Musculoskeletal Disorders in Patients with Diabetes Mellitus

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Abstract:

Objectives: Musculoskeletal Disorders or MSDs are injuries and disorders that affect the human body's movement or musculoskeletal system. Various musculoskeletal disorders (MS) are linked with diabetes mellitus (DM). The aim of this study is to analyze the association of Musculoskeletal disorders with Diabetes Mellitus in diabetic patients.

Methods & Materials: Patients with diabetes mellitus were enrolled in a cross sectional study. Characteristics of DM and demographic features of patients were recorded. Clinical examinations and investigations were held to assess vascular complications and Musculoskeletal disorders. Factor association of MS disorders were assessed by univariate and multivariate analyses.

Results: 308 patients were included from which 84.4% had type 2 Diabetes Mellitus and 15.6 had Type 1 Diabetes mellitus. The median age was calculated to be 53 years between 44 to 63 years. 41% had one or more vascular complications. 34.4% had one or more MS disorders. Osteoarthritis was found in 24.4% of patients. Hand disorders observed as Duputrens contracture 1%, Carpel tunnel syndrome 9.7%, limited joint mobility 3.9%. Shoulder capsulitis was present in 15.3%. Long duration of diabetes and dyslipidemia were associated with increased prevalence of hand abnormalities ($P = 0.018; P = 0.02$, respectively). Age and
dyslipidemia were associated with shoulder capsulitis \( P = 0.018; P = 0.048 \), respectively. Female gender, overweight, and nephropathy were associated with increased odds of osteoarthritis \( P = 0.008, P = 0.003, \) and \( P = 0.031 \), respectively.

**Conclusions:** Musculoskeletal disorders showed an association many different factors of Diabetes mellitus. Hemoglobin A1c level does not appear to be associated with development of Musculoskeletal disorders.

**Key words:** Musculoskeletal, Diabetic Mellitus, Carpel Tunnel

**Introduction:**

Diabetes mellitus (DM) is considered to be one of the major public health problem all over the world. According to an estimation in 2017 there were four hundred and fifty one million people affected with this disorder and there age range was between eighteen year old to ninety nine year old and six hundred and ninty three million increase in such cases was forecasted till the year 2045\(^1\). Various musculoskeletal (MS) disorders have shown association with diabetes mellitus\(^2,3\). The noteworthy conditions of musculoskeletal conditions are shoulder capsulitis (SC), limited joint mobility (LJM), trigger finger (TF), Dupuytren’s contracture (DC), Charcot’s foot (CF), carpel tunnel syndrome (CTS), osteoarthritis (OA), and other rare complications\(^4\). The pathophysiology resulting in these disorders in patients with DM is not clearly traced. Diabetes Mellitus is a chronic metabolic disorder characterized by chronic hyperglycemia. High glucose levels may have affect on cell function and change extra cellular matrix components of the connecting tissue which in results causes the damage\(^3,5\). In comparison to vascular complications caused by diabetes mellitus the musculoskeletal disorders have not been studies deeply or extensively. This cross sectional study was done to analyze the pervasiveness of MS disorders in diabetic patients, their associated factors, and their relationship to other diabetic complications, including micro- and macro vascular complications.

**Methods & Materials:**

This study was conducted in Bilawal Medical College Hospital Jamshoro Pakistan from July 2020 to July 2021. In this study Type 1 DM and Type 2 DM patients were enrolled after consent in a cross sectional study. The eligibility criteria stated atleast one year history of Diabetic Mellitus diagnosed according to the standards of World Health Organization (fasting plasma glucose level of \( \geq 126 \text{ mg/dL} \) (7.0 mmol/l)\(^6\). Patients with a history of hand trauma,
central or peripheral nervous system disease, chronic rheumatic disease, and end-stage renal disease and patients with thyroid disorders were excluded. Ethical approval was obtained from the local ethics committee.

Demographic features such as age, gender, and body mass index (BMI) were recorded for all patient included in the study. Clinical data was recorded including type and duration of diabetes (in years), antidiabetic treatment, the hemoglobin A1C (HbA1c) levels of the patients, and lipid profiles. Dyslipidemia was also defined in accordance with the American Diabetes Association (ADA) criteria. Diabetes was also considered to be controlled only if Hemoglobin A1c level was less than seven percent according to ADA criteria, 2008. Vascular complications of DM were recorded, including microvascular complications (retinopathy, nephropathy, and neuropathy), and also macro vascular complications were recorded (coronary artery disease, peripheral arterial disease, and history of stroke).

Targeted medical history was used to assess Musculoskeletal disorders, standardized physical examination, and investigations if needed. Carpal Tunnel Syndrome diagnosis was based on clinical symptoms including pain and sensory disturbances in the thumb, index, middle, and the outer half of the ring fingers and suspected cases were evaluated by electroneuromyography (ENMG). Diagnosis of SC was based on the limitation of active and passive shoulder joint movements in all directions, especially rotational movements. The following four features were basis of DC Diagnosis: a palmar digital nodule, tethering of the palmar or digital skin, a paratendinous band, and a digital flexion contracture. TF was diagnosed by palpating a nodule or thickened flexor tendon with locking happening in extension and flexion of any fingers. OA was researched on patients with chronic joint or back pain. The diagnosis was based on radiographic finding of reduced joint space, subchondral cyst, and osteophytes.

Descriptive statistics were obtained, such as mean values for continuous variables and proportions for categorical variables. The relation between prevalence of MS disorders and various variables was assessed for statistical significance using the Chi-square test. Multiple logistic regression analysis was conducted to assess the multivariate associations between MS disorders and different factors. A $p$-value $<$ 0.05 was considered statistically significant. Statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS, version 23).
Results:

The study enrolled 308 Diabetes Mellitus patients. The patients' median age was 53 years 44 to 63. The gender was 46 percent male and 54 percent female.

Eighty four percent of patients had Type 2 Diabetes mellitus while sixteen percent had Type 1 Diabetes Mellitus.

The median duration of diabetes was 7 years 4-13. Seventeen percent of our patients had more than 10 years of diabetes. 51.7% were treated with insulin ± oral hypoglycemic. The mean HbA1c value was 8.4±1.8. Poor glycemic control was noted in 67.9% of patients. The mean BMI value was 25.4±3.7kg/m². 46.7% of the patients were overweight, while 15.4% were
obese. In this study, 148 patients (48.05%) had dyslipidemia and 156 (50.6%) had one or more microvascular complications of diabetes.

<table>
<thead>
<tr>
<th>Table 1: Descriptive characteristics of Patients (n= 308).</th>
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<tbody>
<tr>
<td>Age years; medians (IQR)</td>
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<tr>
<td>Duration of DM years; medians (IQR)</td>
</tr>
<tr>
<td>Hemoglobin A1c; means (SD)</td>
</tr>
<tr>
<td>BMI kg/m²; means (SD)</td>
</tr>
</tbody>
</table>

They were dominated by retinopathy in 28% of cases, nephropathy in 16 percent cases and neuropathy in 12 percent cases. Fourteen patients (4.5%) had macrovascular complications of DM (coronary artery disease, peripheral arterial disease, and history of stroke)
The total of patients with MS disorders was 191 (62%) out of total 308 cases. They predominated among type 2 diabetics 178 (68.5%) cases versus 13 (27.1%) in type 1 diabetics. Hand disorders were seen in 57 (18.5%) patients, CTS was the most prevalent (9.7%) condition in which 26 (10%) patients had T2DM versus 4 (8.3%) had T1DM) followed by Triger Finger in 24 (7.8%) patients (3 (6.3%) had T1DM versus 21 (8.1%) with T2DM) and LJM in 12 patients, and all of them had T2DM and DC in 3 (1%) and all of them had T2DM. SC was present in 47 (15.3%) patients (44 (16.9%) had T2DM versus 3 (6.3%) with T1DM) and CF in 1 case (0.3%) with T1DM. OA was seen in 75 (24.4%) patients (72 (27.7%) had T2DM versus 3 (6.3% with T1DM)

Table 2:

<table>
<thead>
<tr>
<th>MS disorders</th>
<th>Type 1 DM n=48</th>
<th>Type 2 DM n=260</th>
<th>P</th>
<th>Total n=308</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>3</td>
<td>6.3</td>
<td>72</td>
<td>27.7</td>
</tr>
<tr>
<td>Shoulder capsulitis</td>
<td>3</td>
<td>6.3</td>
<td>44</td>
<td>16.9</td>
</tr>
<tr>
<td>Carpel Tunnel Syndrome</td>
<td>4</td>
<td>8.3</td>
<td>26</td>
<td>10.0</td>
</tr>
<tr>
<td>Limited joint mobility</td>
<td>0</td>
<td>0.0</td>
<td>12</td>
<td>4.6</td>
</tr>
<tr>
<td>Trigger Finger</td>
<td>3</td>
<td>6.3</td>
<td>21</td>
<td>8.1</td>
</tr>
<tr>
<td>Dupuytren’s contracture</td>
<td>0</td>
<td>0.0</td>
<td>3</td>
<td>1.2</td>
</tr>
<tr>
<td>Total MS disorders</td>
<td>13</td>
<td>27.1</td>
<td>178</td>
<td>68.5</td>
</tr>
</tbody>
</table>

MS: musculoskeletal, DM: Diabetes Mellitus

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

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. Age above 50 years was an associated factor for SC and OA. Duration of diabetes also seemed to confer higher risk; thus patients having diabetes for greater than 10 years were more likely to have hand disorders. Females were more likely to have OA. Overweight and nephropathy seemed
to be significantly associated with OA. Dyslipidemia was significantly associated with increased odds of hand disorders and SC

**Discussion:**

Evaluation of MS disorders in diabetic patients was done in many studies. Previously the studies mostly assessed only individual components mostly upper limb MS abnormalities. Moreover, the coordination between dyslipidemia and MS disorders has been overlooked. However the current study examined various factors associated with increased prevalence of MS disorders in Type 1 DM and Type 2 DM including vascular complications and dyslipidemia.

Three important findings were observed by this study. First, the frequency of Musculoskeletal disorders in Diabetes Mellitus was thirty four percent. The most common MS complications were Osteoarthritis and hand disorders. Secondly, age above 50 years and dyslipidemia were significantly associated with the development of various MS manifestations. Thirdly, Homoglobin A1c level was not found to be linked to any of Musculoskeletal disorders.

Musculoskeletal disorders (one or more) were found in over one-third of enrolled patients. In other previous studies, the prevalence has been reported in about 36–75% of diabetic patients. The lower prevalence of MS complications in our current study could be related to the fact that we included both the type 1 DM and Type 2 DM. In current study, age greater than 50 years and dyslipidemia were found to be associated with Musculoskeletal disorders. Which is in accordance with the previous studies. The occurrence of hand disorders is higher in patients with diabetes compared with nondiabetic patients. Hand disorders observed as Duputrens contracture 1 %, Carpel tunnel syndrome 9.7% , limited joint mobility 3.9 %. Shoulder capsulitis was present in 15.3%. Long duration of diabetes and dyslipidemia were associated with increased prevalence of hand abnormalities. In previous reports, the occurrence ranged between twenty six percent and sixty four percent.

There is well established association between diabetes and SC. Older age and dyslipidemia have been connected to an increased risk of developing SC. Moreover, there was no association found between HbA1c level and MS disorders. These findings are similar to the results of
some previous studies 18,19,20. Strong correlation between SC and microangiopathic complications were corelated10. Nevertheless, such association was not supported in this study.

The most frequent occurring MS disorders in this study were OA, observed in almost twenty four percent of the subjected patients. Most of them had Type 2 Diabetes Mellitus. This association with T2DM, advanced age and high prevalence of overweight could be the reason of this association. Hands, spine, and knees are the most common joints affected. It was found that older age, female gender, and overweight were significantly associated with the presence of OA. These findings were reported in previous study 21,22. This relationship is not entirely obvious it has been traditionally attributed to underlying shared risk factors of age and obesity23,24. 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 complications25. It was founded in this study that nephropathy was strongly linked with increased odds of OA.

**Conclusion:**

Diabetes Mellitus patients face frequent occurrence of Musculoskeletal disorders. Osteoarthritis one of the largest occurring disorder. One or more Musculoskeletal disorders were significantly associated with various factors, especially dyslipidemia. Blood glucose control was not found to be linked with development of MS disorders. It is suggested that the MS examination should be included in the systematic evaluation of patients with diabetes.
References:
