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Shoulder Adhesive Capsulitis and Shoulder Range of Motion in Type II Diabetes Mellitus: Association with Diabetic Complications

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ABSTRACT

This study was done to examine the association between shoulder adhesive capsulitis and chronic diabetic complications and diseases closely related to diabetes in Akdeniz University Hospital. Shoulder adhesive capsulitis were evaluated in 297 consecutive type II diabetic patients attending an outpatient diabetic clinic. Shoulder adhesive capsulitis was detected in 86 patients (29%). There was a significant association between shoulder adhesive capsulitis and limited joint mobility ($p = 0.006$), shoulder adhesive capsulitis and Dupuytren's disease ($p = 0.003$). Odds ratios (OR) for carpal tunnel syndrome, limited joint mobility, and Dupuytren's disease with shoulder adhesive capsulitis were respectively 1.4, 2.1, and 2.4 [95% confidence interval (CI), respectively, 0.7–2.9, 1.2–3.69, and 1.3–4.4]. Also, shoulder adhesive capsulitis was associated with the age of patients ($p = 0.000$) and the duration of diabetes ($p = 0.03$). When other associations between shoulder adhesive capsulitis and diabetic complications were compared, it was associated with retinopathy [$p = 0.014$, OR = 2.2 (95% CI 1.1–4.2)], but there was no association with neuropathy or macroproteinuria. On the other hand, the degrees of passive abduction, internal rotation, external rotation motions of shoulder joints in the all patients were correlated with age of patients, duration of diabetes, neuropathy, and the other hands' problems (Dupuytren's disease, limited joint mobility) ($p < 0.05$). The presence of shoulder adhesive capsulitis may indicate presence of organ involvement. (Journal of Diabetes and Its Complications 13;3:135–140, 1999.) © **1999 Elsevier Science Inc.**

INTRODUCTION

Shoulder adhesive capsulitis is also known as frozen shoulder, scapulohumeral periarthritis, periarthritis of Dupley, periarthritis of shoulder, and check-rein shoulder.[1] It is a condition characterized by limitation of motion of the shoulder joint with pain at the extremes of motion. It was first described by Putnam in 1982 and later by Codman.[2] It is unclear whether the contracture of the shoulder capsule is a passive process related to lack of motion or an active process associated with capsular inflammation. The joint capsule is thickened and is

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loosely adherent to the underlying humeral head; the normal capsular folds are obliterated. There is fibrosis, synovial cell proliferation, and infiltration of the chronic inflammatory cell on the microscopy.[1,2]

Shoulder adhesive capsulitis is slightly more common in women than in men.[1,2] There is usually an underlying condition producing pain and restricted active and passive motion in all planes of the glenohumeral joint.[1,2] Scapulothoracic motion remains unaffected, and, in severe cases, it may be the only residual source of shoulder motion. This process appears to be unique to the glenohumeral joint and is most often seen in patients in their fifth or sixth decade of life. In the majority of cases, its etiology is unknown.[3] A multitude of factors, including cervical spondylosis, local trauma, myocardial infarction, hemiplegia, pancoast tumor, hyperthyroidism, cerebral tumor, and epilepsy have been described in association with the development of periarthrosis of the shoulder.[4–10] The relation between diabetes mellitus and shoulder adhesive capsulitis has been shown in few previous studies.[11–13] But there wasn't any study in the medline that measured the degrees of passive range of motion of shoulder joints in diabetic patients with shoulder adhesive capsulitis.

The purpose of this study was to investigate the prevalence of shoulder adhesive capsulitis in type II diabetes mellitus and to measure the degrees of passive abduction, internal rotation, external rotation motions of shoulder joints, and to see how it is correlated with hand problems and other diabetic complications.

METHODS

Patients. In this cross-sectional study, we evaluated 297 [181 women (60%), 116 men (40%)] patients with diabetes mellitus attending the division of Endocrinology and Metabolism in Akdeniz University Hospital. All of the patients had type II diabetes mellitus with criteria of the World Health Organization. Their ages ranged from 27 to 85 (mean ± SD: 55.21 ± 9.27) years.

The following variables were noted in the patients with diabetes mellitus: age, gender, duration of diabetes, smoking, blood pressure levels, coronary bypass operation, and the other diseases. The criteria for coronary heart disease were a history of definite myocardial infarction or ischemic electrocardiogram (ECG) abnormalities during angina pectoris at rest or during an exercise test and/or coronary artery pathology on the angiography. The diagnosis of myocardial infarction was based on symptoms of chest pain and ECG abnormalities. The occupation of subjects was recorded, as was the history of injuries, operations, or infections in the upper extremities, and these patients were excluded.

Metabolic control of diabetes was evaluated with glycosylated hemoglobin A_{1c} ($GHbA_{1c}$) concentrations, blood glucose concentration on fasting and postprandially. Also blood cholesterol, triglyceride, low-density lipoprotein (LDL), high-density lipoprotein (HDL), very-low-density lipoprotein (VLDL), and urinary protein concentrations were measured.

Retinal examination was performed by experienced ophthalmologists with fundoscopy after dilation of the pupils with a mydriatic agent. Retinopathy was classified as negative or positive.

The specific symptoms of somatic peripheral symmetrical polyneuropathy were pain, paraesthesiae, tickling, and muscle weakness. The patients were considered to have neuropathy if they had typical symptoms and impaired vibratory sensation or if ankle jerks were absent. Nerve conduction of these patients measured with electroneuromyography.

The diagnostic criteria for shoulder adhesive capsulitis, described by Pal et al.[12] were shoulder pain for at least 1 month, inability to lie on the affected shoulder, and restricted active and passive shoulder joint movements in at least three planes. In addition, quantitative evaluation was accomplished with the use of the standard goniometer for maximal passive abduction, internal rotation and external rotation motions of bilateral shoulder joints.

Limited joint mobility was assessed by the method of Rosenbloom.[14] Patients were asked to approximate the palmar surfaces of the fingers in a praying position with fingers fanned and wrists maximally dorsal flexed (extended). If the patient failed to approximate the palmar surfaces completely, the examiner attempted to extend the finger passively. Equivocal or unilateral findings, or simply a sense of unlimited resistance was classified as no limited joint mobility. Failure of any joint to make contact was classified as limited joint mobility.

The diagnosis of Dupuytren's disease was made by one of the authors (PETA) observing one or more of four features: palmar or digital nodule, tethering of palmar or digital skin, a pretendinous band, and digital contracture, by the method of Noble et al.[15]

Statistical Analysis. Statistical evaluation was made with Pearson's χ^2 test, Spearman's correlation, Mann–Whitney U test, independent samples *t* test, and Wilcoxon signed-rank test.

RESULTS

In this study, 297 type II diabetic patients [181 women (60%), 116 men (40%)] were included. The mean (± SD) age of patients was 55.21 ± 9.27 years (range: 27–85 years) and the mean duration of disease was 6.44 ± 6.34 years (range: 0–34 years). Clinical characteristics in patients were shown on **Table 1**. The prevalence of shoulder adhesive capsulitis, limited joint mobility, Dupuytren's disease, carpal tunnel syndrome, trigger

TABLE 1. CLINICAL CHARACTERISTICS OF PATIENTS

Study Group (n = 297)	Shoulder Adhesive Capsulitis		
	Present (n = 86; 29%)	Absent (n = 211, 71%)	p
Age (years)			
Mean ± SD	59.23 ± 8.24	53.60 ± 10.15	0.000
(95% CI)	(57.45–61.01)	(52.23–54.97)	
Gender			
Men	39/116 (33.6%)	77/116 (66.3%)	
Women	47/181 (25.9%)	134/181 (74.1%)	
Duration of diabetes (years)			
Mean ± SD	7.54 ± 6.41	6.00 ± 6.26	0.028
(95% CI)	(6.16–8.92)	(5.15–6.85)	
HDL (mg/dL)			
Mean ± SD	48.37 ± 36.53	45.96 ± 13.52	> 0.05
(95% CI)	(40.08–56.25)	(44.13–47.79)	
LDL (mg/dL)			
Mean ± SD	136.77 ± 44.84	143 ± 36.31	> 0.05
(95% CI)	(127.10–146.45)	(138.08–147.92)	
Total Cholesterol (mg/dL)			
Mean ± SD	217.75 ± 51.17	225.83 ± 50.78	> 0.05
(95% CI)	(206.72–228.79)	(218.95–232.70)	
Triglyceride (mg/dL)			
Mean ± SD	164.06 ± 94.92	178.94 ± 142.63	> 0.05
(95% CI)	(143.59–184.54)	(159.63–198.26)	
$GHbA_{1c}$			
Mean ± SD	6.74 ± 2.6	6.33 ± 4.08	> 0.05
(95% CI)	(6.18–7.31)	(6.05–6.60)	

fingers was in 86 patients [29% (33.6% in men and 25.9% in women)], in 76 patients [26% (28.4% in men and 23.7% in women)], in 56 patients [19% (28% in men and 13% in women)], in 42 patients [14% (0.8% in men and 22.6% in women)], in six patients [2% (0.8% in men and 2.7% in women)], respectively. When we evaluated involvement side of shoulder adhesive capsulitis, we found involvement on the right side (dominant side) in 46 patients (53%), involvement bilaterally in 24 patients (28%), and left side involvement in 16 patients (19%).

Thirty-five percent of patients with shoulder adhesive capsulitis had limited joint mobility; and 41% of patients with limited joint mobility had shoulder adhesive capsulitis. Shoulder adhesive capsulitis was significantly associated with limited joint mobility [$p = 0.006$ (OR = 2.1, 95% CI 1.2–3.6)]. Also, there was significant association between shoulder adhesive capsulitis and Dupuytren's disease [$p = 0.003$ (OR = 2.4, 95% CI 1.3–4.4)]. But no association was found between shoulder adhesive capsulitis and carpal tunnel syndrome or trigger fingers.

The mean age was 59.23 ± 8.24 years in diabetic patients with shoulder adhesive capsulitis and 53.59 ± 10.17 years in the patients without shoulder adhesive capsulitis. Shoulder adhesive capsulitis was associated with age ($p = 0.000$), and duration of diabetes ($p = 0.03$), but shoulder adhesive capsulitis was not associated with patients gender ($p = 0.21$). On the other hand, the degrees of passive range of motion (abduction, internal rotation, external rotation) of shoulder joints in the all patients were correlated with age of patients, duration of diabetes, neuropathy, limited joint mobility and Dupuytren's disease ($p < 0.05$). Association between values of range of motion and the others problems was shown on the **Table 2**.

The degrees of range of motion (abduction, internal rotation and external rotation) of shoulder joints in the patients with right or left shoulder adhesive capsulitis was statistically different from the patients whose had no shoulder adhesive capsulitis ($p = 0.000$), and had shoulder adhesive capsulitis on the other side ($p = 0.000$). Also, patients with bilaterally shoulder adhesive capsulitis had statistically different degrees of limitation from the patients without shoulder adhesive capsulitis ($p = 0.000$). Range of motion of shoulder joints of the patients was illustrated on the **Table 3**.

Prevalence of hypertension, neuropathy, retinopathy, coroner artery disease, macroproteinuria and coroner bypass operation were 51.5%, 22.9%, 15.4%, 13.5%, 12.8%, and 2.4%, respectively. When association between shoulder adhesive capsulitis with chronic com-

TABLE 2. RELATION OF THE PASSIVE RANGE OF MOTION OF SHOULDER JOINTS WITH AGE OF PATIENTS, DURATION OF DIABETES AND THE OTHER PROBLEMS

		Right side			Left side		
		Abduction	Internal Rotation	External Rotation	Abduction	Internal Rotation	External Rotation
Duration of disease	*p*	0.001	0.001	0.025	0.002	0.001	0.040
	r	−0.190	−0.188	−0.135	−0.180	−0.189	−0.119
Age of patients	*p*	0.000	0.000	0.008	0.000	0.000	0.000
	r	−0.247	−0.237	−0.154	−0.340	−0.305	−0.264
Dupuytren's disease	*p*	0.001	0.002	0.000	0.020	0.009	0.015
	r	−0.195	−0.180	−0.218	−0.135	−0.151	−0.141
Limited joint mobility	*p*	0.002	0.003	0.010	0.001	0.008	0.009
	r	−0.177	−0.174	−0.149	−0.184	−0.155	−0.152
Neuropathy	*p*	0.064	0.011	0.006	0.567	0.332	0.04
	r	−0.108	−0.147	−0.160	−0.033	−0.057	−0.118

plications of diabetes mellitus were compared, there was significant association with retinopathy [$p = 0.014$ (OR = 2.2, 95% CI 1.1–4.2)], but there wasn't with neuropathy, coronary artery disease, myocardial infarction or macroproteinuria ($p > 0.05$).

There was no significant association between shoulder adhesive capsulitis and blood triglyceride concentration, total cholesterol concentration, HDL, VLDL, or $GHbA_{1c}$ ($p > 0.05$).

Radiographs of the shoulder were available in 21 of the 86 shoulder adhesive capsulitis patients. No joint abnormality was seen and only one shoulder, in a patient with bilateral involvement, showed supraspinatus tendon calcification and the other one patient showed periarticular osteoporosis.

DISCUSSION

Shoulder adhesive capsulitis is clinically imprecise rheumatological condition, which in the normal population may occur spontaneously but may also be associated with other conditions, such as trauma, myocardial infarction, cerebrovascular accidents, hyperthyroidism, and diabetes mellitus. It is usually frequent in the above 40 years and females.[1,16–18] It may be bilateral or unilateral, but it is more frequent on the nondominant side.[17] Shoulder adhesive capsulitis is bilateral in the

TABLE 3. THE DEGREES OF PASSIVE RANGE OF MOTION OF SHOULDER JOINTS IN TYPE II DIABETES MELLITUS

	Left Shoulder		Right Shoulder	
	Mean ± SD	Range (Median)	Mean ± SD	Range (Median)
Without Shoulder Adhesive Capsulitis				
Abduction	170.14 ± 6.03[d,f]	170	170.15 ± 6.05[a,g]	170
Internal Rotation	72.11 ± 6.28[d,f]	72	72.10 ± 6.31[a,g]	72
External Rotation	90.02 ± 1.24[d,f]	90	90.01 ± 1.40[a,g]	90
Right Shoulder Adhesive Capsulitis				
Abduction	170.33 ± 4.69[b]	170	132.88 ± 15.72[a,b,h]	130
Internal Rotation	71.64 ± 3.49[b]	70	32 ± 13.79[a,b,h]	30
External Rotation	89.28 ± 1.72[b]	90	64.71 ± 13.41[a,b,h]	70
Left Shoulder Adhesive Capsulitis				
Abduction	123.75 ± 15.9[c,d,h]	125	170.56 ± 4.03[c]	170
Internal Rotation	22.81 ± 14.37[c,d,h]	20	72.06 ± 4.4[c]	71.5
External Rotation	52.18 ± 12.1[c,d,h]	50	88.75 ± 2.88[c]	90
Bilateral Shoulder Adhesive Capsulitis				
Abduction	129.58 ± 17.44[e,f]	135	123.91 ± 14.06[e,g]	127
Internal Rotation	28.33 ± 13.64[e,f]	30	22.7 ± 15.53[e,g]	20
External Rotation	54.58 ± 13.74[e,f]	50	51.25 ± 14.23[e,g]	50

[a,b,c,d,e,f,g,h] $p = 0.000$.

diabetics[1,16,17] and it is more frequent in the long duration type I diabetics. Frequency of the shoulder adhesive capsulitis in the diabetics is 4 and 5 fold risk more than the normal.[16,19] Shoulder adhesive capsulitis in the diabetics is 10%–20%,[1,12,16,17,19] but diabetes mellitus is 25% in the patients with shoulder adhesive capsulitis.[17] In our study, the prevalence of shoulder adhesive capsulitis was 29% [53% on the right side (dominant side), 28% bilaterally and 19% on the left side]. Shoulder–hand syndrome may be associated with glenohumeral joint adhesive capsulitis[16,18] and limited joint mobility.[1,18] The condition is diagnosed on clinical symptoms and signs, as there are no noninvasive reliable diagnostic tests.

Lequesne et al.[20] reported abnormal glucose tolerance tests have been found in a significantly greater number of patients with capsulitis of the shoulder (28%) when compared with age- and sex-matched controls with other rheumatological conditions (12%). Bridgman et al.[11] in a large study of 800 diabetic patients found frozen shoulder in 10.8% of them, and compared with 2.3% of 600 nondiabetic controls. They found no association between frozen shoulder and Dupuytren's disease in this study which was conducted at a time when cheiroarthropathy had not been recognized. In our study; shoulder adhesive capsulitis in the type II diabetics was 29%, and there was association between shoulder adhesive capsulitis and Dupuytren's disease. In addition, the degrees of passive range of motion of shoulder joints in the all patients associated with Dupuytren's disease.

Fisher et al.[21] showed an association between shoulder adhesive capsulitis and limited joint mobility in 57 diabetic patients. Pal et al.,[12] in the study of 49 type I and 60 type II diabetic patients showed no correlation between limited joint mobility and shoulder adhesive capsulitis. Both of these studies may be misleading, because Fisher et al.[21] eliminated one-half of their original patient population on the basis that their joints contracture were obviously due to Dupuytren's disease, osteoarthritis, or flexor tenosynovitis, and Pal et al.[12] made no attempt to distinguish the causes of the limitation in finger joint mobility. Arkkila et al.[22] showed no association between shoulder adhesive capsulitis and limited joint mobility in 291 type I and 134 type II diabetic patients. Shoulder adhesive capsulitis is associated with age in type I and II diabetic patients and with the duration of diabetes in type I patients. It is associated with autonomic neuropathy in type I and II diabetic patients and with history of myocardial infarction in type I diabetic patients, independently of time-related variables. In this study, shoulder adhesive capsulitis and the degrees of passive range of motion of shoulder joints were related to age, duration of diabetes, and limited joint mobility. Also, shoulder adhesive capsulitis was associated with retinopathy, but the degrees of passive range of motion of shoulder joints were associated with neuropathy. We didn't find any study in the medline that measured the degrees of passive range of motion of shoulder joint in diabetic patients with shoulder adhesive capsulitis.

Radiographs were normal in the shoulder adhesive capsulitis, but calcified bursitis or tendinitis may be visible.[8,16,17] Also, 1 or 2 months after the beginning of the shoulder adhesive capsulitis localized osteopenia may develop.[1,19] In this study, radiographs showed calcified supraspinatus tendon in one patient, and localized osteopenia in another.

Most good therapy for shoulder adhesive capsulitis was prophylaxis. Early mobilization may prevent shoulder motion limitation. All patients with shoulder adhesive capsulitis may be followed closely for shoulder motion limitation, so that upper extremity function disability may be prevented.

In conclusion, this study showed that shoulder adhesive capsulitis (29%) and limited joint mobility (26%) are common disorders in type II diabetic patients. Shoulder adhesive capsulitis and the degrees of passive range of motion of shoulder joints are associated with age, duration of diabetes, limited joint mobility, Dupuytren's disease, and diabetic complications.

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