ELSEVIER

Journal of Diabetes and Its Complications 23 (2009) 32–39

Journal of Diabetes and its Complications

WWW.JDCJOURNAL.COM

Hand disorders, hand function, and activities of daily living in elderly men with type 2 diabetes☆

Ragnhild I. Cederlund[a], Niels Thomsen[b], Soley Thrainsdottir[c], Karl-Fredrik Eriksson[d], Göran Sundkvist[e,✠], Lars B. Dahlin[b,*]

[a]Division of Occupational Therapy, Department of Health Sciences, Vårdal Foundation, University Hospital Malmö, Lund University, Malmö, Sweden
[b]Department of Clinical Sciences, Malmö, Hand Surgery, University Hospital Malmö, Lund University, Malmö, Sweden
[c]Department of Clinical Sciences, Malmö, Neurology, University Hospital Malmö, Lund University, Malmö, Sweden
[d]Department of Clinical Sciences, Malmö, Vascular diseases, University Hospital Malmö, Lund University, Malmö, Sweden
[e]Department of Clinical Sciences, Malmö, Diabetes Neurology and Epidemiology, University Hospital Malmö, Lund University, Malmö, Sweden

Received 7 May 2007; received in revised form 13 August 2007; accepted 6 September 2007

Abstract

Aims/Hypothesis: This study aimed to examine hand disorders, symptoms, overall hand function, activities of daily living (ADLs), and life satisfaction in elderly men with type 2 diabetes mellitus (DM), impaired glucose tolerance (IGT), and normal glucose tolerance (NGT). **Methods:** Subjects were interviewed and evaluated with a battery of clinical and laboratory tests, including hand assessment, and a questionnaire. **Results:** HbA1c differed between groups (highest in DM, especially in long-term DM). Limited joint motion (LJM), for example, prayer sign and Dupuytren's contracture, was most common in individuals with DM, followed by individuals with IGT, as compared to those with NGT. Vibrotactile sense was impaired symmetrically in the index and little fingers in DM. However, there were no differences for sensibility, dexterity, grip strength, and cold intolerance between groups. Individuals with long-term (>15 years) DM were more affected regarding sensibility and ADL than individuals with short-term DM, who had more sleep disturbances. ADL difficulties were less among IGT subjects. Vibrotactile sense showed correlations with Semmes–Weinstein monofilament test and static two-point discrimination. **Conclusions/Interpretation:** Dupuytren's contracture and impaired vibrotactile sense in finger pulps occurred in patients with DM but not in those with IGT, although LJM occurred in both IGT and DM patients. A longer duration of DM was associated with more severe neuropathy and ADL difficulties. Life satisfaction was high, and hand disorders did not have a significant impact on ADL.

Keywords: Diabetes mellitus; Neuropathy; Hand function; Vibration sense; Impaired glucose tolerance; Sensibility; Dexterity; Grip strength; ADL; LJM

1. Introduction

Diabetes mellitus (DM) is associated with musculoskeletal disorders predominantly in patients with type 1 DM (Chammas et al., 1995; Dyck et al., 1993). Few studies have assessed such abnormalities in patients with either type 2 DM or impaired glucose tolerance (IGT) matched for age and gender (Ardic, Soyupek, Kahraman, & Yorgancioglu, 2003; Cetinus, Buyukbese, Uzel, Ekerbicer, & Karaoguz, 2005; Gamstedt, Holm-Glad, Ohlson, & Sundstrom, 1993). Most studies assessing hand function have used only a single test, such as grip strength or perception threshold (Cetinus et al., 2005; Rahman, Griffin, Rathmann, & Wareham, 2003). Overall hand function combining an assessment of sensibility, dexterity, and grip strength is rarely studied in DM. Furthermore, there are no population-based studies (Eriksson & Lindgarde, 1990; Eriksson et al., 1994) defining overall hand function and its impact on activity of daily living

☆ The authors declare that no conflicts of interest exist.

* Corresponding author. Department of Clinical Sciences, Malmö, Hand Surgery, Malmö University Hospital, SE-205 02 Malmö, Sweden. Tel.: +46 40 33 67 69; fax: +46 40 92 88 55.
E-mail address: lars.dahlin@med.lu.se (L.B. Dahlin).

✠ Göran Sundvist passed away in 2006.

1056-8727/09/$ – see front matter © 2009 Elsevier Inc. All rights reserved.
doi:10.1016/j.jdiacomp.2007.09.002

(ADL) in patients with type 2 DM or IGT (Dyck et al., 1993). An association between hand function and ADL has been demonstrated in patients with vibration-induced neuropathy (Cederlund, Nordenskiold, & Lundborg, 2001). Thus, studies in well-defined populations of individuals with various glucose tolerances and with a specific gender and age are crucial for understanding how DM and IGT may influence the musculoskeletal and nervous systems of the hands with its consequences on ADL. The consequences of DM may be determined by factors such as severity of the disease and the impact on ADL (Bruce, Davis, & Davis, 2005; Castaneda, Bermudez, & Tucker, 2000; Miller, Rejeski, Reboussin, Ten Have, & Ettinger, 2000; Wray, Ofstedal, Langa, & Blaum, 2005). Our aim was to systematically define hand disorders [e.g., Dupuytren's contracture, limited joint motion (LJM)], symptoms (e.g., cold intolerance, pain), hand function, ADL performance, and life satisfaction in elderly men with type 2 DM, IGT, and normal glucose tolerance (NGT), matched for age, height, and body mass index (BMI) recruited from a prospective, population-based study initiated between 1975 and 1979.

2. Subjects, materials, and methods

The study was designed as a cross-sectional investigation with an explorative approach. The ethics committee gave approval of the study, and informed consent was obtained from subjects.

2.1. Subjects

A health screening program of 48-year-old men was conducted in the city of Malmö, Sweden, between 1975 and 1979. Of a total population of 9033, 6956 men agreed to participate in an oral glucose tolerance test (OGTT; Eriksson & Lindgarde, 1990; Eriksson et al., 1994). Four hundred twenty-three subjects with an abnormal OGTT on two consecutive occasions were invited to participate in a long-term intervention. Between 1989 and 1991, the same individuals, now with a mean age of 61 years (±2 S.D.), were screened again and reclassified according to the WHO criteria (DM, IGT, NGT). The following two groups were identified: 51 individuals with IGT and 69 individuals with DM. A group of 62 individuals with NGT was randomly matched according to gender, age, height, and BMI. Between 2003 and 2005, the same individuals, now with a mean age of 74.8±1.3, were invited to a follow-up study. Among the 182 original individuals, 46 had died (24 with DM, 10 with IGT, and 12 with NGT), 12 were too seriously affected to participate (3 with DM, 6 with IGT, and 3 with NGT), 7 had moved away from the Malmö area (2 with DM, 3 with IGT, and 2 with NGT), and 10 declined participation (5 with DM, 2 with IGT, and 3 with NGT), thereby leaving 107 individuals for a follow-up (Thrainsdottir, Englund, Rosén, Petersson, & Sundkvist, 2006). After initialization of the present study, another 12 patients with DM and 3 with NGT were lost due to intercurrent disease or death. Finally, four patients were excluded due to a suspected hereditary neuropathy with flexion deformities in the feet (one patient) or neuropathy associated with deficiency of vitamin B_{12}. The final losses of participants in the three groups were as follows: 46/69 (67%) subjects in DM, 21/51 (41%) in IGT, and 27/62 (44%) in NGT. The remaining 88 participants were classified into three groups (DM, IGT, NGT) based on OGTT 1989–1991 (NGT, n=35; IGT, n=30; DM, n=23) and OGTT 2003–2005 (NGT, n=26; IGT, n=17; DM, n=45). Twenty-five patients had constant NGT, 7 patients had constant IGT, and 23 had constant DM between 1989–1991 and 2003–2005.

2.2. Clinical assessment

Interviews and assessments were performed by the same occupational therapist who was unaware of the individuals' glucose tolerance.

2.2.1. Demographic data

Demographic data on age, marital status, living accommodation, smoking habits, and hand problems were registered.

2.2.2. Hand disorders, symptoms, and function

Questions regarding hand disorders and symptoms, occurrence of decreased range of motion in the shoulder and hand (prayer sign), trigger fingers, Dupuytren's contracture, nerve entrapments, and hand infections were recorded (no/yes) and examined. Cold intolerance was quantified with a visual analogue scale (VAS).

For assessment of hand function, seven tests were performed on both hands according to a previous protocol with reliable and validated instruments (for details, see Cederlund, Iwarsson, & Lundborg, 2003):

1. Vibration sense, using tactilometry (PID AB, Malmö, Sweden) within the frequencies 8–500 Hz, thereby calculating a sensibility index (SI) reflecting dysfunction of vibration sense (large fiber neuropathy) as compared to a reference population (calculation of an SI, i.e., the area beneath the curve divided by the area beneath the curve from the reference population; Stromberg, Dahlin, & Lundborg, 1998). Index and little fingers were investigated bilaterally.
2. Semmes–Weinstein monofilament (SWF) testing was performed for assessment of perception of touch/pressure. Measurement on three critical sites for median and ulnar nerve, respectively, gave six sites for each hand (maximum score of 30).
3. Static two-point discrimination (s2PD) using the Dellon Disk-Criminator.
4. Shape/Texture Identification (STI) test using the index finger (Jerosch-Herold, 2005).