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Research Article

Frequency and Pattern of Upper Limb Musculoskeletal Disorders in Patients with Type 2 Diabetes Mellitus

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Abstract

Background and Aim of the Work: Higher prevalence of musculoskeletal pain, especially upper limb musculoskeletal disorders was revealed in patients with type 2 diabetes mellitus. In this study, we sought to determine the frequency and pattern of upper limb musculoskeletal disorders in patients with T2DM.

Methods: This cross-sectional study, examined 80 diabetic patients who were referred to the clinic of endocrinology in 22-Bahman academic hospital and Persian Diabetes Clinic. Furthermore, the demographic characteristics and prevalence of adhesive capsulitis, carpal tunnel syndrome, trigger finger, and Dupuytren`s contracture were investigated.

Results: According to the results, 8 adhesive capsulitis (10%), 3 trigger finger (3.75%), and 6 carpal tunnel syndrome patients (7.6%) were reported in the study population. None of the patients in this study suffered from Dupuytren`s contracture. Analytical tests showed that carpal tunnel syndrome is more common among women ($p = 0.007$). There was a significant relationship between trigger finger and age and disease duration ($p = 0.018$, 0.016, respectively). In addition, trigger finger was directly associated with age. The HbA1c level below 7 showed that there was a slightly significant relationship between adhesive capsulitis and carpal tunnel syndrome. There was an inverse relationship between the duration of diabetes mellitus and the incidence of adhesive capsulitis.

Conclusion: The present study provided some evidence for the importance of musculoskeletal complications in diabetic patients. Besides, the female gender was identified as a risk factor for carpal tunnel syndrome. It is important to value the importance of these disorders in the prevention and rehabilitation of diabetic patients.

Keywords: *Diabetes Mellitus; Rheumatic and Musculoskeletal Diseases*

Introduction

Diabetes mellitus (DM) is a worldwide health concern with a remarkable impact on individuals, health systems, and costs to society [1]. According to the International Diabetes Federation (IDF), diabetes affected 425 million adults worldwide in 2018, and it is estimated to affect up to 629 million people by 2045 [2]. Conditions are even worse in the Middle East and North Africa region (MENA) [3] since they reportedly have the highest prevalence of diabetes in the world with about 37 million diabetic patients.

The chronic hyperglycemia of diabetes is correlated with lifelong disorders such as nephropathy, retinopathy, neuropathy, and musculoskeletal disorders [4,5]. According to recent studies, a higher prevalence of musculoskeletal disorders was reported in patients with type 2 diabetes mellitus (T2DM) in comparison with non-diabetic patients [6]. The pathophysiology of most of these disorders remains unknown [7,8]. However, neuropathy, vasculopathy, or connective tissue disorders are said to contribute to such disorders [9]. Although musculoskeletal diseases can cause pain and loss of function at the involved locations and limit the workout programs that are part of the treatment program of the diabetic people [7], there is limited data about the musculoskeletal disorders of diabetic patients and most of the studies have been carried out in Europe [10]. Therefore, there is a growing interest in paying more attention to the development in the interpretation of relation musculoskeletal pain prevalence in diabetic patients.

Among all types of musculoskeletal pain, it is demonstrated a significant difference for limb pain, especially shoulder and hand, are most frequently involved [11]. Upper limb musculoskeletal disorders are different in DM patients include adhesive capsulitis (AC), trigger finger (TF), Dupuytren's contracture (DCT), and carpal tunnel syndrome (CTS) other rare complications [7]. Given the different methods, the findings of the previous survey are not comparable [6]. Hence, the present study aimed to investigate the frequency and types of upper limb musculoskeletal difficulties in people with T2DM in Mashhad, Iran.

Materials and Methods

In this cross-sectional study, 80 subjects with T2DM were enrolled from the endocrinology clinic of 22-Bahman Hospital and Parsian diabetes clinic, Mashhad, Iran, from 2013 to 2014. T2DM patients were diagnosed based on the following diagnostic criteria: 1. Hemoglobin A1c (HbA1c) level 6.5% or higher, 2. Fasting plasma glucose (FPG) level 126 mg/dL (7 mmol/L) or higher; fasting is defined as no caloric intake for at least 8 hours, 3. 2-hour plasma glucose level of 200 mg/dL (11.1 mmol/L) or higher during a 75-g oral glucose tolerance test (OGTT), 4. Random plasma glucose of 200 mg/dL (11.1 mmol/L) or higher was seen in a patient with classic symptoms of hyperglycemia (i.e. polyuria, polydipsia, weight loss).

Data collection

The information collected in the study are outlined as follows: demographic and clinical data such as age, gender, marital status, education level, family history of diabetes mellitus, fasting blood glucose (FBS), level of phosphorus, lipid profile (low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglycerides (TG), cholesterol (Chol)), HbA1c, Uric acid, and creatinine.

Exclusion criteria included a history of other metabolic diseases, trauma, surgery, and fractures of the upper limb. Eligible patients were examined based on musculoskeletal disorders including CTS, TF, AC, and Dupuytren`s contracture. The diagnosis of Dupuytren`s contracture included four features: a palmar or digital nodule, a pretentious band, and digital contracture. Key diagnostic criteria for identifying the CTS were pain or paresthesia or sensory loss in the median nerve distribution. TF was diagnosed based on palpable nodule or thickened flexor tendon with locking during extension or flexion of any finger. AC was associated with a stiff and painful shoulder.

Statistical analysis

Statistical analyses were performed in SPSS, version 18. The normal distribution assumptions were assessed by the Kolmogorov-Smirnov test. Mean ± standard deviation was applied for quantitative normally distributed variables, median (plus range) for quantitative nonparametric data, and number (plus percentage) for qualitative variables. The Pearson product-moment test was used to detect relation among continuous parameters and multiple linear regression analysis was conducted to detect correlation between pain measurements and other parameters. A P-value of less than 0.05 was considered statistically significant.

Ethical consideration

Written informed consent was obtained from each participant. This study was approved by the Medical Research Ethics Committee of Islamic Azad University of Mashhad, Iran.

Results

As shown in table 1, 80 patients with T2DM were enrolled in the study, including 38 females (47.5%) and 42 males (52.5%) with a mean age of 58.4 ± 10.7 years. The majority and minority of patients were in age groups of 50 - 59 and 80 - 89 respectively. The duration of the disease in most of the patients was less than 10 years old. The distribution of demographic variables was normal ($p < 0.05$) as calculated by the Kolmogorov-Smirnov test. Diabetic patients were investigated for AC, carpal tunnel syndrome, TF, and DCT. Accordingly, 8 AC (10%), 3 TF (3.75%), 6 CTS patients (7.6%), and 21.35% in total were detected in the study population. None of the patients in this study suffered from Dupuytren`s contracture.

	Patient (n = 80)	AC		TF		CTS		DCT	
Age (years)[b]			+		+		+		+
30 - 39	4 (5%)[a]	3	1	4	0	3	1	4	0
40 - 49	12 (15%)	11	1	12	0	12	0	12	0
50 - 59	27 (34%)	26	1	25	2	24	3	27	0
60 - 69	25 (31%)	21	4	24	1	24	1	25	0
70 - 79	10 (12%)	10	0	10	0	10	0	10	0
80 - 89	1 (3%)	1	0	1	0	1	0	1	0
Gender									
Male	42 (52.5%)	37	5	41	1	42	0	42	0
Female	38 (47.5%)	35	3	36	2	32	6	38	0
Duration of disease[b]									
10 > years	53 (0.67%)	48	5	48	5	50	3	53	0
11 - 19 years	16 (0.20%)	14	2	14	2	14	2	16	0
20 - 29	7 (0.08%)	7	0	7	0	6	1	7	0
30 - 39	3 (0.03%)	2	1	2	1	3	0	3	0

Table 1: *Baseline of clinical and laboratory data according to the pattern of upper limb musculoskeletal disorders in the diabetic patients.*

[a]: Data are presented as No. (%).

[b]: Missed data due to non-cooperation of a patient

AC: Adhesive Capsulitis, TF: Trigger Finger, CTS: Carpal Tunnel Syndrome, DCT: Dupuytren's Contracture.

Association analysis

P-values were calculated using the Chi-square test. There was no remarkable correlation between CTS, TF, AC, and blood glucose-lowering agents (p-values: 0.949, 0.817, and 0.970, respectively).

As illustrated in table 2, there was a relationship between AC and duration of T2DM (p-value = 0.016). Having obtained significant results, the Pearson correlation analytical test was performed. Pearson correlation test showed that with a decrease in the duration of

T2DM to less than 10 years, the number of complications of AC increases (p-value = 0.016, r = -0.13). There was a significant relationship between TF, age, and disease duration (p-values = 0.018, 0.016, respectively). There was also a significant relationship between TF and age, meaning that as the age increases between 50 and 70 years, the incidence of this disorder increases (p-value = 0.016, r = -0.13). According to the results, there was a significant relationship between CTS and gender (p-value = 0.007). The analytical test showed that the rate of this disorder increases among women (p-value = 0.007, r = 1).

	Gender		Duration		Age	
	Statistical value	p-value	Statistical value	p-value	Statistical value	p-value
CTS	7.164	0.007	15.626	0.788	30.320	0.806
TF	0.459	0.498	37.277	0.016	58.452	0.018
AC	0.356	0.414	37.277	0.016	35.041	0.670

Table 2: *Association of upper limb musculoskeletal disorders and demographic variables.*
Medication: Blood glucose lowering agents.
p-values calculated using chi-square test.
CTS: Carpal Tunnel Syndrome; TF: Trigger Finger; AC: Adhesive Capsulitis.

The relationship between T2DM control variables such as HbA1c, TG, HDL, LDL, blood pressure, and musculoskeletal disorders were investigated, and two significant associations were detected; HbA1c level below 7 showed a slightly significant relationship with AC and CTS (both p-values = 0.05).

Discussion

Diabetes Mellitus is a systemic disease that not only causes metabolic problems but also a wide range of musculoskeletal pain leading to disability and decreased life quality [8]. According to the reports, few studies have focused on the correlation among T2DM complications, and upper limb musculoskeletal disorders [11,12]. Our results have revealed that the prevalence of upper limb musculoskeletal diseases in people with T2DM was 21.35% in total. The most common upper limb musculoskeletal complications were AC, followed by CTS, and TF disorders. Existing literature indicates musculoskeletal disorder was highly prevalent in patients with T2DM [13]. In previous studies, musculoskeletal disorders frequencies in the hands, shoulders, and upper limbs were approximately 20.5, 19.5, and 32.9%, respectively [6,13]. Musculoskeletal difficulty directly or indirectly interferes with or reduces the physical activity levels of patients with diabetes [14]. Kermani., *et al.* in 2017 found the most common musculoskeletal complications were CTS, TF, AC, and DCT among DM patients [11]. In a study conducted by Zreik., *et al.* in 2016, AC was found an overall mean prevalence of AC in DM of 13.4% [15]. According to meta-analysis, diabetic patients are five times more tend to develop AC than the control group [15]. In addition, in diabetic people, AC is considered resistant to treatment and more severe [16]. Tighe., *et al.* showed that the occurrence of AC was two to four times higher in diabetics compared to the non-diabetic society in the US, and the frequency of diabetes in people with AC was shown at 38.6% [17]. Cagliero., *et al.* reported that DM is the most prevalent metabolic disorder that causes CTS, found in 14%–16% of subjects [18]. A cross-section of 100 people with upper limb musculoskeletal diseases demonstrated that in patients with DM, the incidence of TF ranges from 5% to 36% [19]. They found 12% of patients suffering from CTS.

According to our result, Dupuytren`s contracture is not associated with T2DM. On the contrary, it is reported that DCT as the highest prevalent disorder, frequency ranges from 12% to 14% in T2DM [8]. The most remarkable confounding parameter is the consumption of alcohol as it can cause DCT independent of its influence on the liver [20]. Due to the prohibition of alcohol consumption in Islam, the prevalence of DCT in Muslim societies was reportedly lower, compared to other musculoskeletal disorders [11]. More studies are needed to investigate the precise of this hypothesis. The results showed that there was a direct correlation between the age and incidence of TF. Furthermore, there was an inverse correlation between the duration of T2DM and the incidence of AC. Kidwai., *et al*. showed that there

was a direct correlation between age and duration of the disease with musculoskeletal disorders, which is somewhat consistent with our study [6]. In addition, Akulwar., *et al*. argued that there was no considerable correlation between the age and duration of T2DM and the incidence of CTS, which was consistent with our study as well [21]. We found female patients suffer from upper limb musculoskeletal pain than men, which is consistent with previous studies [14,22]. Whelton and Peach in 2017 reviewed that AC most commonly influences people in middle age and influences women to some extent more than men [16].

Different studies have come to controversial conclusions about the relationship between controlling blood glucose levels and musculoskeletal complications [23]. In the present study, an inverse relationship between HbA1c as an indicator of blood glucose control and the rate of AC and CTS was observed. However, Singh examined type 1 diabetes patients and reported that there was no significant correlation between CTS and controlling blood glucose [24]. It has been reported that the rate of AC is associated with age and duration of the disease, in both patients with T1DM and T2DM [8].

Conclusion

Due to the increase in the prevalence of T2DM and its complications, we recommend the health care system consider the early diagnosis of T2DM which may result in better treatment procedures. A comprehensive musculoskeletal examination should be included as an essential part of T2DM patient care. This study tried to provide evidence for the importance and frequency of upper limb musculoskeletal complications in diabetic patients. Besides, the female gender was identified as a risk factor for CTS.

Limitations of the Study

This study faced some limitations. First, the mismanagement of data gathering happened due to the non-cooperation of participants with the physician. Second, this was a cross-sectional study and had no follow-up; thus, we could not clearly establish a causal relationship between musculoskeletal disorders and the development of T2DM. Third, the sample size was limited, and further larger studies are required in this regard.

Conflicts of Interest

The authors have declared that no competing interests exist.

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