

## Original Research Article

# An observational study on musculoskeletal manifestations in type 2 Diabetes mellitus in rural population of Himachal Pradesh, India

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## ABSTRACT

**Background:** The prevalence of diabetes mellitus (DM) is increasing at an alarming rate throughout world. Diabetes is mostly known for vascular and neurological complications. Musculoskeletal manifestations though not as serious as neurovascular complications can be very disabling. These may involve, the upper as well as the lower limb. This study was performed with aim to find out the prevalence of musculoskeletal manifestations in type 2 diabetics in a far-flung district of Himachal Pradesh, India.

**Methods:** Total 350 patients with type 2 DM were included in the study. All patients underwent screening for any musculoskeletal abnormalities. The patients with musculoskeletal abnormalities were further assessed to find the exact diagnosis according to predefined criteria.

**Results:** The shoulder was the most commonly involved joint 21.7% of the patients followed by hand in 16.28% patients and knee in 13.18% patients. Foot was involved in 12% and hand in 7% of the patients. The commonest manifestation in upper limb was adhesive capsulitis in 19.1% and in lower limb was symptomatic knee osteoarthritis in 14.57% patients.

**Conclusions:** Author observed high prevalence of musculoskeletal complications in type 2 diabetics in this study.

**Keywords:** Diabetes mellitus, Limb, Lower, Manifestation, Musculoskeletal, Upper

## INTRODUCTION

Diabetes Mellitus (DM) is a growing epidemic worldwide. DM affects all the systems of human body but is commonly known for microvascular and macrovascular complications. Orthopedic manifestations of diabetes are related to duration of disease, degree of metabolic control, microvascular and neurological complications and presence of end organ damage.<sup>1</sup>

Musculoskeletal manifestations of DM have been generally under-recognized and poorly treated compared with other complications, such as neuropathy, retinopathy, and nephropathy. These manifestations,

which are some of the causes of chronic disability, involve not only the joints, but also the bones and the soft tissues.<sup>2</sup> The percentage of diabetic patients with functional disability will increase as the number of diabetic patients increases, and hence constitute a major public health problem.<sup>3</sup> India is going to have highest number of diabetic patients by 2030.<sup>3</sup> In a recent study by all India institute of medical sciences the incidence of diabetes in patients above 50 years of age is about 12% in India.

All the studies done on diabetic complications in India have been reported from big cities.<sup>4,5</sup> This study was done at a rural medical college located in Chamba district of

Himachal Pradesh catering entirely rural population with limited health care facilities.

## METHODS

This cross-sectional study was jointly performed by the department of orthopedics and department of internal medicine between June 2017 to June 2019 at a rural medical college in the most far flung district of Himachal Pradesh.

The 350 consecutive patients suffering from type 2 DM who fulfilled the inclusion criteria were included in the study after taking informed written consent from all. Complete data regarding age, sex, body mass index (BMI,) duration of diabetes, recent most HbA1C reports was collected. The presence of non-musculoskeletal manifestations like retinopathy, nephropathy and vasculopathy were also noted.

### Inclusion criteria

- Patients with type 2 DM for more than 2 years

### Exclusion criteria

- Patients with associated systemic diseases like malignancy, hypothyroidism, rheumatoid arthritis, alcoholism, type 1 diabetes mellitus or known connective tissue disorders were excluded.

All the cases were screened for symptoms related to orthopedic manifestations of DM. A GALS (gait, arm, legs, spine) screening was performed for all the patients which if significant lead to REMS (Regional examination for musculoskeletal system) and the orthopedic abnormalities were noted. The various orthopedic manifestations were diagnosed on the basis of the following clinical features.

### Adhesive capsulitis

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).

### Rotator's cuff tendinitis

Shoulder pain on active abduction (specially 60° and 120°), tenderness over the greater tuberosity, and positive impingement sign.

### Bicipital tendinitis

Anterior shoulder pain worsened with active flexion, tenderness over the bicipital groove, and positive Yergason's maneuver and/or Speed's test.

### Olecranon bursitis

Pain, tenderness, and swelling at the location of the olecranon bursa.

### Lateral epicondylitis

Pain and tenderness over the lateral epicondyle with pain against resistance on wrist extension.

### Medial epicondylitis

Pain and tenderness over the medial epicondyle with pain against resistance on wrist flexion.

### Carpal tunnel syndrome

It was diagnosed by the relevant history, the Tinel sign, triggered by the percussion of the carpal tunnel [The patient reports pain resembling an electric sensation along the course of the median nerve] and, the Phalen test - the patient has to hold the hands against each other in full palmar flexion, paresthesia's beginning between 30 to 120 s in this position. These findings were confirmed by electrodiagnostic tests.

### Diabetic chiroarthropathy

Two clinical sign were essential for the diagnosis: prayer sign (the patient is unable to approximate the palmar surface of the fingers when raising the hands as if in prayer) and the tabletop sign (when the patient is asked to lay the palms flat on the tabletop he is unable to touch the palmar surface of the fingers to the table).

### Dupuytren's contracture

The presence of a palmar or digital nodule, tethering of palmar or digital skin, a paratendinous band and a digital flexion contracture, palpable thickening of the palmar fascia, with a flexor deformity of the second, third, fourth, or fifth fingers.

### Flexor tenosynovitis

Palpable nodule or thickening flexor tendon, and/or locking during extension and flexion of any finger.

### De quervain's tenosynovitis

Pain and tenderness over radial styloid with a positive Finkelstein maneuver.

### Diabetic sclerodactyly

It was defined as thickening of the skin on the dorsal aspect of the hand in association with limited joint mobility in the absence of Raynaud phenomenon, calcinosis, and telangiectasia.

**Diabetic osteolysis**

It was characterized by osteoporosis of the proximal phalanges in the hands and feet, documented by X-ray radiographs.

**Diabetic muscle infarction**

It was defined as a palpable painful mass with swelling and induration of the surrounding tissue without systemic symptoms, in addition to evidence of edema in the muscle on magnetic resonance imaging.

**Trochanteric bursitis**

Pain and tenderness at the location of the trochanteric bursa.

**Pre-patellar bursitis**

Pain, tenderness, and swelling at the location of the pre-patellar bursa.

**Anserine bursitis**

Pain, tenderness, and swelling at the location of the anserine bursa.

**Neuroarthropathy**

The diagnosis is based on clinical features, laboratory tests and imaging studies. Clinical features include erythema, warmth, foot deformity, a medical history of long-standing diabetes. Radiographic aspects are important in diagnosing Charcot neuroarthropathy, although they are not present in patients with stage 0 disease.

**Osteoporosis**

Osteoporosis was diagnosed on the basis of Singh's criteria based on the trabecular pattern of the proximal femur.

**DISH**

The diagnosis of DISH was based on radiologic features. Radiographic criteria for the diagnosis require the involvement of at least four contiguous thoracic vertebral segments, preservation of intervertebral disc spaces and the absence of apophyseal joint degeneration or sacroiliac inflammatory changes.

**Diabetic muscle infarction**

It was defined as a palpable painful mass with swelling and induration of the surrounding tissue without systemic symptoms, in addition to evidence of edema in the muscle on magnetic resonance imaging.

**Diabetic amyotrophy**

The diagnosis was based on a clinical presentation [wasting of the proximal upper or lower extremity muscles or the paraspinal muscles, preceded by severe pain and dysesthesia of the involved part], the presence of diabetes and neural studies.

**Diabetic muscle infarction**

It was defined as a palpable painful mass with swelling and induration of the surrounding tissue without systemic symptoms, in addition to evidence of edema in the muscle on magnetic resonance imaging.

**RESULTS**

Total 350 cases were included in the study. Out of which 135(38.5%) were males and 215(61.5%) females. The average age of the study group was 51.5 years with range from 42 to 79 years. The average body mass index (BMI) of the diabetic patients was 27.5 with range from 21.7 to 31.8. The average duration of DM was 8.7 years (range: 2 to 22 years). Only patients with type 2 DM were included in the study. Only 47(13.4%) patients had controlled diabetes with average HbA1c of less than of 8.

GALS screening was positive in 58% patients and REMS showing positive orthopedic manifestations in 36.5% as shown in Table 1.

**Table 1: Patient Morphology with incidence manifestations.**

<b>Total number of patients</b>	<b>350</b>
Average age (In years)	51.5
Sex distribution	
Males	135 (38.5%)
Females	215 (61.5)
Average BMI	27.5
Average duration of dm (In years)	8.7
Gals screening	203 (57.9%)
Total number of patients with musculoskeletal manifestations*	127 (36.2%)
Upper limb manifestations*	97(24.8%)
Lower limb manifestations*	58(20%)
Other manifestations	19(5.4%)

\*Most of the patients had multiple musculoskeletal manifestations.

In the upper limb shoulder adhesive capsulitis was the most common manifestation seen in 67 (19.1%) followed by flexor tenosynovitis in hand, seen in 52 (14.8%) patient.

Carpal tunnel syndrome was present is 43 (12.28%), cheiroarthropathy in 32 (9.14%). Depatterns contracture was least frequent manifestation observed only in 9(2.57%) patients as shown in Table 2.

**Table 2: Upper limb manifestations.**

Manifestations	No of patients
Adhesive capsulitis	67(19.1%)
Bicipital tendinitis	25(7.14%)
Rotatory cuff tendinitis	28(8%)
Flexor tenosynovitis	52(14.8%)
Carpal tunnel syndrome	43(12.28%)
Depatterns contracture	9(2.57%)
Cheiroarthropathy	32(9.14%)
Medial epicondylitis	11(3.14%)
Lateral epicondylitis	19(5.42%)
Olecranon bursitis	17(4.85%)

In the lower limb symptomatic knee osteoarthritis was the most common manifestation (14.57%) observed. Foot was the 2<sup>nd</sup> most common involved part in the lower limb. Callosities and foot ulceration were seen in 39 (11.14%) patients. 19 patients reported with some form of tendinopathy with tendoachilles tendon being the most commonly involved as shown in Table 3.

**Table 3: Musculoskeletal manifestations in lower limbs.**

Manifestations	Diabetic group
Trochanteric bursitis	17(4.85%)
Symptomatic knee osteoarthritis	51(14.57%)
Anserine bursitis	19(5.4%)
Prepatellar bursitis	13(3.7%)
Charcot neuropathic osteoarthropathy of foot and ankle	23(6.5%)
Callosities and foot ulceration	39(11.14%)
Tendinopathy (TA)	19(5.4%)
Planter fasciitis	16(4.7%)
Skeletal deformities (hammer toe, claw toe, curly toe etc.)	9(2.5%)
Cellulitis	11(3.14%)

Overall upper limb manifestations were more than lower limb manifestations in this study. Shoulder was the most commonly involved joint with adhesive capsulitis as the most commonly reported manifestation.

Hand and knee were second and third most commonly involved joints as shown in Table 4.

**Table 4: Region wise musculoskeletal manifestations.**

Region	No. of patients
Shoulder	76(21.7%)
Hand	57(16.28%)
Knee	46(13.14%)
Foot	42 (12%)
Elbow	27(7%)
Back	18(5.12%)

DISH was the most common non limb manifestation observed in this study seen in 10.57% of the patients. A significant number of patients had Osteoporosis, though we generally observe a large no. of patients with osteoporosis in our hospital. This could be attributed to the topography and long winter in this region.

**Table 5: Other musculoskeletal manifestations.**

Manifestations	No. of patients
Osteoporosis	28(8%)
Dish	37(10.57%)
Osteolysis	4(1.14%)
Amyotrophy	3(0.85%)
Muscle infarction	1(0.28%)

## DISCUSSION

It is estimated that more than 50% of diabetic patients will suffer from chronic disability.<sup>6</sup> Vascular and neurological complications are the main causes of chronic disability.<sup>7</sup> However associated features like obesity in type 2 diabetes and musculoskeletal manifestations also contribute to chronic disability.

Various studies have observed various personal, occupational and psychosocial factors related to the musculoskeletal disorders.<sup>8</sup> Connective tissue disorders, neuropathy or vasculopathy may have a synergistic effect on the increased incidence of musculoskeletal disorders in DM.<sup>9</sup> Crispin and Alcocer in their study observed that prolonged hyperglycemia in uncontrolled diabetic patients results in collagen glycosylation. Glycosylated collagen is less soluble, offers increased resistance to collagenases and accumulates in connective tissue, which not only alters the extra cellular matrix structure and function but also affects cell viability.<sup>10</sup> Vascular endothelial growth factor, which is associated with DM vascular disease, appears to be involved in the synovial proliferation of the subacromial bursa and shoulder joint contraction in type 2 DM patients with rotator cuff tendinopathy.<sup>11</sup> Rosenbloom et al, in their study observed that alterations in periarticular connective tissue are related to changes occurring in the microvasculature causing limited mobility syndrome.<sup>12</sup>

A number of studies have shown that in DM musculoskeletal manifestations are related to disease duration, degree of metabolic control, and the presence of end organ damage.<sup>13,14</sup> In this study author observed that upper limb manifestations are more common with hand being the most commonly involved region followed by shoulder and symptomatic knee osteoarthritis. the incidence of orthopedic manifestation in this study was 25% which was consistent with many published studies.<sup>15-17</sup> Many studies have shown lower incidence of orthopedic manifestations mostly because they have limited their observations to particular regions like hand or shoulder or upper limbs.<sup>18-20</sup>

Most common orthopedic manifestation in this study was adhesive capsulitis followed by flexor tenosynovitis. In the lower limb osteoarthritis was the most common manifestation in 16% patients followed by foot callosities and ulcers in 11%. High incidence of osteoarthritis could also be attributed to hilly topography of the region. Suzanne Attar et al, in their study observed CTS as the most common manifestation in diabetic patients followed by adhesive capsulitis.

Dependent contracture [DC] was observed only in 2% patients in our study. However, a number of western studies have shown higher incidence of DC.<sup>21-23</sup> This could be attributed to the multifactorial etiology of DC. A no. of studies has shown that metabolic control in DM is a strong predictor for development of musculoskeletal manifestations of which the most important is blood glucose control.<sup>24,25</sup> However, in this study, author didn't observe a consistent relation between higher HbA1c levels and skeletal manifestations.

The most consistent observation in our study was correlation between duration of disease and musculoskeletal manifestations. All the patients with DM for more than 10 years had one or multiple musculoskeletal manifestations.

Many studies have shown that patients with type 2 diabetes had greater impairments in mobility and more difficulties performing basic activities of daily living (ADL) than similarly aged non-diabetic persons.<sup>26,27</sup> This leads to loss of independence, and it may predict future hospitalization, institutionalization, and death.

Musculoskeletal manifestations occasionally can be initial presentation of endocrine disease. Being aware of the presentation as well as the unique physiology of these complaints will help alert the clinician to an early diagnosis of endocrine disease. In addition, understanding whether certain endocrine disease occurs more often in rheumatologic illness will enable the clinician to investigate their occurrence leading to earlier intervention and resulting in decreased morbidity from this concomitant illness.<sup>28</sup>

Occupations that involved manual labor increased the risk of hand complications in patients. This finding is in line with those reported by other Savas et al.<sup>29</sup> The risk of flexor tenosynovitis and CTS was higher in patients with peripheral neuropathy. This could be attributed to the loss of sensation in addition to the fact that the patients presented late when surgery was mandatory.

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