

Impact of Upper Limb Musculoskeletal Disorders on Quality of Life in Type 2 Diabetes Mellitus

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ABSTRACT

Introduction: Diabetes Mellitus (DM) is a chronic multisystem disease characterised by persistent hyperglycaemia that lead to a wide range of complications, including Musculoskeletal Disorders (MSD). Quality Of Life (QOL) in chronic diseases such as DM has an important role in mental, physical and social performance of patients and plays an important role in health care.

Aim: To study the impact of upper limbs MSD on QOL in diabetic patients.

Materials and Methods: A cross-sectional study was conducted at Department of Internal Medicine in Imam Khomeini Hospital, Sari, North of Iran from March 2013 to April 2016, on 50 patients with type 2 DM suffering from upper limb MSD and 50 age and sex matched diabetic patients with no upper limb problems.

QOL was evaluated using the Mental and Physical Components Scores (MCS and PCS) of the Short Form-36 and Diabetes Quality of Life (DQOL). In patients with MSD, Arthritis Impact Measurement Scales 2-Short Form (AIMS2-SF) was completed. Comparisons between groups were undertaken using Chi-square test for categorical data and t-tests for continuous data. Statistical significance was taken at $p \leq 0.05$.

Results: Patients with MSD showed significantly lower mean of PCS (36.05 ± 6.8 vs. 41.52 ± 10.4 , $p=0.003$), and higher DQOL (2.76 ± 0.41 vs. 2.45 ± 0.6 , $p=0.006$), but MCS scores were not significantly different.

Conclusion: Upper limb MSDs could reduce quality of life in diabetic patients. Physicians are required to be aware of these complications and manage them effectively.

Keywords: Adhesive capsulitis, Carpal tunnel syndrome, Trigger finger

INTRODUCTION

Diabetes mellitus is a chronic multisystem disease characterised by persistent hyperglycaemia that lead to a wide range of complications, including MSD. QOL in chronic diseases such as DM, has an important role in mental, physical and social performance of patients and plays an important role in health care [1]. Health related QOL predict mortality rate in people with DM as an independent risk factor [2,3]. The impact of DM on quality of life is increased by the high prevalence of coexisting chronic medical disorders. Comorbidities such as depression and arthritis can have profound effects on patients ability to manage their self-care, impair their function and pose significant barriers to lifestyle changes and regimen adherence [4]. One of the most influential of these conditions is MSD especially in upper limbs. This condition causes difficulties in accomplishing daily life tasks such as dressing, self-care, and cooking. It seems that the joint tissue damage in diabetes is caused by an excess of advanced glycation end products that form covalent cross-links within collagen fibers, altering their structure and functionality [5]. Some kinds of upper limbs MSDs are Carpal Tunnel Syndrome (CTS), adhesive capsulitis of the shoulder, tenosynovitis and dupuytren's contracture [6]. These disorders are reported up to 20-30% in diabetic patients [6-8]. Longer duration and poor control of diabetes are believed to have an impact on risk of developing these complications [9]. Control of hyperglycaemia by exercise, diet, and medication may improve or prevent the development of rheumatic conditions [10-12]. The role of MSD especially upper limbs on diabetic patient's mental and physical QOL is uncertain. The aim of this study was to evaluate QOL in type 2 DM with upper limbs MSD. A better understanding of the influence of these conditions on diabetes patients QOL may lead to improvements in comprehensive management of diabetes and subsequently, increase the QOL of these patients. In addition, identification of factors associated with these complications may lead to improved QOL for diabetics. So,

we consider this study for evaluation of this influence and associated potential risk factors.

MATERIALS AND METHODS

The present cross-sectional study was conducted at Department of Internal Medicine in Imam Khomeini Hospital, Sari, North of Iran from March 2013 to April 2016. Data was derived by evaluating QOL in type 2 diabetes patients with and without upper limb MSD according to history and physical examination. The study was approved by Vice President of Research and Technology and Ethics Community of Mazandaran University of Medical Sciences (Code: IR.MAZUMS.REC 18.4.1393). The study was done with patients consent.

Data Collection

Both demographic characteristics and general information including age, sex, Body Mass Index (BMI) calculated by dividing weight (kg) by height squared (m^2), HbA1c level, disease duration (defined as number of years since diagnosis), education level (was categorised into illiterate or elementary as low and high school and college as high education), treatment (Insulin or oral hypoglycaemic agents), and concomitant hyperlipidaemia and hypertension were collected from medical records and interviews. Upper limb MSDs including CTS, adhesive capsulitis and trigger finger were recognised according to history and physical examination by rheumatologists. Patient survey questionnaires were completed by patients and controls.

Study Population

The study population comprised 50 patients with type 2 DM who suffered from upper limb musculoskeletal involvement as cases and 50 age and sex matched diabetic patients without musculoskeletal complaints as controls. The sample size was calculated 20 patients in each group, according to results of Miller A et al., study [13]. For mean and SD of QOL in SF-36 in physical functioning and mental health with

power and confidence level of 90% and 95%, respectively. Because of multiple kinds of upper MSD involvement, we considered 50 patients in each group. Approval was obtained from the Ethics Committee of Mazandaran University of Medical Sciences (Code:18.4.1393).

Diabetic patients aged 40-70 years old with a known history of more than two years and at least one type of upper extremity musculoskeletal symptoms were included. Type 2 diabetes patients were diagnosed according to the World-American Diabetes Association (ADA) 2013 criteria including symptoms of diabetes (thirst, polyuria, weight loss, blurry vision) plus random plasma glucose concentration ≥ 200 mg/dL, or fasting plasma glucose ≥ 126 mg/dL or two hour plasma glucose ≥ 200 mg/dL during an oral glucose tolerance test.

Inclusion criteria: Inclusion criteria was defined as patients with Type 2 diabetes who were suffering from upper limb MSD.

Exclusion criteria: Exclusion criteria's were existence of other diabetes complications (symptomatic peripheral neuropathy, retinopathy, nephropathy, definite ischaemic heart disease), history of chronic obstructive pulmonary disease, uncontrolled hypo or hyperthyroidism, fibromyalgia, other inflammatory arthritis such as rheumatoid arthritis or psoriatic arthritis, symptomatic lower limb pain including osteoarthritis. Informed consent was obtained from patients, then, they were interviewed and examined by an internist and rheumatologists. Patients were asked about the presence of musculoskeletal pain in upper limbs currently felt, symptoms of CTS, adhesive capsulitis and trigger finger. To establish diagnosis they were examined by rheumatologist. Clinical evidence of CTS was sought by inducing paraesthesia in the distribution of the median nerve on percussion of the median nerve at the wrist (Tinel's test) and sustained palmar flexion of the wrist (Phalen's test). Adhesive capsulitis was diagnosed according to shoulder stiffness, along with decreased range of motion and pain and the decreased range of motion that was worst in abduction and external rotation. For trigger finger diagnosis, complain of a catching or locking sensation with or without pain, and existence of a palpable nodule and thickening along the affected flexor tendon sheath overlying palmar aspect of the metacarpophalangeal joint was considered [6,14]. The population study was evaluated and collected by rheumatologist and internist from two rheumatology clinics (for cases) and an academic diabetes care center (for controls).

Quality of Life Assessments

Participants were asked to complete the Persian version of Diabetes Quality Of Life (DQOL), SF-36v2 and in patients with MSD, AIMS2-SF was applied [15-17]. Questionnaire was used with the permission of the authors. DQOL, in 15 items scored on a five point Likert scale, provides a total health related QOL score that predicts self-reported diabetes care behaviours and satisfaction with diabetes [18]. Higher scores are signs of low QOL. The SF-36v2 measures perceived health status in the form of a 36-item questionnaire, providing two broad areas of subjective well-being PCS and MCS and eight domains of functioning and well-being including physical functioning, role physical, role emotional, social functioning PCS and mental health, energy/vitality, pain and general health perception (MCS). The PCS items include an assessment of the participant's self-report on the level of limitations experienced in performing moderate activities and the MCS items include questions on feeling calm and peaceful. The range of scores of PCS and MCS are from zero (worse) to 100 (best) [19]. The AIMS2-SF, is a shortened version of the AIMS2 aimed at measuring health status in people with arthritis. The measure asks about five core domains including physical functioning, pain, psychological status; social interactions and roles [20]. Higher scores indicate greater impact of arthritis on the patients.

STATISTICAL ANALYSIS

Descriptive data are presented for the total sample and type 2 diabetes patients with and without MSD. Differences were examined

using t-test for continuous variables and Chi-square test for categorical variables. The SF-36v2, AIMS2 and DQOL were scored using standard procedures. Next, mean differences in MCS and PCS scores of quality of life and DQOL by MSD were calculated in type 2 diabetes patients. Then AIMS 2-SF scores in patients with MSD were evaluated by mean \pm SD. Correlation of SF-36 and DQOL scores with AIMS 2-SF was evaluated by Pearson correlation and its significance was presented at levels of 0.05 and 0.01. Data analysis was performed using SPSS software. Statistical significance was taken at $p \leq 0.05$.

RESULTS

Fifty patients were identified as fulfilling the inclusion criteria with diabetes related upper limb problems and 50 participants as controls.

Patient Demographics

Eighty six percent of patients were female and 93% were married. 64% were illiterate or had elementary education, 80% were housewives and 15% were employed. Twenty-three percent of patients were using insulin to control diabetes. The mean age and diabetes duration were 54.05 ± 9.6 and 10.71 ± 7.5 years, and the mean of BMI and HbA1c were 28.53 ± 4.5 kg/m² and $7.64 \pm 1.4\%$, respectively. Comparison of demographics data between two groups are shown in [Table/Fig-1].

Variables	Patients with MSD	Patients without MSD	p-value
Age: mean \pm SD (years)	55.37 \pm 7.5	52.76 \pm 11.2	0.17
Sex (F/M)	42/8	44/6	0.77
Body mass index (kg/m ²)	29.27 \pm 5.3	27.88 \pm 3.7	0.14
Diabetes duration (years)	13.15 \pm 7.9	8.57 \pm 6.5	0.06
HbA1c (%)	7.46 \pm 1.0	7.81 \pm 1.7	0.23
Married: n (%)	45 (90%)	48 (96%)	0.48
Educational state, high school and college: n (%)	17 (34%)	19 (38%)	0.64
Insulin user: n (%)	14 (28%)	9 (18%)	0.34
Lipid lowering therapy: n (%)	40 (80%)	37 (74%)	0.63
Treatment for hypertension: n (%)	26 (52%)	24 (48%)	0.84

[Table/Fig-1]: Comparison of demographic and diabetes related variables in diabetic patients with and without upper limb Musculoskeletal Disorder (MSD).

*Comparisons between groups were undertaken using chi-square test for categorical data and t-tests for continuous data

Kinds of Musculoskeletal Symptoms

Twenty four patients were diagnosed with adhesive capsulitis, 18 patients with CTS and 13 patients with trigger finger, and 11 patients had more than one problem. Thirty-six percent of patients reported using analgesics for pain control. Two patients had history of finger injection and another one shoulder injection. One patient underwent surgery because of CTS. There were two patients with dupuytren's contracture, but because of coexistence of symptomatic knee osteoarthritis, they were not included in the study.

Questionnaires Scores

Questionnaires scores (for SF-36v2 in PCS and MCS domain and DQOL) were compared in diabetic patients with upper limb MSD and patients without these problems and are demonstrated in [Table/Fig-2].

Questionnaires scores	Patients with MSD	Patients without MSD	p-value
SF-36 (PCS)	36.05 \pm 6.8	41.52 \pm 10.4	0.003
SF-36 (MCS)	44.07 \pm 8.8	47.10 \pm 8.9	0.095
DQOL	2.76 \pm 0.41	2.45 \pm 0.6	0.006

[Table/Fig-2]: Questionnaire scores in diabetic patients with and without upper limb Musculoskeletal Disorder (MSD).

* Applied test for comparisons between groups was t-tests

Short Form (SF), Physical Components Scores (PCS), Mental Components Scores (MCS), Diabetes Quality of Life (DQOL)

Scores of three questionnaires in patients with upper limbs MSD showed significant differences ($p \leq 0.05$) in physical domain of AIMS2-SF, DQOL and PCS of SF 36 for adhesive capsulitis, physical and role domain of AIMS 2 SF for CTS, and none for trigger finger [Table/Fig-3]. Pearson correlation of SF-36 and DQOL scores with AIMS2-SF scores were demonstrated in [Table/Fig-4].

	All patients with MSD (n=50)** mean±SD	Adhesive capsulitis (n=24) mean±SD	Carpal tunnel syndrome (n=18) mean±SD	Trigger finger (n=13) mean±SD	p-value
AIMS2-SF domains (0-10): Physical	3.44±2.0	4.19±1.9	2.50±1.9	3.32±1.8	0.142
Symptoms	4.13±2.1	4.20±2.1	3.80±2.0	3.33±2.8	0.232
Affect	4.62±1.6	4.80±1.7	4.26±1.3	4.73±1.8	0.706
Social Interaction	4.44±1.9	4.06±2.4	4.70±1.2	4.80±1.3	0.919
Role	4.23±2.3	4.70±1.9	3.26±2.3	4.03±2.8	0.332
DQOL (0-5)	2.76±0.41	2.83±0.4	2.62±0.5	2.62±0.3	0.084
SF-36 (0-100): PCS	36.05±6.8	34.76±7.8	36.23±6.0	36.63±6.8	0.040
MCS	44.08±8.8	43.59±10.5	45.53±6.9	44.01±9.2	0.514

[Table/Fig-3]: Questionnaires scores in diabetic patients with upper limb Musculoskeletal Disorder (MSD).*

*Applied test for comparisons between groups was ANOVA

**11 patients had more than one problem

Arthritis Impact Measurement Scales 2-Short Form (AIMS2-SF), Diabetes Quality of Life (DQOL), Physical Components Scores (PCS), Mental Components Scores (MCS), Short Form (SF)

	Physical	Symptoms	Affect	Social Interaction	Role
PCS	0.338*	-0.002	-0.308*	-0.173	-0.018
MCS	-0.149	-0.153	-0.92	0.141	-0.309
DQOL	0.324*	0.273	0.425**	0.138	0.101

[Table/Fig-4]: Pearson correlation of SF-36 and DQOL scores with AIMS2-SF scores.

*Correlation is significant at the 0.05 level.

**Correlation is significant at the 0.05 level

Physical Components Scores (PCS), Mental Components Scores (MCS), Diabetes Quality of Life (DQOL)

DISCUSSION

Current study showed that upper limb MSD in type 2 diabetic patients have a significant impact on QOL according to physical QOL (SF-36), AIMS and DQOL questionnaire, compared to those without these problems. Reduced physical QOL is mainly due to adhesive capsulitis. The association between MSD and DM has been described previously [21,22]. Diabetes is associated with impaired QOL compared with the non-diabetic population [3]. Previous studies reported that reduced physical QOL in diabetic patients is mainly determined by MSD and cardiovascular disorders [1]. The magnitude of the reported QOL reductions ranged between three to five points in PCS and also in MCS which is supported by Adriaanse MC et al., [1]. In current study, QOL was also significantly lower in patients with upper limb MSD according to DQOL scores. In addition, physical and affect domains of AIMS2-SF were significantly correlated to PCS and DQOL. In one study in Asian patients, the impact of chronic disorders on health related quality of life was demonstrated that DM lowered SF-36 scores by more than two points on three SF-36 scales and diabetic patients with MSD (including rheumatism, back pain and other bone or muscle illnesses) experienced further lowering of SF-36 scores exceeding two points on at least six scales [23]. Rumchurn N et al., reported adhesive capsulitis (25%), CTS (20%), trigger finger (29%), limited joint mobility (28%) and Dupuytren's contracture (13%) as the most frequent findings in diabetic patients that were related to higher HbA1c ($p=0.018$) [11]. In current study, adhesive capsulitis (48%),

CTS (36%) and trigger finger (26%) were the most frequent findings, and 22% patients had more than one problem. These differences in abundance may be related to our exclusion criteria in order to estimation of nearly pure impact of upper limb MSD on QOL. Recognising the high impact of MSD on QOL in DM is important for management and care of these patients. Depression and arthritis can impair function and make significant barriers to lifestyle changes and regimen adherence. Ignoring management of these disorders, can result in ineffective control of diabetes specific risk factors and may miss opportunities to improve patients functioning, QOL and risk of mortality [1,4,24]. This is a detailed study of upper limb MSD encountered by patients with DM which utilises a systematic rheumatological examination. We used valid and reliable instruments for QOL (SF-36 and DQOL) and impact of arthritis (AIMS2-SF). Up to our knowledge, while the SF-36 and DQOL have been used before, this study is the first report of impact of upper MSD in DM using AIMS2-SF. We used combination of medical records, patients history and physical examination and self-report of questionnaires to determine the upper limb MSD impact on QOL.

There were no significant differences between patients with or without upper limb MSD in terms of age, gender or BMI, kind of hypoglycaemic agents (Insulin or oral agents) and HbA1c although participants tended to have longer duration of diabetes. Therefore, we expect no substantial bias on these results. It was demonstrated that collagen glycosylation, Vascular endothelial growth factor and microvascular disease due to prolonged hyperglycaemia in uncontrolled diabetic patients may have some roles in MSD in diabetic patients [25-27].

LIMITATION

Some study limitations need to be addressed. The study is limited by small sample size in upper limb MSD subgroups which did not allow evaluation of each type of MSD impact on QOL.

CONCLUSION

In conclusion, DM has been associated with a number of MSD manifestations, supported by epidemiological studies. Upper limb MSD among type 2 diabetes patients are more prevalent and have a profound impact on the patient's QOL, which is more prominent in adhesive capsulitis. Identification and treatment of these disorders may lead to better QOL in these patients.

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