Musculoskeletal Disorders in Patients with Diabetes Mellitus: A Cross-Sectional Study

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1. Introduction

Diabetes mellitus (DM) is a major public health problem worldwide. It was estimated that in 2017 there were 451 million (age: 18–99 years) people with DM. These figures were expected to increase to 693 million by 2045 [1]. A variety of musculoskeletal (MS) disorders have been associated with DM and can cause significant disability [2, 3]. These conditions include shoulder capsulitis (SC), limited joint mobility (LJM), trigger finger (TF), Dupuytren’s contracture (DC), Charcot’s foot (CF), carpal tunnel syndrome (CTS), osteoarthritis (OA), and other rare complications [4]. The pathophysiology leading to these disorders in patients with DM is not well understood. DM is a chronic metabolic disorder characterized by chronic hyperglycemia. High glucose levels may affect cell function and alter extracellular matrix components of the connective tissue producing damage [3, 5]. In contrast to vascular complications of DM, which has been studied extensively, MS disorders have been hitherto neglected. This study was carried out to investigate the prevalence of MS disorders in Moroccan diabetic patients, their associated factors, and their relationship to other diabetic complications, including micro- and macrovascular complications.

2. Materials and Methods

A cross-sectional study was performed between January 2015 and March 2016 and enrolled consecutive patients with...
3.1. Participant’s Characteristics. The study included 376 DM patients. The participants’ median age was 54 years [45–62]. There were as many men as women among the participants (n = 188, sex ratio=1). 318 patients (84.6%) had T2DM while 58 (15.4%) had T1DM. The median duration of diabetes was 8 years [4–13]. Sixteen percent of our patients had more than 10 years of diabetes. 50.7% were treated with insulin ± oral hypoglycemic. The mean HbA1c value was 8.5 ± 2%. Poor glycemic control was noted in 68.9% of patients. The mean BMI value was 26.4 ± 3.6 kg/m². 45.7% of the patients were overweight, while 15.4% were obese. In this study, 149 patients (39.6%) had dyslipidemia and 155 (41%) had one or more microvascular complications of diabetes. They were dominated by retinopathy in 28.2% of cases, and nephropathy and neuropathy were observed, respectively, in 16.1% and 12.8% of our patients. Sixteen patients (4.3%) had macrovascular complications of DM (coronary artery disease, peripheral arterial disease, and history of stroke) (Table 1).

3.2. Prevalence of Abnormalities. The total of patients with MS disorders was 129 (34.3%) out of total 376 cases. They predominated among type 2 diabetics 119 (37.4%) cases versus 10 (17.2%) in type 1 diabetics. Hand disorders were seen in 54 (14.4%) patients; CTS was the most prevalent (8.8%) condition in 33 (8.8%) patients (28 (8.8%) had T2DM versus 5 (8.6%) with T1DM) followed by TF in 22 (5.9%) patients (20 (6.3%) had T2DM versus 2 (3.4%) with T1DM) and LJM in 11 patients, and all of them had T2DM and DC in 2 (0.5%) and all of them had T2DM. SC was present in 47 (12.5%) patients (45 (14.2%) had T2DM versus 2 (3.4%) with T1DM) and CF in 1 case (0.3%) with TIDM. OA was seen in 73 (19.4%) patients (71 (38.4%) had T2DM versus 2 (2.2%) with T1DM) (Table 2). Furthermore, One and two disorders were seen in 25.8% and 5.1% of our patients, respectively, while three disorders in the same patient were seen infrequently (3.5%). The prevalence rates according to demographic and clinical characteristics of patients are shown in Table 3.

In the multivariate analysis, the only factors that were significantly associated with increased prevalence of one or more MS disorders were age above 50 years and dyslipidemia (P = 0.002 and P = 0.009, respectively). Age above 50 years was an associated factor for SC and OA (P = 0.019 and P = 0.010, respectively). Duration of diabetes also seemed to confer higher risk; thus patients having diabetes for > 10 years were more likely to have hand disorders (P = 0.017). Females were more likely to have OA (P = 0.009). Overweight and nephropathy seemed to be significantly associated with OA (P = 0.004 and P = 0.032, respectively). Dyslipidemia was significantly associated with increased odds of hand disorders and SC (P = 0.019 and P = 0.047, respectively) (Table 4).

4. Discussion

Many studies have evaluated MS disorders in diabetic patients, but most assessed only an individual component, especially upper limb MS abnormalities. Moreover, the relationship between dyslipidemia and MS disorders has been
Table 1: Descriptive characteristics of the study population (n = 376).

| Range | \(\text{Age yrs; medians (IQR)}\) | 54 [45-62] | 17-88 |
|-------|----------------------------------|------------|-------|
| \(\text{Gender}\) | \(\text{Menn\%)}\) | 188 (50) | \(\text{Female n\%)}\) | 188 (50) |
| \(\text{Type of DM}\) | \(\text{T1DM n\%)}\) | 58 (15.4) | \(\text{T2DM n\%)}\) | 318 (84.6) |
| \(\text{HbA1c; means (SD)}\) | 8.5±1.9 | 4.2-17 |
| \(\text{BMI kg/m\"^2; means (SD)}\) | 26.4±3.6 | 17-42 |
| \(\text{Duration of DM yrs; medians (IQR)}\) | 8 [4-13] | 1-37 |
| \(\text{Retinopathy n\%)}\) | 106 (28.2) | \(\text{Nephropathy n\%)}\) | 61 (16.1) |
| \(\text{Neuropathy n\%)}\) | 48 (12.8) | \(\text{Macrovascular complications n\%)}\) | 16 (4.3) |
| \(\text{Dyslipidemia n\%)}\) | 145 (41) |

DM: diabetes mellitus; T2DM: type 2 diabetes mellitus; T1DM: type 1 diabetes mellitus; HbA1c: hemoglobin A1c; BMI: body mass index.

Table 2: Prevalence and distribution of cases according to MS disorders in relation to type of diabetes.

| \(\text{Type of diabetes}\) | \(\text{Type 1 N = 58}\) | \(\text{Type 2 N = 318}\) | \(\text{P}\) | \(\text{Total N =376}\) |
|-----------------------------|-------------------------|-------------------------|-------|------------------------|
| \(\text{MS disorders}\) | \(n\%\) | \(n\%\) | \(n\%\) | \(n\%\) |
| \(\text{Osteoarthritis}\) | 2 3.4 | 71 22.3 | \(0.001^*\) | 73 19.4 |
| \(\text{Shoulder capsulitis}\) | 2 3.4 | 45 14.2 | \(0.023^*\) | 47 12.5 |
| \(\text{Carpel Tunnel Syndrome}\) | 5 8.6 | 28 8.8 | 0.964 | 33 8.8 |
| \(\text{Limited joint mobility}\) | 0 0 | 11 3.5 | 0.151 | 11 2.9 |
| \(\text{Trigger Finger}\) | 2 3.4 | 20 6.3 | 0.397 | 22 5.9 |
| \(\text{Dupuytren's contracture}\) | 0 0 | 2 0.6 | 0.545 | 2 0.5 |
| \(\text{Total MS disorders}\) | 10 17.2 | 119 37.4 | 0.149 | 129 34.4 |

MS disorders (one or more) were seen in over one-third of our patients. In previous reports, the prevalence ranged between 26% and 64% [12, 13]. In our study, CTS was found in 8.8% followed by TF seen in 6.3% and LJM in 3.5% of patients. Duration of diabetes (≥10 years) was observed to be associated with such disorders (\(P = 0.017\)). In fact, this association between the hand abnormality and the duration of diabetes is a consistent finding [14, 15]. Moreover, we found a significant association between dyslipidemia and increased prevalence of hand disorders (\(P = 0.019\)).

The association between diabetes and SC is well established [16, 17]. In our study, SC was found in 12.5%. Prior studies reported variable prevalence rates of SC ranging between 11% and 19% in patients with diabetes, compared with 2% to 3% of age-matched controls [18]. In this study, older age and dyslipidemia have been linked to an increased risk of developing SC. Moreover, there was no association between HbA1c level and MS disorders. These findings are similar to the results of some previous studies [10, 19, 20]. Cagliero et al. reported a strong correlation between SC and microangiopathic complications [10]. Nevertheless, such association was not supported by our report.
The most frequent MS disorders in this study were OA, observed in 19.4% of our patients. Most of them had T2DM. This association with T2DM can be partially explained by advanced age and high prevalence of overweight in this population. Hands, spine, and knees are the most common joints affected. We found that older age, female gender, and overweight were significantly associated with the presence of OA \( (P = 0.01, P = 0.009, \text{ and } P = 0.004, \text{ respectively}) \). These findings were reported in previous study \[21, 22\]. This relationship is not entirely clear; it has been traditionally attributed to underlying shared risk factors of age and obesity \[23, 24\]. The coexistence of both OA and DM can be a source of greater disability. In a population cohort with hip and knee OA, Hawker et al. reported that one in six have diabetes. Among those with both OA and diabetes, baseline difficulty walking was a significant predictor of risk for serious diabetes complications \[25\]. In this study, we found that nephropathy was significantly associated with increased odds of OA \( (P = 0.032) \).

Finally, this work has some possible limitations. It was an observational study and some additional confounders as smoking and physical activity were not included.
Table 4: Multivariate analysis of factors associated with MS disorders.

| variable            | Hand disorders | Shoulder capsulitis | Osteoarthritis | MS disorders (total) |
|---------------------|----------------|--------------------|----------------|----------------------|
|                     | OR (95% CI)    | OR (95% CI)        | OR (95% CI)    | OR (95% CI)          |
|                     | P value        | P value            | P value        | P value              |
| AGE (yrs)           |                |                    |                |                      |
| <50                 | 1              |                    | 1              |                      |
| ≥50                 | 3.06 (1.09-8.62) | 3.15 (1.31-7.54) | 2.94 (1.50-5.73) |                      |
| Gender              |                |                    |                |                      |
| Male                |                |                    |                |                      |
| Female              | 2.15 (1.20-3.85) | 0.009              |                |                      |
| BMI (%)             |                |                    |                |                      |
| Normal              | 1              |                    | 1              |                      |
| Overweight          | 1.84 (1.21-2.80) | 0.004              |                |                      |
| Obesity             | 0.6 (0.3-1.15) | 0.128              |                |                      |
| Duration (yrs)      |                |                    |                |                      |
| <10                 | 1              |                    | 1              |                      |
| ≥10                 | 2.09 (1.14-3.83) | 0.017              |                |                      |
| Dyslipidemia        |                |                    |                |                      |
| Non                 | 1              |                    | 1              |                      |
| Yes                 | 2.03 (1.12-3.68) | 0.019              | 1.90 (1-3.59) | 0.047                |
| Nephropathy         |                |                    |                |                      |
| Non                 |                |                    | 1              |                      |
| Yes                 | 2.14 (1.06-4.29) | 0.032              |                |                      |

BMI: body mass index.

5. Conclusion

In the present study, MS disorders occur with a greater frequency in patients with DM. OA was the most frequently seen disorder. One or more MS disorders were significantly associated with various factors, especially dyslipidemia. Blood glucose control does not appear to be associated with development of MS disorders. We suggest that the MS examination should be included in the systematic evaluation of patients with diabetes.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent

Written informed consent was obtained from patients for this study.

Conflicts of Interest

No conflicts of interest were declared by the authors.

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Naima Benrachid contributed to the preparation of the manuscript.

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