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Diabetic Cheiroarthropathy in a Sample of Iraqi Diabetic Patients

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Abstract:
Background: *Diabetic cheiroarthropathy is a term derived from the Greek word "cheiros" meaning "of the hand", It is characterized by stiff hands with distinctively thick, tight, and waxy skin, especially on the dorsal aspects of the hands. It is part of long term complication of diabetes and many suggest it is associated with microvascular complication. The aim of the study was to determine the prevalence of diabetic cheiroarthropathy in Iraqi patients with diabetes, and to study its association with diabetic retinopathy and glycemic control.*
Material and Methods: *A cross-sectional study in which 110 diabetic patients and 110 non-diabetic healthy people who accepted to take part in the study were randomly recruited. 45 of the diabetic patients have Type 1 diabetes mellitus, and the other 65 have Type II diabetes mellitus. All diabetic patients and non-diabetic controls were examined for the presence of cheiroarthropathy, It's association with sex, age of onset and duration of diabetes was recorded, the diabetic patients were also examined by an ophthalmologist for the evidence of diabetic retinopathy.*
Results: *The total prevalence of cheiroarthropathy in all studied diabetic patients was 55.5%, while the prevalence in the control group was 4.5%. The cheiroarthropathy was more sever in Type 1 diabetes compared with Type 1I diabetes. Longer disease duration in both types of diabetes was associated with increased incidence of cheiroarthropathy, Diabetic retinopathy was higher in frequency in patients with cheiroarthropathy than in those without.*
Conclusions: *The prevalence of diabetic cheiroarthropathy is high and nearly equal in both types of diabetes, but more sever in type 1 diabetes mellitus, it was associated with the duration of diabetes in both types and with the presence of diabetic retinopathy for only type1 diabetes mellitus.*
Keywords: *Diabetes mellitus, cheiroarthropathy, retinopathy.*

I. Introduction

1.1 introductions

Diabetic cheiroarthropathy also known as limited joint mobility (LJM), which is derived from the Greek word "cheiros" meaning "of the hand", is characterized by stiffening of the hands. The skin is distinctively thick, tight, and waxy, especially on the dorsal aspects of the hands, which are, usually symmetrically affected. The appearance of the hands is reminiscent of scleroderma[1-3]

The joints more frequently involved are the small joints of the hands [4-7]. Diabetic cheiroarthropathy usually results in a painless, non-inflammatory limitation of the hands and fingers, impairing the grip strength[8,9]. The fifth finger is most frequently affected. while the least frequently affected are the interphalangeal joints of the thumb [1-3].

1.2 Pathogenesis

The aetiopathogenesis remains unknown, the suggested mechanisms includes, neuropathy, microangiopathy affecting dermal capillaries and arterioles, qualitative abnormalities of collagen, and more recently, increased non-enzymatic glycation of the collagen in subcutaneous tissue[10].

Clinical interest lies particularly in the suggestion that limited joint mobility could act as a marker for microvascular complications in longstanding poorly controlled Type1diabetes mellitus (T1DM)[11].

The microvascular disease has been hypothesized to play a role in the pathogenesis of LJM , this hypothesis is based on the presence of other microvascular complications as (retinopathy, nephropathy, and neuropathy) plus the documentation of microvascular abnormalities in the nail-fold capillaries in patients with LJM, raises the possibility of some common pathogenetic mechanisms between them[12].

1.3 Clinical examination

Patients with LJM typically have limited extension of the Metacarpophalangeal Joint (MCP), Proximal interphalangeal joint (PIP), and Distal interphalangeal joint (DIP), the limitation generally beginning in the ulnar side digits, spreading to the radial side digits later, simple physical examination can be used to screen for LJM as the prayer (preacher) sign, the table top sign and if these two screening tests were positive, warrant careful passive examination of each joint to document limited extension[13].

The onset of LJM is insidious and may predate the recognition of overt diabetes [14].

Diabetic cheiroarthropathy can be classified according to the joints involved into slight PIP or MCP involvement, moderate PIP and MCP involvement, and sever PIP, MCP plus wrist involvement[14].

The aim of the study was to determine the prevalence of diabetic cheiroarthropathy in Iraqi patients with diabetes, and to study its association with diabetic microvascular complication (diabetic retinopathy) and glycemic control.

II. Material And Methods

2.1 Study Design and subjects:

A cross-sectional study in which 110 diabetic patients and 110 non-diabetic healthy people who accepted to take part in the study were randomly recruited at the endocrine clinic of AL Kindi teaching hospital in Baghdad. 45 of the diabetic patients have T1 DM, 18 males and 27 females with a mean age of 35.8 years, and the age of onset of diabetes was between 15-65 years. The other 65 diabetic patients have Type II diabetes mellitus (T2DM), 32 males and 33 females, with a mean age of 56.9 years and the age of onset of diabetes was between 44-67 years. The disease duration was 5-35 years for both groups.

The control group consisted of 110 healthy people with no history of diabetes mellitus or other diseases, have the same sex distribution as the studied sample with a mean age of 46.2 years.

2.2 History and examination:

All participants underwent a thorough baseline evaluation including a detailed review of their medical history, physical examination, and contemporary assessments of basic demographics: (age, gender, height, weight, body mass index (BMI)). A full medical history including the duration and age of onset of diabetes was obtained.

All diabetic patients and non-diabetic controls were examined for the presence of cheiroarthropathy by:

A) Prayer sign: The patient is asked to put his or her hands together in a praying position with the fingers fanned and to press together the palmer surfaces of the interphalangeal joints and the palms.

B) Table top test: Is conducted by asking the patient to place the palms of his hands down on a table top with the fingers spread.

C) If these tests were positive, the examiner, confirm the limitation of joint motion with passive extension of the fingers.

All the diabetic patients were examined by an ophthalmologist for the presence of diabetic retinopathy after pupillary dilatation in a dark room.

Glycemic control was assessed by calculating the average of previous 12 months readings of fasting blood glucose (obtained from computerized archive for each patient).

2.3 Laboratory tests:

Blood samples were obtained from each patient at the time of examination and were analyzed in the same laboratory for HbA1c.

2.4 Statistical analysis:

SPSS v.18 (statistical package for social sciences version 18) used for data input and analysis. Continuous variables presented as mean ± standard deviation (SD) and discrete variables presented as numbers and percentages. ANOVA test used to test the significance of difference between means of more than two samples. T test for two independent variables used to test the significance of difference between two means. Chi square test for independence and Fisher exact test used as appropriate to test the significance of association between discrete variables.

III. Results

Characteristics of the subjects studied are shown in table1.

Table 1: Personal, clinical and laboratory variables for study diabetic patients

Variables	Study Group	N	Min	Max	Mean	SD	P value
Age	Control	110	32	59	46.2	6.2	<0.001
	T1DM	45	15	65	35.8	13.5	
	T2DM	65	44	67	56.9	5.7	
	Total	220	15	67	47.2	11.0	
Height (cm)	Control	110	153	185	165.1	7.6	0.023
	T1DM	45	100	182	160.9	12.4	
	T2DM	65	149	187	165.4	9.3	
	Total	220	100	187	164.3	9.4	
Weight (kg)	Control	110	50	120	76.0	11.3	<0.001
	T1DM	45	22	90	64.1	15.1	
	T2DM	65	54	110	74.7	12.2	
	Total	220	22	120	73.2	13.2	
BMI (kg/cm2)	Control	110	19.8	37.0	27.8	3.1	<0.001
	T1DM	45	16.4	34.3	24.5	4.4	
	T2DM	65	20.8	37.8	27.3	4.0	
	Total	220	16.4	37.8	27.0	3.9	

Sixty one of 110 diabetic patients have cheiroarthropathy while 5 of 110 of non-diabetic control have cheiroarthropathy, so the prevalence of diabetic cheiroarthropathy is 55.5%, while in non-diabetic control group was 4.5%, there is a significant association between diabetes and Cheiroarthropathy. The prevalence in T1DM is 55.6% which is slightly higher than that in T2DM which is 55.4%. Table (2).

Table 2: Prevalence of Cheiroarthropathy among study groups.

Study Group	Prevalence of Cheiroarthropathy	95% Confidence Interval	
		Lower	Upper
Control	4.5% (5 /110)	1.7%	10.7%
T1DM	55.6% (25 /45)	40.2%	70.1%
T2DM	55.4% (36 /65)	42.6%	67.6%
All Diabetic	55.5% (61 /110)	45.7%	64.9%
All Sample	30.0% (66 /220)	24.1%	36.6%

15.6% of T1DM have diabetic cheiroarthropathy with the involvement of PIP joint and MCP joint which is higher than that in T2DM which was 10.8%. Involvement of the PIP joint, MCP joint and wrist (large joint) is found in 8.8% of T1DM patients which is also higher than in T2DM which was 1.5%, indicating a more severe involvement of joints in T1DM than T2DM . Table (3).

Table 3: Distribution of patients according to study group and to joints affected by Cheiroarthropathy.

Joint Type	Study Group				Total		P Value
	T1DM		T2DM				
	N	%	N	%	N	%	
	45	100.0	65	100.0	110	100.0	
DIP	13	28.9	14	21.5	27	24.5	0.378
MCP	7	15.6	7	10.8	14	12.7	0.459
wrist	4	8.9	1	1.5	5	4.5	0.106

In T1DM 9 of 18 male patients, and 16 of 27 female patients have cheiroarthropathy , In T2DM 13 of 32 male patients and 23 of 33 female patients have cheiroarthropathy. Among all study groups; females predominates in having cheiroarthropathy rather than males; anyhow this association was significant only in T2DM group ($P<0.05$). Table(4)..

Table 4: Distribution of Cheiroarthropathy in each study group according to sex.

Study Group		Cheiroarthropathy				Total		P value
		Present		Not				
		N	%	N	%	N	%	
Control	Male	2	40.0	48	45.7	50	45.5	
	Female	3	60.0	57	54.3	60	54.5	0.802
	Total	5	100.0	105	100.0	110	100.0	
T1DM	Male	9	36.0	9	45.0	18	40.0	
	Female	16	64.0	11	55.0	27	60.0	0.540
	Total	25	100.0	20	100.0	45	100.0	
T2DM	Male	13	36.1	19	65.5	32	49.2	
	Female	23	63.9	10	34.5	33	50.8	0.018
	Total	36	100.0	29	100.0	65	100.0	

Retinopathy is significantly associated with cheiroarthropathy in T1DM patients (P<0.05) while the association was not significant with T2DM. Table (5).

Table 5: Distribution of diabetic patients according to presence of retinopathy, diabetes type and presence of Cheiroarthropathy.

Study Group		Retinopathy				Total		P value
		Yes		No				
		N	%	N	%	N	%	
T1DM	Cheiroarthropathy	10	100.0	15	42.9	25	55.6	
	No Cheiroarthropathy	0	0.0	20	57.1	20	44.4	0.001
	Total	10	100.0	35	100.0	45	100.0	
T2DM	Cheiroarthropathy	7	70.0	29	52.7	36	55.4	
	No Cheiroarthropathy	3	30.0	26	47.3	29	44.6	0.312
	Total	10	100.0	55	100.0	65	100.0	
All	Cheiroarthropathy	17	85.0	44	48.9	61	55.5	
Diabetic	No Cheiroarthropathy	3	15.0	46	51.1	49	44.5	0.003
	Total	20	100.0	90	100.0	110	100.0	

There is no significant association between average fasting blood sugar (12 months) and the development of diabetic cheiroarthropathy (P value 0.894). Also there is no significant association between HbA1c and the development of diabetic cheiroarthropathy. Table (6).

Table 6: Descriptive statistics related to Cheiroarthropathy. a laboratory findings related to glycemic control.

Study Group		Cheiroarthropathy	N	Mean	SD	P value
T1DM	FBS (mmol/L)	Cheiroarthropathy	25	15.2	6.0	0.586
		No	20	14.2	5.4	
	HbA1C (%)	Cheiroarthropathy	25	7.9	2.6	0.393
		No	20	7.3	2.2	
T2DM	FBS (mmol/L)	Cheiroarthropathy	36	12.3	5.0	0.728
		No	29	12.7	4.9	
	HbA1C (%)	Cheiroarthropathy	36	7.2	1.7	0.814
		No	29	7.1	2.1	
All	FBS (mmol/L)	Cheiroarthropathy	61	13.4	5.6	0.894
Diabetic		No	49	13.3	5.1	
	HbA1C (%)	Cheiroarthropathy	61	7.5	2.1	0.430
		No	49	7.2	2.1	

Age of diabetes onset has no significant effects on the development or absence of cheiroarthropathy (P>0.05).

Longer disease duration in both types of diabetes is significantly associated with the development of cheiroarthropathy (P>0.05).Table (7).

Table 7: Disease factors (age at onset and disease duration).

Study Group		Cheiroarthropathy	N	Mean	SD	P value
T1DM	Age at Onset (year)	Yes	25	20.4	11.4	0.646
		No	20	21.9	9.8	
	Disease Duration (years)	Yes	25	17.6	8.3	0.009
		No	20	12.0	4.4	
T2DM	Age at Onset (year)	Yes	36	40.4	8.7	0.257
		No	29	42.7	6.6	
	Disease Duration (years)	Yes	36	17.6	8.4	0.010
		No	29	13.0	4.5	
All Diabetic	Age at Onset (year)	Yes	61	32.2	14.0	0.451
		No	49	34.2	13.1	
	Disease Duration (years)	Yes	61	17.6	8.3	<0.001
		No	49	12.6	4.5	

IV. Discussion

A strong association between cheiroarthropathy and diabetes mellitus has been shown in this study, 55.5% of the diabetic patients (55.6% T1DM and 55.4% T2DM) have cheiroarthropathy. A study by Lawson et al [5] have similar results regarding T1DM but different from that of T2DM, in which the association of cheiroarthropathy with T1DM was 51% and T2DM was 39%, the lower and different results in T2DM with our study can be attributed to the shorter duration of disease (T2DM) in their study sample (13 years), and that 45% of them have average disease duration of 5.6 years, while in our study the disease duration for T2DM patients was 15.5 years, and only 1.5% of T2DM patients are with disease duration below 6 years, so they are more susceptible for the development of cheiroarthropathy in our study[3,16-19].

The severity of diabetic cheiroarthropathy in T1DM was higher than T2DM, this may be attributed to enzymatic glycosylation of collagen, and because of an earlier age of onset, so individuals before puberty are subjected to early hyperglycemia before and at puberty resulting in the lying down of greater amount of highly glycosylated collagen especially during the pubertal growth spur. (20) [1,2] Also the increased level of growth hormone and increased level of insulin like growth factor (IGF1) down regulate collagenase, leading to inhibition of collagen resorption and so increase its deposition[21]. This finding was confirmed by longitudinal cohort study from Amin R et al[22] which showed an increased risk of limited joint mobility with longer duration of DM and with puberty.

The higher prevalence of cheiroarthropathy in women than in men in T2DM can be explained by the fact that most males are employed in manual work, while most women are housewives in our community and not involved in physical activities, this manual hand activity provides a good physical exercise which decrease the incidence of cheiroarthropathy [23] .

There is no significant association between the patient's age or the age of onset of diabetes and the development of cheiroarthropathy which is similar to that of Guillot B et al[24] who showed that diabetic cheiroarthropathy are unrelated to patient age.

The association with the duration of diabetes is significant and the longer the duration of diabetes the greater the possibility to develop cheiroarthropathy, this result is similar to that of Arkkila et al and Renard E[16,19], they found strong association between LJM and diabetes duration.

The diabetic cheiroarthropathy and average fasting blood glucose level or HbA1c were not significantly associated and this result is similar to that obtained by Fitzcharles et al (25[1,2] .

The cheiroarthropathy and retinopathy were significantly associated, this result is similar to that obtained by Rosenbloom[11].

V. Conclusions

The prevalence of diabetic cheiroarthropathy is high and nearly equal in both types of diabetes but the severity is higher in T1DM. Diabetic cheiroarthropathy was associated with the duration of diabetes in both types and with the presence of diabetic retinopathy in T1DM only.

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