

Original Research Article

Musculoskeletal Disorders in Patients with Type 2 Diabetes Mellitus

Yogesh Karoli¹, Ritu Karoli², Jalees Fatima², Vaibhav Shukla²

¹Senior Consultant, Dept of Orthopaedics, Ram Manohar Lohia Combined Hospital, Gomti Nagar, Lucknow.

²Professor, Department of Medicine, Era's Lucknow Medical College, Sarfarzganj, Lucknow.

Corresponding Author: Ritu Karoli

Received: 23/05/2016

Revised: 23/06/2016

Accepted: 24/06/2016

ABSTRACT

Introduction/aim: Musculoskeletal complications are frequently found in persons with diabetes mellitus. They are under recognized and not much studied. They can be very incapacitating and significantly compromise quality of life. The aim of our study was to identify the prevalence of musculoskeletal abnormalities in Type 2 diabetes mellitus and possible association of these abnormalities with diabetic microvascular and macrovascular complications and the relationship of poor glycemic control with musculoskeletal abnormalities

Materials and methods: This cross-sectional hospital based study was conducted in at a medical college hospital of North India. Three hundred patients of type 2 diabetes were included and assessed for glycemic status and vascular complications. All patients underwent screening for any musculoskeletal abnormalities.

Results: Out of 300 study participants musculoskeletal disorders were diagnosed in 96 (32%) patients. Adhesive shoulder capsulitis was the commonest disorder which was present in 35 (36%) patients followed by Diabetic cheiroarthropathy in 16 (17%) patients. Other common disorders were flexor tenosynovitis (7%), trigger finger (7%) and plantar fasciitis (6%). Poor glycemic status, obesity and microvascular complications were predictors of musculoskeletal disorders.

Conclusion: Musculoskeletal disorders are commonly present in patients with type 2 diabetes. They have correlation with poor glycemic control and microvascular complications. Clinicians should therefore be aware of the possible musculoskeletal complications of diabetes to intervene and provide the best care for patients presenting with these disorders.

Key words: Musculoskeletal disorders, type 2 diabetes, diabetic complications.

INTRODUCTION

Diabetes mellitus (DM) is considered as global epidemic of recent times. The prevalence of diabetes for all age groups worldwide was estimated to be of 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. [1] Diabetes mellitus is a major cause of concern because of its increasing prevalence rate has led to consequent increase in the incidence of related microvascular as well as

macrovascular complications. [2] However, it is also commonly associated with musculoskeletal disorders that can be very incapacitating and significantly compromise quality of life. [3,4]

Though, impact of musculoskeletal complications is largely on quality of life of people with diabetes, the early recognition of this affection is important for two reasons: can be reversed by treatment and, in the same time it represents the marker of other diabetic microvascular complications. In a study by Rosenbloom et al. [5] the

prevalence of proteinuria and retinopathy was of 11% in diabetic patients without diabetic cheiroarthropathy versus 50% in diabetic patients with diabetic cheiroarthropathy.

Musculoskeletal complications are frequently found in persons with diabetes mellitus. [3,4] Considering a high prevalence of DM in our region and its strong correlation with musculoskeletal abnormalities worldwide, it is important to know the magnitude of this relationship in our local population and also the factors which are associated but there is very limited data from the Asian population. [6] In a study from Karachi 54% patients had musculoskeletal abnormality. [7]

The aim of our study was to identify the prevalence of musculoskeletal abnormalities in Type 2 diabetes mellitus and possible association of these abnormalities with diabetic microvascular and macrovascular complications and the relationship of poor glycemic control with musculoskeletal abnormalities.

MATERIALS AND METHODS

This cross-sectional study was conducted in at a medical college hospital of North India between January 2013 to December 2013. We included 300 patients with type 2 diabetes mellitus according to the American Diabetes Association criteria [8] from medical wards and outpatient departments. We excluded those patients who had malignancy, critically ill or end stage target organ diseases. All patients provided written informed consent and study was approved by the Institutional Ethics Committee.

The parameters evaluated were age, duration of diabetes, type of diabetic therapy (diet, insulin, or hypoglycemic agents), chronic diabetic complications (retinopathy, nephropathy, and peripheral neuropathy, stroke, coronary artery disease), number of parity, and menopause status. Physical examination included blood pressure (millimeters of mercury), weight (in kilograms), height (in meters) and waist

circumference (in centimeters). Body mass index was calculated with body weight divided by the square of body height (kilograms per square meter). The following laboratory data were obtained: electrocardiography fasting blood glucose, glycosylated hemoglobin (HbA1c), total and high-density lipoprotein (HDL) cholesterol, triglycerides, creatinine, and urinalysis. Retinopathy was assessed by ophthalmoscopy after pupil dilation with a mydriatic agent. Peripheral neuropathy was assessed by questioning patients about symptoms of paresthesia, as well as measuring the sensory threshold (vibratory, thermal and touch) on the feet. Patients were considered to have nephropathy if patients had urine-albumin creatinine ratio was ≥ 1.5 mg/mmol and/or albuminuria in 24-h collection was ≥ 20 mg on two occasions. The study protocol was approved by the Institutional Ethics Committee. All participants gave their written informed consent.

Statistical analysis

Analysis was done using the Statistical package for social sciences (SPSS 15.0 version). The qualitative variables were described as frequencies and proportions and quantitative variables as mean and standard deviation. Student's t-test was used for comparing the means of continuous variables. Numbers and percentages were compared by Chi-square test and Mantel-Haenszel test if needed. The associations between age, sex, glycemic status, duration of diabetes and its complications and the presence of musculoskeletal disease were examined by spearman correlation coefficients. Logistic regression was used to perform multivariate analysis

RESULTS

A total of 300 patients were examined. Table 1 is showing demographic characteristics of our patient population. Out of them 164 patients were males and 136 were females. The mean age of the patients was 48.6 ± 10.2 years.

Table 2 is showing prevalence of microvascular and macrovascular complications, glycemic status and presence of co-morbidities in patients with diabetes.

Prevalence of musculoskeletal disorders has been shown in Table 3. Out of 300 study participants musculoskeletal disorders were diagnosed in 96 (32%) patients. Adhesive shoulder capsulitis was the commonest disorder which was present in 35 (36%) patients followed by Diabetic cheiroarthropathy in 16 (17%) patients. Other common disorders were flexor tenosynovitis (7%), trigger finger (7%) and plantar fasciitis (6%).

BMI glycemic control, manual labor were significantly correlated ($r=0.80$ and 0.36 , $p<0.001$) with presence of musculoskeletal disease similarly microvascular complications (neuropathy, nephropathy and retinopathy) also showed positive correlation in univariate analysis while gender, duration of diabetes hypertension and dyslipidemia had no correlation with the musculoskeletal disease status. In multivariate analysis, poor glycemic control $OR=3.7$, 95% CI 1.6-9.5.5, $p=0.002$, microvascular complications ($OR=3.6$, 95% CI 1.3-8.07 $p=0.001$) and obesity ($OR=2.8$, 95% CI 1.3-6.5, $p=0.02$) were significantly predictors of the presence of musculoskeletal disease.

Table 1: Characteristics of study patients with type 2 diabetes mellitus (n=300)

Characteristics	N=300
Age(years)	48.6±10.2
Male: Female	164(55%): 134(45%)
Duration of diabetes (Years)	7.8± 4.6
Glycosylated hemoglobin (%)	8.14± 0.8
Body Mass Index(Kg/m ²)	23.8± 1.83
Musculoskeletal Disease prevalence (%)	96 (32%)

Data are mean±SD or number (%)

Table 2: Prevalence of Co-morbidities and diabetes related complications in Patients with type 2 diabetes mellitus(n=300)

Name of the complication	Prevalence (%)
Hypertension	35
Dyslipidemia	30
Macrovascular complications(ischemic heart disease/peripheral artery disease/cerebrovascular disease)	46
Retinopathy	20
Nephropathy	26
Neuropathy	40
Foot ulcers	12

Table 3: Prevalence of musculoskeletal diseases among the study participants

Name of the complication	Prevalence (n=96)
Shoulder adhesive capsulitis	35 (36%)
Diabetic cheiroarthropathy	16 (17%)
Flexor tenosynovitis	7 (7%)
Trigger finger	7 (7%)
Plantar fasciitis	6 (6%)
Carpal tunnel syndrome	4 (4%)
Muscle infarction	3 (3%)

Data is expressed in number (%)

DISCUSSION

Type 2 diabetes mellitus has become a growing health concern in our country. It requires continuous lifelong management to reduce high morbidity and premature mortality caused by its associated complications

Epidemiologic studies have shown that the prevalence of several rheumatologic manifestations is increased in subjects with diabetes mellitus. [9-11] Frozen shoulder, rotator cuff tears, Dupuytren’s contracture, trigger finger, and cheiroarthropathy are among the most common diseases in the upper limb. Significant damage to the Achilles tendon, including plantar fasciitis in the lower leg, has been observed, and results in reduced ankle motion and onset of diabetic foot ulcers. Common symptoms include pain, swelling, and stiffness, can limit the range of motion of the affected joint, thereby impairing function and ability to perform activities of daily living. [12-14]

Kidwai et al had reported [5] 54% of prevalence of musculoskeletal abnormalities, out of which 30% of patients had upper limb musculoskeletal manifestations on examination. In the hand region, limited joint mobility (9.5%), carpal tunnel syndrome (9%), trigger finger (3.8%), and Dupuytren's contracture (1%) were found more frequent as compared to controls, while in shoulder region of diabetic subjects, adhesive capsulitis and tendonitis was found in 10.9% and 9.5% respectively as compared to 2.5% and 2% in controls.

The lower prevalence of musculoskeletal manifestations in our study could be related to the fact that we excluded osteoarthritis and osteoporosis which were

extremely common findings in our study population.

In a study from Kashmir, Bhat et al also found that 33% of their patients had musculoskeletal manifestations Adhesive capsulitis was present in 13.1% patients, flexor tenosynovitis in 18.8% and cheiroarthropathy in 17.8%.

A study done in US [15] confirmed the incidence of adhesive capsulitis being two to four times higher in diabetics than in the general population and the prevalence of diabetes in patients with adhesive capsulitis was shown at 38.6%. Cagliero [16] in his study identified a frequency of 12% capsulitis in diabetic patients

The wide spectrum of rheumatic affections related to DM can be classified according to the involved musculoskeletal structures which The conditions mentioned above can be divided into two main categories according the role of DM in the pathogeny of the condition: I. Primary role - the conditions considered an intrinsic complication of DM: Diabetic cheiroarthropathy, Neuropathic arthritis, Diabetic amyotrophy, Diabetic muscle infarction. II. Secondary role- DM is a predisposing condition: osteoporosis, reflex sympathetic dystrophy, etc.

There is the relevance of different pathogenetic pathways in musculoskeletal diseases associated with diabetes. Diabetes by itself, can amplify the damage induced by other be a causative factors. Micro and macro vascular complications of diabetes may influence muscle strength and joint function, and can limit range of motion.

According to an accepted hypothesis, the joint tissue damage in diabetes is caused by an excess of advanced glycation end products (AGEs), their accelerated synthesis occurs in diabetes because of the increased availability of glucose. A key characteristic of reactive AGEs is the formation of covalent cross-links within collagen fibers, altering their structure and functionality. [17]

In addition to the AGE-mediated pathogenetic mechanism, hyperglycemia in

itself may lead to alterations in the redox environment, specifically in the polyol pathway, resulting in increased intracellular water and cellular edema. [18]

Microvascular disease may contribute to tendon damage, leading to tissue hypoxia, overproduction of oxygen free radicals, and a permissive apoptotic environment. [19] The association between reduced nerve proliferation inside tendons and sensitive neuropathy reduces pain perception. Consequently, patients with neuropathy may excessively exercise their tendons, making them prone to damage.

Type 2diabetes has frequent associated with, obesity and metabolic syndrome, all of which are recognized as factors causing joint disease. Tendon damage in obese subjects is associated with two different mechanisms, i.e., increased yield on load-bearing tendons and biochemical alterations attributed to systemic dysmetabolic factors. With increasing adiposity, weight-bearing tendons are exposed to higher loads, which can lead to overuse tendinopathy. [18]

Alternatively, there is an systemic hypothesis is based on studies showing that association with adiposity for non-load-bearing tendons. [19] Adipose tissue is now recognized as a major endocrine and signaling organ. In obese subjects, fatty tissue releases bioactive peptides and hormones, with the “adipokinome”. These proteins influence several activities in various mesenchymal cell phenotypes (tenocytes, chondrocytes, and osteocytes), which may directly modify tendon structure. [20] Effect of advanced age in patients with type 2 diabetes mellitus must also be considered. Aging tendons and ligaments are subjected to degenerative changes, as a result of these physiologic age-related changes, tendons and ligaments become weaker, and are more likely to tear or suffer from overuse injury. [21]

Over the past years, it has been shown that poor glycemic control and microvascular complications were the strong predictors of musculoskeletal

disorders. High glycosylated haemoglobin predisposed to the development of musculoskeletal complications in diabetic patients. [22-24] Similar findings were also observed in our study.

Occupations that involved manual labor increased the risk of hand complications in our patients. This finding was in accordance with other study by Savas et al. [25]

Limitations of the study were small sample size; study design which was hospital based cross sectional study and not the representative population of all the patients with type 2 diabetes. A prospective community based study with large number of patients is actually needed to know the temporal association of this complication of diabetes. Prevention and strict control of this metabolic disorder is essential, because it has been demonstrated that limited joint motion is related to duration of disease and hyperglycemia. So now there is need to make physicians, dentists and patients more aware of this complication of diabetes mellitus and oral health care should be an integral part of comprehensive diabetes management from the outset.

CONCLUSION

Musculoskeletal disorders are commonly present in patients with type 2 diabetes. They have correlation with poor glycemic control and microvascular complications. Clinicians should therefore be aware of the possible musculoskeletal complications of diabetes to intervene and provide the best care for patients presenting with these disorders.

REFERENCES

1. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care*.2004; 27:1047-1053.
2. Fowler MJ. Microvascular and macrovascular complications of diabetes. *Clin Diabet*. 2008; 26:77-82.
3. Arkkila PE, Gautier JF: Musculoskeletal disorders in diabetes mellitus: an update. *Best Pract Res Clin Rheumatol* 2003, 17:945-970.
4. Serban AL, Udrea GF. Rheumatic manifestations in diabetic patients. *J Med Life*. 2012 Sep 15; 5(3):252–257.
5. Rosenbloom AL, Silverstein JH, Lezotte DC, Richardson K, McCallum M. Limited joint mobility in childhood diabetes mellitus indicates increased risk for microvascular disease. *N Engl J Med*.1981; 305:191-4.
6. Sarkar P, Pain S, Sarkar RN, Ghosal R, Mandal SK, Banerjee R. Rheumatological manifestations in Diabetes mellitus. *J Indian Med Assoc* 2008, 106:593-4
7. Kidwai SS, Wahid L, Siddiqi SA, Khan RM, Ghauri I, Sheikh I. Upper limb musculoskeletal abnormalities in type 2 diabetic patients in low socioeconomic strata in Pakistan. *BMC Res Notes*. 2013; 6:16.
8. American Diabetes Association. Standards of medical care in diabetes: 2013. *Diabetes Care* 2013;36 Suppl 1:S11-S66
9. Rosenbloom AL, Silverstein JH. Connective tissue and joint disease in diabetes mellitus. *Endocrinol Metab Clin North Am*. 1996; 25:473-483.
10. Smith LL, Burnet SP, McNeil JD. Musculoskeletal manifestations of diabetes mellitus. *Br J Sports Med*. 2003; 37:30-35.
11. Lebiedz-Odrobina D, Kay J. Rheumatic manifestations of diabetes mellitus. *Rheum Dis Clin North Am*. 2010; 36:681-699.
12. Sanya AO, Obi CS. Range of motion in selected joints of diabetic and non-diabetic subjects. *Afr J Health Sci*. 1999; 6:17-21.
13. Shinabarger NI. Limited joint mobility in adults with diabetes mellitus. *Phys Ther*. 1987; 67:215-218.
14. Abate M, Schiavone C, Pelotti P, Salini V. Limited joint mobility in diabetes and ageing: recent advances in pathogenesis and therapy. *Int J Immunopathol Pharmacol*. 2010; 23: 997-1003
15. Bhat TA, Dhar SA, Dar TA, Naikoo MA, Naqqash MA, Bhat A et al. The Musculoskeletal Manifestations of Type 2 Diabetes Mellitus in a Kashmiri

- Population. *Int J Health Sci (Qassim)*. 2016; 10(1):57-68.
16. Tighe CB, Oakley WS. The prevalence of a diabetic condition and adhesive capsulitis of the shoulder. *South Med J*. 2008; 101:591-595.
 17. Cagliero E, Apruzzese W, Perlmutter GS, Nathan DM. Musculoskeletal disorders of the hand and shoulder in patients with Diabetes Mellitus. *Am J Med*. 2002; 112:487-490.
 18. Abate M, Schiavone C, Di Carlo L, Salini V. Achilles tendon and plantar fascia in recently diagnosed type II diabetes: role of body mass index. *Clin Rheumatol*. 2012; 31:1109-1113.
 19. Franco R, Sánchez-Olea R, Reyes-Reyes EM, Panayiotidis MI. Environmental toxicity, oxidative stress and apoptosis: ménage à trois. *Mutat Res*. 2009; 674:3-22.
 20. Abate M, Schiavone C, Salini V. Neoangiogenesis is reduced in chronic tendinopathies of type 2 diabetic patients. *Int J Immunopathol Pharmacol*. 2012; 25:757-761.
 21. Narici MV, Maffulli N, Maganaris CN. Ageing of human muscles and tendons. *Disabil Rehabil*. 2008; 30:1548-1554.
 22. Vance MC, Tucker JJ, Harness NG. The association of hemoglobin A1c with the prevalence of stenosing flexor tenosynovitis. *J Hand Surg Am*. 2012; 37:1765-1769.
 23. Ardic F, Soyupek F, Kahraman Y, Yorgancioglu R. The musculoskeletal involvement seen in type 2 diabetes. *Clin Rheumatol*. 2003; 22: 229-33.
 24. Ramchurn N, Mashamba C, Leitch E, Arutchelvam V, Narayanan K, Weaver J, et al. Upper limb musculoskeletal abnormalities and poor metabolic control in diabetes. *Eur J Intern Med*. 2009; 20: 718-21.
 25. Savas, S, Koçoglu BK, Koyuncuoglu HR, Uzar E, Celik H, Tamer NM. The effects of the diabetes related soft tissue hand lesions and the reduced hand strength on functional disability of hand in type 2 diabetic patients. *Diabetes Res Clin Pract*. 2007; 77: 77-83.

How to cite this article: Karoli Y, Karoli R, Fatima J et al. Musculoskeletal disorders in patients with type 2 diabetes mellitus. *Int J Health Sci Res*. 2016; 6(7):99-104.
