabetic

Foot

ABSTRACT

Aims: Present-day screening of the diabetic foot involves the Semmes Weinstein Monofilament Test for evaluating loss of sensibility, while testing for intrinsic muscle weakness is not implied. Just as with the early detection of sensibility loss, early detection of intrinsic muscle weakness might have important implications for the prevention of both ulceration and deformity in patients with diabetes. The purpose of this study is to investigate the prevalence of patients with diabetes presenting intrinsic muscle weakness of the hallux, but with a normal sensibility of the sole of the foot.

Methods: A cross-sectional study design was applied. Intrinsic muscle function of the hallux was measured with the Paper Grip Test, while sensibility of the sole of the foot was measured with the Semmes Weinstein Monofilament Test 5.07/10-g.

Results: In a period of three months a total of 266 patients with diabetes (mean age 60, 134 females (50%), 177 type 2 diabetes mellitus (67%)) met the inclusion criteria and were examined for both intrinsic muscle weakness of the hallux and sensibility of the soles of the feet. The results showed that intrinsic muscle weakness was present more frequent in patients with impaired sensibility ($P = 0.001$), also 20% of the population had intrinsic muscle weakness in the presence of normal sensibility. Multivariate regression analysis showed that only age is associated with patients with diabetes presenting normal sensibility but impaired intrinsic muscle function ($P = 0.017$).

Conclusions: The Paper Grip Test could have added value to current physical examination of the feet in patients with diabetes.

© 2016 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Diabetes mellitus is an increasing problem in the world. Data assembled (2011) from Dutch general practitioners shows that

the prevalence of diabetes mellitus in The Netherlands was approximately 801,000, while the incidence was 87,000 [1]. In 2013 4.5% of the Dutch population was registered as diabetes patient, and type 2 diabetes mellitus was registered

* Corresponding author at: Department of Plastic Surgery, Gelre Hospital, Apeldoorn, The Netherlands.

E-mail address: wimtheuvenet1@gmail.com (W.J. Theuvenet).

<http://dx.doi.org/10.1016/j.diabres.2016.07.007>

0168-8227/© 2016 Elsevier Ireland Ltd. All rights reserved.

more than five times as often as type 1 diabetes mellitus [2]. Globally, in 2014 there were 387 million patients with diabetes, to which another 205 million people is expected to be added in the next 20 years [3].

An infamous complication of diabetes mellitus is the diabetic foot. The incidence of leg amputations in The Netherlands (2003–2004) was 8.8 per 100,000 person-years, while half of this population was diagnosed with diabetes. Furthermore, the incidence of amputations in patients over 45, diagnosed with diabetes, is 150.9 per 100,000 person-years, which is approximately twelve times higher than in patients over 45 who haven't been diagnosed with diabetes [4].

Former studies reported that 84% of diabetic related amputations are preceded by ulceration of the feet [5]. Many of these amputations can be prevented by early recognition of high-risk patients, frequent examination of the feet and providing adequate information and customized footwear [6].

The diabetic foot does not only result in a serious deterioration of the Quality of Life, but it also accounts for approximately 170 million euros a year of the costs of the National Health Care Programme in The Netherlands [7].

Therefore, as the prevalence and incidence of diabetes mellitus keep rising, the need for a simple, but still effective method to detect the high-risk foot becomes greater.

An article published in 2002 described the Paper Grip Test as a simple, inexpensive, non-invasive method to screen for intrinsic muscle weakness of the hallux in leprosy patients [8]. The weakness of these muscles, in combination with the loss of sensibility of the soles of the feet, result in an increased risk of both ulceration and deformity of the feet [9]. A similar process might occur in the diabetic foot.

Present-day screening of the diabetic foot involves the Semmes Weinstein Monofilament Test for evaluating loss of sensibility [10]. Possibly, in analogy with leprosy patients, not only loss of sensibility, but also intrinsic muscle weakness of the hallux exists in the diabetic foot.

It turns out that 24.8% of the leprosy patients have a normal sensibility, but do have intrinsic muscle weakness of the hallux [8]. In the population of patients with diabetes there are no adequate data available concerning muscle weakness of the hallux. However, it is not unlikely that a significant number of the patients with diabetes has a normal plantar sensibility, in the presence of intrinsic muscle weakness of the hallux, as is the case with the leprosy patients.

Thus, just as with the early detection of sensibility loss, the early detection of intrinsic muscle weakness might have important implications for the prevention of both ulceration and deformity in patients with diabetes.

The purpose of this study is to investigate the prevalence of patients with diabetes presenting intrinsic muscle weakness of the hallux, as measured with the Paper Grip Test, but with a normal sensibility of the sole of the foot, as measured with the Semmes Weinstein Monofilament Test 5.07/10-g. We are particularly interested in whether the Paper Grip Test is able to increase the yield of a multidimensional screening procedure in addition to other well known risk factors for future complications.

2. Subjects

From all patients included in this study a signed informed consent has been obtained. The responsible ethics committee has given approval for the reported investigations.

In 2015, over a three-month period, consecutive patients with diabetes (new patients and patients who came for follow-up) visiting the out-patient diabetes Clinic of the Gelre Hospital at Apeldoorn (a Regional Teaching Hospital in The Netherlands) were examined for both intrinsic muscle weakness of the hallux and sensibility of the sole of the foot by two examiners.

Patients with diseases of the central nervous system, amputations of the feet, deformities or large infections of the feet, ulceration grade 4–5 on the feet, known neuropathies unrelated to diabetes mellitus, myopathies or radiculopathies of L4–S2 were excluded from this study. Patients with small non-infected ulcerations were not excluded.

Out of a total of 301 patients, 266 patients with diabetes met the inclusion criteria. Information about age, gender, type diabetes mellitus (type 1 or type 2), duration of diabetes, length and weight (BMI) and HbA_{1c} serum levels was obtained of each patient. Finally, a questionnaire was administered to determine the smoking status of each patient.

3. Materials and methods

3.1. The Paper Grip Test

The Paper Grip Test (PGT) was conducted in the same way as described by de Win et al. in 2002 [8]; while the patient (footwear and socks removed) sits up straight with hips, knees and ankles in 90° of flexion. The examiner insures that the patients stays in the same position and keep his/her heels on the floor during the test. Prior to the testing the patients has a brief look at his/her feet, for patients with diabetes presenting impaired sensibility of the feet will not feel the paper, causing difficulty in holding the paper. The examiner puts a slip of paper of 250–300 g/m² with a size of 86 × 54 mm under the phalanges of the hallux, just distal to the MTP joints. The examiner pulls the paper away with gradually increasing power in a horizontal direction, while the patient offers resistance. In all examinations a smooth underground was used. The PGT was performed up to three times on both feet when the patient was not able to grip the paper. The PGT was considered positive (abnormal) when it was possible to easily pull the paper away all three times. The test was considered negative (normal) when the patient was able to grip the paper at least one out of three times.

3.2. Sensibility testing

Sensibility of the foot sole was tested by means of a Semmes–Weinstein Monofilament test (SWM) [10]. This has been described to be a reproducible method for detecting loss of protective sensation of the sole of the foot. The SWM was conducted using a 5.07/10-g monofilament applied to a non-callused site on three areas: the first metatarsal head (medial plantar nerve), the fifth metatarsal head (lateral plantar

Download English Version:

<https://daneshyari.com/en/article/5898884>

Download Persian Version:

<https://daneshyari.com/article/5898884>

[Daneshyari.com](https://daneshyari.com)