Diabetic hand syndromes as a clinical and diagnostic tool for diabetes mellitus patients

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ARTICLE INFO

Article history:
Received 11 May 2011
Received in revised form
26 June 2011
Accepted 11 July 2011
Published on line 9 August 2011

Keywords:
Diabetic hand syndrome
Limited joint mobility syndrome
Trigger finger
Dupuytren’s disease
Carpal tunnel syndrome

ABSTRACT

Diabetes mellitus (DM) is a chronic disease characterized by hyperglycemia with various complications including diabetic hand syndrome (DHS); a condition characterized by association of distinct entities: limited joint mobility (LJM), Dupuytren’s disease (DD), flexor tenosynovitis (FTS) and carpal tunnel syndrome (CTS) resulting in significant morbidity and mortality. The aim of this study was to evaluate the prevalence of these changes and their association to diabetes duration. We studied 142 type 2 and 45 type 1 DM patients and investigated the presence of these hand changes and peripheral neuropathy (PNP).

The prevalence of LJM was 29.4%, DD was 17.6%, FTS was 10.7% and CTS 41.7% in all diabetics. The prevalence of CTS was more in type 2 DM (83.3%) as compared to type 1 DM (24.4%). Age and duration of diabetes were clearly related to these changes. A clear association between these changes and PNP was observed. The prevalence of CTS and hand changes was higher in type 2 diabetics. The association of DD and PNP suggests that common factors could contribute to their pathogenesis. Consequently, clinical examination for diabetic hand should not ignore it.

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1. Introduction

Diabetic hand syndrome (DHS) is a common clinical problem for diabetic patients and almost invariably involves the long standing diabetes, suboptimal glycemic control and microvascular complications [1–5]. The hand may reveal some vital pathological signs for diabetic patients and clinical examiners should not ignore these signals during diagnosis [5]. The questions rises, does DHS is another significant sign for all diabetic patients? Although there is some previous accumulating evidence suggesting that [6], this yet is not proven scientifically.

DHS is characterized by three conditions: first, the limited joint mobility (LJM) or diabetic cheiroarthropathy [4,6–8] which is quite frequent in diabetes with a prevalence ranging from 20 to 54% [7,9]. Second, trigger finger or flexor tenosynovitis (FTS) [3,10,11] with a prevalence of 13–20% [7,10,12]. Third, Dupuytren’s disease (DD) [10,13,14] with an incidence of 14–26% [7,13,14], some of which are often combined and can be potentially disabling.

Compression neuropathies i.e., the carpal tunnel syndrome (CTS) is more common in diabetic than in non-diabetic patients [7,10,15,16] with a prevalence of 14–60% [7,10,17].

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Although several such studies have been conducted in the western population, very limited data (if any) are available from our country. Moreover, since these hand disorders are also observed in non-diabetic patients, the prevalence is thought to be much higher in diabetic patients [18]. To confirm this dogma, in this study we evaluate the prevalence of these changes and their association to diabetes duration and its complication in DHS using clinico-electrophysiological measurements.

2. Methods

One hundred and eighty-seven diabetic patients were selected for this study (110 females and 77 males) attended the diabetic clinic at Al-Hikma Modern Hospital and enrolled in this study. Out of these subjects, 142 patients were type 2 and 45 patients were type 1 DM. Their age range was between 17 and 75 years (mean ± 51.82 ± 11.68 years). The duration of their illness ranged from 14 days to 30 years. Those patients with a history of neurological diseases, chronic renal failure, and inflammatory arthritis of the wrist, chronic alcoholism, previous Colle’s fracture or hand injury were excluded from the study as well as pregnant females. All subjects gave informed consent and the study was reviewed and approved by the local ethics committee.

2.1. Clinical examination

All the patients were examined clinically by endocrine specialist and general medical practitioner. The patients were examined for the presence of the following clinical findings:

LJM was assessed by the Prayer sign: patients were asked to bring the palmar surfaces of the fingers together in a praying position with the wrist maximally extended. Failure of metacarpophalangeal or proximal interphalangeal joints to make a contact was classified as a positive prayer sign, which means LJM [19] in addition to that the skin is distinctively thick, tight, and waxy [6].

Trigger finger or FTS was diagnosed by palpating a nodule or thickened flexor tendon with locking phenomenon during extension and flexion of any fingers [18]. The diagnosis of Dupuytren’s disease was made by the observation of one or more of the following four features on examination: a palmar or digital nodule, tethering of the palmar or digital skin, a pretendinous band, and a digital flexion contracture [20].

2.2. Neurophysiological testing

The test was conducted at the electromyography unit – Al-Hikma Modern Hospital. The median nerve of both sides and the ulnar nerve of the right side were tested for the presence of neuropathy or evidence of CTS. The following parameters were studied: the sensory latency (SL), the sensory nerve conduction velocity (SNCV), the distal motor latency (DML), the motor nerve conduction velocity (MNCV) and the F-wave latency. Testing was done with standard technique [21] on Dantec counterpoint 4-channel electromyography, Denmark. All studies were performed with the patient supine and a skin temperature relatively maintained at around 25°C. Diagnosis of CTS was made by clinically provocative tests (positive Tinel sign and Phalen test) [22] and electrophysiologically when median DML is of more than 4.5 ms [23], SL greater than 3.5 ms [21], SNCV less than 49 m/s [23,24].

It is worthy to state, that diagnosing CTS usually made by comparing its neurophysiologic data with those of ulnar nerve at the same hand. When the data of the latter nerve show changes, then the diagnosis will no more be a CTS but the picture rather goes with PNP [15].

2.3. Statistical analysis

The results were expressed as mean ± standard deviation (SD). Differences between two groups were evaluated with a two-tailed Student’s “t” test. The linear-regression analysis and the correlation coefficient “r” were used to study the relationship between variables. The association between variables was tested using Chi-square test. The significance level was set at p < 0.05 for all tests. Analyses were performed using the software program SPSS Statistics 11.0 (SPSS International BV, Chicago, IL, USA).

Table 1 – Demographic features of the diabetic patients.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Diabetic patients</th>
<th>Type 1 (n = 45)</th>
<th>Type 2 (n = 142)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>LJM</td>
<td>55</td>
<td>29.4</td>
<td>9</td>
</tr>
<tr>
<td>DD</td>
<td>33</td>
<td>17.6</td>
<td>2</td>
</tr>
<tr>
<td>FTS</td>
<td>20</td>
<td>10.7</td>
<td>4</td>
</tr>
<tr>
<td>CTS</td>
<td>78</td>
<td>41.7</td>
<td>11</td>
</tr>
<tr>
<td>LJM + DC</td>
<td>22</td>
<td>11.7</td>
<td>9</td>
</tr>
<tr>
<td>LJM + FTS</td>
<td>7</td>
<td>3.7</td>
<td>25</td>
</tr>
<tr>
<td>DD + FTS</td>
<td>2</td>
<td>1.1</td>
<td>0</td>
</tr>
<tr>
<td>LJM + DD + FTS</td>
<td>1</td>
<td>0.53</td>
<td>0</td>
</tr>
<tr>
<td>PNP</td>
<td>79</td>
<td>42.2</td>
<td>46</td>
</tr>
</tbody>
</table>

LJM: limited joint mobility, DD: Dupuytren’s disease, FTS: flexor tenosynovitis (trigger finger), CTS: carpal tunnel syndrome, and PNP: peripheral neuropathy.

The prevalence of DD with LJM was significantly (p < 0.05) higher as compared to those in diabetics without LJM.
### 3. Results

#### 3.1. Clinical data

Clinical assessment revealed LJM in 55 (29.4%) patients, DD in 33 (17.6%) patients and FTS in 20 (10.7%) patients. LJM co-existed with DD was present in 11.2% and with FTS in 3.7% of the patients. DD co-existed with FTS in 2 patients. Out of the total 187 diabetic patients, only one had the three clinically distinct syndromes (Table 1).

Out of the 55 diabetics with LJM, DD was found in 22 (40%) as compared to 7.5% in 132 diabetics without LJM ($p < 0.05$); on the contrary, FTS was noticed in 12.7% versus 9.8% in 132 diabetics without LJM (Table 2). In 33 diabetics with DD, FTS was found in 6.1% versus 11.7% in 154 diabetics without DD.

#### 3.2. Neurophysiological data

CTS was present in 78 (41.7%) patients, 11 of them were type 1 DM (3 males 8 females) with duration of illness ranging from 2 to 15 years. The rest 67 patients were type 2 DM (15 males, 52 females) with duration of illness of 14 days–22 years.

### 3.3. Type of DM

Out of the 45 type 1 diabetic patients, 9 (20.0%) had LJM with duration of illness ranging from 10 to 22 years, 2 (4.4%) had DD and was diabetic for 15 years and 4 (8.8%) had FTS and they were diabetic for 15 years (Table 1).

Out of the 142 type 2 diabetic patients, 46 (32.4%) had LJM, 31 (21.8%) had DD. Both were diabetic for 13–30 years. The FTS was present in 16 (11.3%) patients who had the illness for 12–20 years (Table 1).

### 3.4. Peripheral neuropathy

PNP in form of axonal or demyelinating type was present in 79 patients. Of those, 25 patients were of type 1 DM with duration of illness 2–22 years and 54 patients were of type 2 DM with duration of illness 1–30 years (Table 1). The rest of the patients proved to have normal conduction velocities.

### 3.5. Clinical and neurophysiological data

Absent sensory nerve compound action potential was noticed in 9 patients with DD, 7 with LJM and 5 who had co-existed DD and LJM. Those patients proved to have severe entrapment of the median nerve at its corresponding carpal tunnel on neuro-physiological testing. Of the 79 patients having PNP on neuro-physiological examination, 24 had LJM, 23 had DD and 8 had FTS (Table 3). Their duration was 5–30 years. In PNP patients as compared to those without PNP, LJM was found in 30.4% versus 28.7%, DD was found in 29.1% versus 9.3% ($p < 0.05$), and FTS was found in 10.1% versus 11.1% (Table 3).

### 3.6. Correlation between the patients age, diabetes duration and hand changes

The age of patients show significant correlation with both LJM and DD ($p < 0.05$; $r = 0.56$, $r = 0.61$, respectively). Moreover, the duration of illness, was positively correlated with LJM, DD, and FTS in type 1 DM ($p < 0.05$; $r = 0.49$, $r = 0.71$, $r = 0.58$, respectively). Likewise, these hand changes show positive relationship with the duration of illness in type 2 ($p < 0.05$; $r = 0.63$, $r = 0.69$, $r = 0.54$, respectively) as presented in Table 4.

### 4. Discussion

Peripheral diagnosis for rheumatic disorders including: hand deformities, hand strength and hand injuries have been reported but are more prevalent in diabetics than in

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**Table 2 – Percentage of hand changes in diabetic patients with and without limited joint mobility.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Diabetic patients</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With LJM (n = 55)</td>
<td>Without LJM (n = 132)</td>
<td></td>
</tr>
<tr>
<td>DD</td>
<td>12.7%</td>
<td>9.8%</td>
<td></td>
</tr>
<tr>
<td>FTS</td>
<td>7.5%</td>
<td>33 (40%)</td>
<td></td>
</tr>
<tr>
<td>LJM: limited joint mobility, DD: Dupuytren’s disease, and FTS: flexor tenosynovitis (trigger finger).</td>
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<td></td>
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</tbody>
</table>

**Table 3 – Percentage of hands changes in the diabetic patients with and without peripheral neuropathy.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Diabetic patients</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With PNP (n = 79)</td>
<td>Without PNP (n = 108)</td>
<td></td>
</tr>
<tr>
<td>DD</td>
<td>29.1%</td>
<td>10.1%</td>
<td></td>
</tr>
<tr>
<td>LJM</td>
<td>10%</td>
<td>12.7%</td>
<td></td>
</tr>
<tr>
<td>FTS</td>
<td>30.4%</td>
<td>28.7%</td>
<td></td>
</tr>
<tr>
<td>PNP: peripheral neuropathy, LJM: limited joint mobility, DD: Dupuytren’s disease, and FTS: flexor tenosynovitis (trigger finger).</td>
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<td></td>
</tr>
</tbody>
</table>

**Table 4 – Correlation between the patients age, diabetes duration and hand changes.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Age</th>
<th>Duration of illness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P value</td>
<td>r value</td>
</tr>
<tr>
<td>LJM</td>
<td>&lt;0.05</td>
<td>0.56</td>
</tr>
<tr>
<td>DD</td>
<td>&lt;0.05</td>
<td>0.61</td>
</tr>
<tr>
<td>FTS</td>
<td>&lt;0.05</td>
<td>–</td>
</tr>
</tbody>
</table>
the general population [6]. Yet, they are not unique to patients with DM. In this study, the percentage of LJM, DD and CTS were within the range reported previously [7,9,10,13,14,19,25]. On the contrary, only 10.7% of patients have FTS [7,13,14]. This finding could be ascribed to fewer patients included in the present study. It had been reported that diabetic patients with LJM have an increased incidence of additional rheumatic complaint [7,10,13,26–28]. This proved to be true; it was noticed in this study a significant association between LJM and DD. Furthermore, these finding is in agreement with recent data from Papanas and Maltezos [6] who described LJM and DD as a substantial part of patients with DM.

In this study, a significant positive correlation between hand changes and increasing age of the patients and duration of diabetes was noticed. A finding which confirm other researchers work [6–8,10,12,14,29].

A higher proportion of type 2 diabetic patients have LJM, DD and FTS as compared to type 1 diabetic patients, a finding which is in agreement with other reports [9,27] but contradicts other reports [10,14]. This discrepancy may reflect, in part, the fewer type 1 diabetic patients involved in this study or merely different ages of the two groups are important in this respect.

Likewise, it was shown that CTS is a common finding in type 2 diabetics as compared to type 1 diabetics. This could be attributed to the younger ages in the latter group or because the females represent the majority of the patients in the earlier group [30,31]. The absence of sensory nerve action potential in patient with severe entrapment of the median nerve in the carpal tunnel region and having hand changes could support the association between these changes and the duration of diabetes. However, in a study of patients with type 1 or type 2 DM compared with control subjects without DM, Cagliero et al. [18] found that the prevalence of CTS among patients with DM was not significantly increased above that in non-diabetic controls.

A clear association between DD and PNP was found in the present study, a finding had been demonstrated previously [13,14,31]. In addition, Kizilcan and Benbir [32] suggest that female patients with diabetic neuropathy might have a more severe sensorial neuropathy than patients without skin lesions. This association would suggest that similar factors might be contributing to the pathogenesis of DD and PNP in which DHS may cause pathogenic factor seem to be vascular denervation or nerve damage.

Future planning is to search for the association of these hand changes and the presence of retinopathy and/or nephropathy and to correlate them with the degree of diabetic control.

5. Conclusion

The prevalence of CTS and hand changes was higher in type 2 diabetics. The association of Dupuytren’s disease and PNP suggests that common factors could contribute to their pathogenesis. Consequently, clinical examination for diabetic hand should not ignore it.

Acknowledgements

We thank the nurses, interns, and medical staff of Al-Hikma Modern Hospital for their excellent clinical care for the diabetic patients.

Conflict of interest

There are no conflicts of interest.

References


