



Original Article

Diabetic hands: A study on strength and function



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ABSTRACT

Objective: To study hand strength and function in type 2 DM patients.

Methods: We collected data on hand strength and function, disease duration, glycemic, creatinine and HbA_{1c} levels, degree of pain and stiffness and physical examination in 100 DM patients comparing them with 100 hand osteoarthritis patients and 100 controls.

Results: DM patients had hand strength and function better than osteoarthritis patients and worse than controls. De Quervain tendinitis associated with hand strength ($p = 0.005$); hand function associated with carpal tunnel syndrome ($p < 0.0001$), De Quervain tendinitis ($p = 0.006$), HbA_{1c} level ($p = 0.005$), insulin use ($p = 0.030$), disease duration ($p = 0.0006$), pain ($p < 0.0001$) and stiffness ($p < 0.0001$) in univariate analysis. In multivariate analysis only disease duration and stiffness remain as significant.

Conclusion: Hand strength and function are impaired in DM patients. Loss of function associated with stiffness and disease duration; loss of strength associates with De Quervain tendinitis.

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1. Introduction

Besides the already universally recognized complications of diabetes mellitus (DM) in cardiovascular system, kidneys and eyes, the musculoskeletal system may also be affected in this disease [1]. Diabetic patients have a high rate of frozen shoulder, tendinitis, carpal tunnel syndrome and Dupuytren contractures [1]. The diabetic involvement of the hands is recognized as diabetic cheiroarthropathy or stiff hand syndrome and causes limitation of mobility, fixed contractures, impairment of grip strength and may be accompanied by a thick, waxy and tight skin [1]. Connective tissue disorders, neuropathy, vasculopathy or combinations of these problems, may underlie the increased incidence of musculoskeletal disorders in DM but the exact pathophysiology of most of these disorders remains obscure [2].

The involvement of the hands may cause important impairment to realize activities of daily living. This might result in economic losses and social isolation, loss of independence and reduced quality of life. With increase in general life expectancy and growing numbers of diabetic patients, this problem may be amplified and assume a greater clinical importance than before.

Although widely recognized, few studies address the problem of loss of hand strength and function in diabetes patients. Casanova

et al. [3], studying 15 diabetic patients found that only 27% of them reported no difficulties with hand function while 53% of them had minor difficulties and 20% reported serious difficulties. These authors noted that diabetes patient's perception of their hand function appear to be much better than their real performance because of insidious onset of the problem and gradual adaptation. Sava et al. [4], studying 44 patients with type 2 DM, found that hand disability was associated with loss of muscle strength but not with the presence of Dupuytren's disease, trigger finger and stiff hands syndrome. Redmond et al. [5], analyzing 60 type 1 and 2 DM patients, linked hand dysfunction to the presence of carpal tunnel syndrome, obesity and loss of muscle strength. Cetinus et al. [6] studying 76 type 2 DM patients found that they have lower hand grip strength and that in 34.9% of them the decreased hand power affected performance of daily activities.

To look further in this issue, we studied hand function and strength of the hand in diabetes mellitus patients comparing them with osteoarthritis patients and normal controls.

2. Methods

This study was approved by the local Committee of Ethics in Research and all participants signed consent. We included 300 patients: 100 with hand osteoarthritis diagnosed according to clinical classification criteria from American College of Rheumatology [7] from a single Rheumatology Unit, 100 adult patients with type 2 DM from a single Endocrinology Unit and 100 auto declared healthy controls without any hand problems that came to

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the Hospital for Eye Refraction (Ophthalmology Unit) and Gynecological Preventive Care. This was a convenience sample and the patients were chosen according to appointment order and willingness to participate in the study.

Exclusion criteria were incapacity to understand the written consent, history of previous wrist or hand trauma in the last three months, previous hand or wrist surgery, patients with neurological diseases, cervical radiculopathy, inflammatory rheumatic diseases or others muscle skeletal conditions that affect upper limbs.

After demographic data collection all patients had complete wrists and hands physical examination with special attention to Tinnel and Phallen sign (for carpal tunnel syndrome), Finkelstein's maneuver (for De Quervain tendinitis), trigger fingers, Dupuytren contracture and prayer's sign (for diabetic cheiroarthropathy) [8].

All patients underwent measurement of hand grip strength using a Jamar dynamometer[®], in the sitting position, with the shoulder adducted and neutrally rotated, elbow at 90° flexion and the forearm and wrist in a neutral position resting on a hard surface. Measurements were done in triplicate considering the higher result as the final. Patients were also submitted to hand function Cochin scale [9] that measure the capacity to realize activities of daily life through 18 questions answered by a Likert scale (0 = no difficulties; 1 = small difficulties; 2 = moderated difficulties; 3 = a lot of difficulties, 4 = impossible to do).

DM and osteoarthritis patients had graduation of pain and stiffness in the hands by a VAS (Visual Analogic Scale) from zero to 10 where zero means no symptoms and 10, the worse symptom possible. DM patients had also data collection on disease duration, treatment drugs, Hb (hemoglobin) A_{1C}, creatinine and fasting glycemia if these tests were done in the last 3 weeks.

3. Statistical analysis

All data was gathered in frequency and contingency tables. Data distribution was studied by Kolmogorov–Smirnov test; central tendency was expressed in mean and standard deviation (SD) for parametric samples and median and interquartile range (IQR) for non-parametric samples. To compare the three groups we used Chi squared test for nominal data and one-way ANOVA or Kruskal–Wallis tests for numerical data according to sample distribution. To compare two groups we used Fisher and chi squared tests for nominal and Mann–Whitney or unpaired *t* test for numerical data.

Table 2

comparison of pain, stiffness, hand grip strength and function of the hands in controls (*n* = 100); diabetes mellitus patients (*n* = 100) and osteoarthritis patients (*n* = 100).

	Controls <i>n</i> = 100	Diabetes mellitus <i>n</i> = 100	Osteoarthritis <i>n</i> = 100	<i>p</i>
Pain VAS	–	0–10 Median 0 (IQR=0–1.0)	0–10 Median 5.0 (IQR = 4–7.0)	<0.0001 ^a
Stiffness VAS	–	0–10 Median 0 (IQR = 0–20)	0–10 Median 5.0 (IQR = 3.0–7.0)	<0.0001 ^a
Handgrip strength Dominant hand (mm/Hg)	10–60 Median 28.3 (IQR = 1.6–36.6)	16.6–71.60 Median 38.3 (IQR = 30.0–46.6)	21.6–60.0 Median 40 (IQR = 35.0–50.0)	<0.0001 ^b
Handgrip strength Non dominant hand (mm/Hg)	20.0–60.0 Median 36.6 (IQR = 30.0–46.6)	6.6–65.0 Median 32.4 (IQR = 25.0–40.0)	8.3–60.0 Median 25.0 (IQR = 20.0 33.3)	<0.0001 ^b
Cochin function scale	0–11 Median 0 (IQR = 0–0)	0–57 Median 0 (IQR 0–3)	0–64 Median 16.5 (IQR = 5.0–30.0)	<0.0001 ^b

VAS, visual analogic scale.

^a Mann–Whitney.

^b Kruskal–Wallis.

Table 1

Data on sample pairing (100 type 2 diabetes mellitus patients, 100 hand osteoarthritis patients and 100 controls).

	Controls <i>n</i> = 100	Osteoarthritis <i>n</i> = 100	Diabetes mellitus <i>n</i> = 100	<i>p</i>
Gender	5 males/95 females	4 males/96 females	5 males/95 females	0.92 ^a
Age (years)	63.82 ± 6.58	64.86 ± 6.35	64.18 ± 8.10	0.57 ^a
Dominant hand right/left	96/4	99/1	99/1	0.21 ^a

^a Chi-squared.

^b Unpaired *t* test.

Correlation studies were done by Spearman test. The adopted significance was 5%. Associations and correlations with *p* ≤ 0.05 in univariate analysis were further studied by multiple regression. Calculations were done with help of the software Medcalc version 12.0.

4. Results

4.1. Descriptive analysis and data on sample pairing

In the studied sample there was 14 males and 286 females with median age of 65 years (from 41 to 84; IQR = 41–69 years). Gender and age distribution of each group, as well as data on pairing can be seen in Table 1.

DM patients had a median disease duration of 15 years (from 8 to 40 years; IQR = 12–20 years) and 52% used insulin as treatment. The median fasting glycemia was of 195 mg/dl (from 62 to 280 mg/dl; IQR = 95.0–126.5 mg/dl); median HbA_{1C} was 7.15% (from 5.05 to 12.0; IQR = 6.3–8.1%) and median creatinine was 0.9 mg/dl (from 0.6 to 2.0; IQR of 0.7–1.0 mg/dl).

The physical examination showed that 18% of diabetic patients had carpal tunnel syndrome (by Tinnel and/or Phallen sign), none had Dupuytren, 3% had trigger fingers, 14% had De Quervain's tendinitis and 16% had a positive prayer's sign.

4.2. Comparison of the three samples

Comparison of VAS of pain and stiffness in the hands, hand strength in dominant and non dominant hands and Cochin functional scale are seen in Table 2.

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