

## Original Research Article

# Musculoskeletal manifestations in type 2 diabetes mellitus

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### ABSTRACT

**Background:** Musculoskeletal complications of diabetes have been generally ignored and poorly treated as compared to other complications. Hence we carried out this study to find the prevalence of musculoskeletal manifestations in type II diabetes mellitus and its correlation with age, BMI, duration of diabetes, and control of diabetes.

**Methods:** 100 consecutive patients of type II diabetes were studied. Duration of diabetes, control of diabetes, and any musculoskeletal complaints were noted. Complete examination with special reference to BMI, waist circumference and waist hip ratio was done. Fasting and postprandial blood sugar and HbA<sub>1c</sub> was estimated. Correlation of musculoskeletal manifestations with age, BMI, duration of diabetes, and control of diabetes was evaluated and statistical analysis was done.

**Results:** Study shows that the prevalence of musculoskeletal manifestations was 42%. Difficulty with stairs (73 cases) and joint pain (87cases) were the commonest difficulties patients experienced. Most common affected joint was shoulder joint (56%). Adhesive capsulitis (28 cases), tendonitis (15 cases), limited joint mobility (3 cases) were commonest musculoskeletal manifestations. There was a statistically significant positive correlation between musculoskeletal manifestations and age (odds ratio: 4.4), BMI (odds ratio: 9.6), and control of diabetes (odds ratio: 2.61). There was a positive correlation between duration of diabetes and the presence of musculoskeletal manifestations; however it was not statistically significant.

**Conclusions:** Musculoskeletal manifestations are frequent in Type 2 diabetics and have a positive correlation with age, duration of diabetes, control of diabetes, and BMI.

**Keywords:** Adhesive capsulitis, Complications, Musculoskeletal, Type 2 diabetes mellitus

### INTRODUCTION

Diabetes Mellitus is fast emerging as a global epidemic. It presents with a myriad of acute and chronic complications of which macrovascular and microvascular complications dominate the physician's and patient's attention. The musculoskeletal complications are very common but often ignored and highly under recognised. They can be very incapacitating and contribute to significant physical disability and impair quality of life. The exact pathophysiology of these complications is not known, however, connective tissue disorders, neuropathy

or vasculopathy may have a synergistic effect. It is postulated that prolonged hyperglycaemia results in collagen glycosylation.

This glycosylated collagen is less soluble, offers increased resistance to collagenases and accumulates in connective tissue, which not only alters extracellular matrix structure and functions but also impairs cell viability thus resulting in various manifestations.<sup>1</sup> There is wide variety of complications in diabetics involving bones, joints and periarticular structure and commonest ones include frozen shoulder (adhesive capsulitis), limited joint mobility (diabetic chiroarthopathy),

Dupuytren's contracture, carpal tunnel syndrome, flexor tenosynovitis (trigger finger), DISH (diffuse idiopathic skeletal hyperostosis), Charcot's joints, osteomyelitis, reflex sympathetic dystrophy, and diabetic amyotrophy.<sup>2</sup>

Previous studies have correlated presence of these musculoskeletal complications with age, duration of diabetes, diabetes control etc. However no such study had been published from central India. We aimed to study prevalence of these musculoskeletal complications and correlate it with age, BMI, duration of diabetes and control of diabetes. Heightened awareness of these musculoskeletal complications and simple bedside examination with minimal investigations will go a long way in reducing patient's morbidity and improving functional status.

## **METHODS**

This was a cross sectional observational study carried out in General medicine OPD, Medicine wards, and diabetic clinic of our institute between April to June 2016. Patients with Type II Diabetes who were more than 18 years of age were included in the study. Healthy adults more than 18 years of age were included as controls. Patients with chronic liver disease, hypothyroidism, alcoholism, renal osteodystrophy (diabetic end stage renal disease), collagen vascular disorder, rheumatoid arthritis, and trauma related musculoskeletal morbidities were excluded from the study.

One hundred consecutive patients of type 2 diabetes and 100 age and sex matched healthy controls were enrolled after taking written informed consent. Detailed history about duration of diabetes, control of diabetes, any musculoskeletal complaints and details of ongoing treatment was noted. Complete physical examination with special reference to BMI and waist hip ratio was done. Fasting and postprandial blood sugar and HbA<sub>1c</sub> was estimated. Musculoskeletal complication assessment was done by clinical examination. GALS (gait, arm, legs, spine) screening was performed where each of component was examined in detail which if significant lead to REMS (Regional examination of musculoskeletal system) in which various joints were evaluated for abnormalities on inspection, palpation, movement of joints, and functional assessment of joints for any abnormalities. X-ray and if needed MRI was done. Correlation of musculoskeletal manifestations with age, BMI, duration of diabetes, and control of diabetes was evaluated and statistical analysis was done.

Assessment of various musculoskeletal complications was done as follows<sup>3</sup>

- Adhesive capsulitis was defined as history of unilateral and/or bilateral pain in the deltoid area with no history of trauma and equal restriction of active and passive glenohumeral movement in a

capsular pattern (external rotation > abduction > internal rotation)

- Tendonitis was considered positive with presence of inflammation in either of the two tendons i.e. rotator cuff or biceps with a history of pain in the deltoid or anterior shoulder region and restricted active movements in the corresponding muscles.
- Flexor tenosynovitis or trigger finger was diagnosed by palpating a nodule or thickened flexor tendon with locking phenomenon during flexion or extension of any finger.
- DCT (Dupuytren's contracture) was defined as palpable thickening of palmar fascia with flexor deformity of 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> finger.
- CTS (carpal tunnel syndrome) was considered positive with positive Tinel's/ Phalen's sign, loss of power of abductor pollicis brevis, thenar wasting and reduced sensation in 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> finger that is in the distribution of the median nerve.
- LJM (limited joint mobility) or diabetic chieroarthropathy was characterized by thick, tight waxy fingers over the dorsal aspect of hands with flexion deformity of metacarpophalangeal and interphalangeal joint and inability to make a fist or inability to bring the palms completely together with wrist maximally flexed forming the prayer sign.
- Diabetic foot, Charcot foot and osteomyelitis was diagnosed by acute, inflammatory swelling and characteristic laboratory and radiographic feature.
- Diabetic amyotrophy was defined as a severe painful and atrophic shoulder girdle, or thigh and/or back muscles.
- The diagnosis of DISH (diffuse idiopathic skeletal hyperostosis) was based on Resnick's criteria, including flowing ossification along at least four continuous vertebral bodies, preservation of disc space, absence of vacuum phenomena or vertebral body marginal sclerosis, and absence of apophyseal joint ankylosis or sacroiliac joint erosion or fusion.

## **Statistical analysis**

Statistical analysis was done using statistical software OpenEpi info version 7.1 Anova was used.

## **Ethical issues**

Written Informed consent was obtained from all subjects and confidentiality of data was assured. The study has been approved by the institutional ethics committee.

## **RESULTS**

Majority of the cases (n=61) were between 5<sup>th</sup> and 7<sup>th</sup> decade with mean age of 54.68 years of which 62% were females. Approximately half the cases (n=58) had diabetes for more than 15 years. Only 4 patients had diabetes of less than 5 years duration. It was found that cases had a higher waist circumference (94.70±9.96) as

compared to controls (89.18±8.19) and this difference was statistically significant (p<0.05). Similarly the BMI in cases was higher (22.88±4.66) as compared to controls (21.79±4.92) and waist hip ratio was also higher in cases (0.95±0.01) as compared to controls (0.94±0.02) but this difference was not statistically significant. It was observed that approximately 2/3<sup>rd</sup> of patients had normal BMI, however there were twice as many obese (n=6) in cases group as compared to controls (n=3). As far as control of diabetes was concerned, 22 % patients had diabetes mellitus under control (HbA<sub>1c</sub> <7) and 40 % of patients had very poor control of diabetes (HbA<sub>1c</sub> >10).

**Table 1: Distribution of study subjects according to musculoskeletal complaints.**

Complaints	Cases (n=100)	Control (n=100)	p value
Pain in any joints	65	15	<0.01, HS
Stiffness in muscle, joints, or back	56	10	<0.01, HS
Swelling of joints	39	0	<0.01, HS
Difficulty with stairs	73	6	<0.01, HS
Difficulty with washing/dressing oneself	52	3	<0.01, HS

It was found that more than 65 % patient had one or other musculoskeletal symptoms of which pain in joints and difficulties with stairs were more common. As compared to controls, this difference was statistically significant (Table 1).

We observed that shoulder joint involvement (56%) was commonest followed by, hand and wrist, knee, elbow, spine, foot and ankle. The overall prevalence of musculoskeletal manifestations was 42%. Adhesive capsulitis (n=28), tendonitis (n=15) and limited joint mobility (n=3) were the commonest musculoskeletal manifestations and as compared to controls this was

highly significant. Two patients each were found to have flexor tenosynovitis Dupuytren’s contracture, diabetic foot and carpal tunnel syndrome, diabetic amyotrophy were seen in one patient each (Table 2).

**Table 2: Distribution of study subjects according to musculoskeletal diagnosis.**

Musculoskeletal diagnosis	Cases (n=100)	Control (n=100)	p value
Adhesive capsulitis	28	4	<0.01, HS
Tendonitis	15	3	<0.01, HS
Limited joint mobility or diabetic chieroarthropathy	3	0	
Flexor tenosynovitis	2	0	<0.01, HS
Dupuytren’s contracture	2	0	
Diabetic foot	2	0	
Carpel tunnel syndrome	1	0	
Diabetic amyotrophy	1	0	

It was observed that as the age advanced, there was increased prevalence of musculoskeletal abnormalities and it was statistically significant for patients with following manifestations (limited joint mobility or diabetic chieroarthropathy, flexor tenosynovitis, Dupuytren’s contracture, diabetic foot, carpal tunnel syndrome, diabetic amyotrophy) (p value <0.007, odds ratio 4.4) (Table 3).

In 25 patients who had BMI more than 25 kg/m<sup>2</sup> the involvement of musculoskeletal manifestations was seen in 20 (80%), while out of 75 patients with BMI <25 kg/m<sup>2</sup>, 70.6% i.e. 53 patients did not have these manifestations. This difference was statistically significant (p value <0.001, odds ratio 9.6).

**Table 3: Association between age and various musculoskeletal manifestations in diabetes mellitus.**

Age groups (years)	Adhesive capsulitis		Tendonitis		*Others	
	Present	Absent	Present	Absent	Present	Absent
20-30	0	1	0	1	0	1
31-40	2	8	1	9	1	9
41-50	7	10	6	11	2	15
51-60	12	17	9	20	7	22
61-70	13	19	12	20	10	22
>70	7	4	3	8	8	3
p value	0.13		0.21		0.007	
Odds ratio	1.689 (0.67-4.23)		1.5 (0.5-4.02)		4.4 (1.2-16.1)	

**Table 4: Association between glycosylated levels (HbA<sub>1c</sub>) and various musculoskeletal manifestations in diabetes mellitus.**

HbA <sub>1c</sub> levels	Adhesive capsulitis		Tendonitis		Others*	
	Present	Absent	Present	Absent	Present	Absent
<7	8	14	6	16	5	17
7-8	10	3	4	9	2	11
8.1-9	12	2	5	9	4	10
9.1-10	8	3	3	8	2	9
>10	33	7	28	12	25	15
P value	0.0001		0.024		0.04	
Odds ratio	7.35 (2.611-20.69)		2.807 (0.99-7.92)		2.49 (0.83-7.44)	

\*(Others include- limited joint mobility or diabetic chieroarthropathy, Flexor tenosynovitis, Dupuytren's contracture, diabetic foot, Carpel tunnel syndrome, diabetic amyotrophy)

When the association between duration of diabetes and various musculoskeletal manifestations in diabetes mellitus was studied, it was observed that there was a positive correlation in duration of diabetes and musculoskeletal involvement. However, it did not reach statistical significance.

It was observed that out of 22 patients with well controlled diabetes, 36% patients had adhesive capsulitis while out of the 78 patients who had poorly controlled diabetes 80% had adhesive capsulitis and this difference was statically significant [OR 7.35 (CI 2.61-20.69)]. Similarly, there was positive correlation between poor control of diabetes and presence of tendonitis and other musculoskeletal abnormalities (Table 4).

## DISCUSSION

In this study, 100 cases and 100 age-matched controls were taken with mean age of 54.68 years. A study conducted in Adnan Menderes University Hospital Turkey, included 102 patients with mean age 58±9.1years.<sup>4</sup> In study from North- west India total 5732 cases were analysed and out of them 66% had their age > 50 years.<sup>5</sup>

The risk of chronic complications increases as a function of duration of hyperglycemia.<sup>6</sup> Connective tissue disorders, neuropathy or vasculopathy may have a synergistic effect on the increased incidence of musculoskeletal disorders in diabetes mellitus.<sup>7</sup> It was found in present study that in 71% cases, the duration of diabetes was more than 10 years. In a study in Turkey 4 it was observed that mean duration of diabetes was 32.4±7.74 years and in study from North West India majority of patients 79.6% had duration of diabetes for more than 5 years.<sup>5</sup>

It is also clear that lack of good control of the blood sugar levels and complications of diabetes (such as diseases of the central or peripheral nervous systems, myopathy, renal insufficiency) may influence muscle strength and joint function. This may amplify the musculoskeletal

signs and symptoms.<sup>8</sup> In this study, 78% cases had HbA<sub>1c</sub> >7. In study from Northwest India 14.6% study subjects had HbA<sub>1c</sub> ≤7.<sup>5</sup> In a study conducted in Adnan Menderes University Hospital Turkey mean HbA<sub>1c</sub> level in diabetic group was 7.8±0.6.<sup>4</sup>

Diabetics with musculoskeletal manifestations have limitations in performing basic activities. With help of GALS screening, various joint involvement can be deduced. In this study, shoulder joint involvement (56%) was commonest followed by foot and ankle (45%), hand and wrist (41%), knee (39%), spine (21%) and hip (3%). In study of upper limb musculoskeletal abnormalities in Pakistan.<sup>3</sup> it was noted that shoulder abnormalities were more frequent than hand abnormalities. While in study among Kashmiri population hand, elbow and shoulder were most commonly affected areas.<sup>8</sup>

In this study the overall prevalence of musculoskeletal manifestations was 42%. While in study from Northwest India the prevalence was 57.01% and in a study of Kashmiri population 33% had musculoskeletal manifestations.<sup>5,8</sup>

The result of our study indicate that with advancing age, incidence of musculoskeletal manifestations increased and it was statistically significant for limited joint mobility or diabetic chieroarthropathy, flexor tenosynovitis, Dupuytren's contracture, diabetic foot, carpal tunnel syndrome and diabetic amyotrophy (p value <0.007, [OR 4.4 (CI 1.2- 16.1)]. Findings of our study replicates those from study done in North West India, and Pakistan, which showed the positive relationship between advancing age and musculoskeletal manifestation.<sup>3,5</sup> Similar finding was also seen in study of Adan Menderes University hospital Turkey which shows that relationship between age and musculoskeletal complications (p=0.004).<sup>4</sup>

In patients with BMI more than 25kg/m<sup>2</sup> the prevalence of musculoskeletal manifestations was significantly higher, p value <0.001, [OR 9.6 (CI 3.2-28.9)]. Similar finding was also seen in study from North West India.<sup>5</sup>

The observation that as duration of diabetes increased, incidence of musculoskeletal manifestations also increases was also noted in other studies.<sup>3-5</sup>

It was found that in patients with well controlled diabetes, 36% patients had adhesive capsulitis while out of the 78 patients who had poorly controlled diabetes 80% had adhesive capsulitis and this difference was statistically significant (odds ratio=7.35). Similarly there was positive correlation between poorly controlled diabetes and presence of tendonitis and other musculoskeletal abnormalities. Present finding replicates the finding of study from North West India in which poor glycemic control as evidenced by HbA<sub>1c</sub> was associated with rheumatological manifestations, and also study from Adan Menderes University hospital Turkey in which levels of HbA<sub>1c</sub> in diabetic patients with cheiroarthropathy, frozen shoulder or both were higher than those in controls (p<0.05).<sup>4,5</sup> However, in study from Pakistan no association was found between upper limb musculoskeletal abnormalities and degree of hyperglycemia.<sup>3</sup>

There are some limitations to this study. All patients could not undergo imaging studies and MRI could not be done due to non-availability in present set up. Musculoskeletal manifestations in type 1 diabetes mellitus have not been studied. Correlation of these manifestations with microvascular and macrovascular complications has not been done. Further studies studying this correlation may provide newer insights in pathogenesis of these manifestations.

## CONCLUSION

Considering the high prevalence of diabetes mellitus in India and its association with musculoskeletal abnormalities worldwide, it is need of hour to study musculoskeletal manifestations and its association with different factors.

In the present study we conclude that the prevalence of musculoskeletal manifestations was 42%. Difficulty with stairs (73 cases) and joint pain (87 cases) were the most common difficulties patients experienced. Most common affected joints were shoulder joints (56%) followed by hand and wrist, knee, elbow, spine, foot and ankle. Adhesive capsulitis (28 cases), tendonitis (15 cases), limited joint mobility or diabetic cheiro-arthropathy (3 cases) were commonest musculoskeletal manifestations. There was a statistically significant positive correlation between musculoskeletal manifestations and age (odds ratio: 4.4), BMI (odds ratio: 9.6), and control of diabetes

(odds ratio: 2.61). There was a positive correlation between duration of diabetes and the presence of musculoskeletal manifestations; however it was not statistically significant. Hence this study highlights that increased awareness about early recognition of musculoskeletal complications in type 2 diabetes among physicians, diabetologists, rheumatologists, orthopaedicians and patients themselves is the need of hour. Strict control of hyperglycaemia and early physiotherapy referral will go long way in improving quality of life in these patients.

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