



Musculoskeletal Complications of Diabetes and Relation to Glycemic Control

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Abstract

Background of study: Diabetes is a highly prevalent disease in India. There are many studies on microvascular and macrovascular complication of diabetes. Diabetes also predisposes to other complications like musculoskeletal and gastrointestinal complications. There are not many studies on the musculoskeletal complications of diabetes which produces significant morbidity for the patient. Hence we planned for this study on the musculoskeletal complication of diabetes. The aims of the study were to find out the prevalence of musculoskeletal complication of diabetes and its relation with duration and degree of glycaemic control.

Methods: The study was designed as a cross sectional observational study in the diabetic OPD setting of Thiruvananthapuram medical college. Institutional ethical committee clearance was obtained prior to starting the study. After meeting the inclusion and exclusion criterias, 150 consecutive diabetic patients attending the OPD were included in the study after getting informed consent. They were evaluated clinically for musculoskeletal complications. Basic biochemical tests were done at biochemistry lab, Thiruvananthapuram medical college. Data collected was analysed by SPSS software.

Results & Discussion: Prevalence of musculoskeletal complications were 44% (66 out of 150). Adhesive capsulitis was the most common musculoskeletal manifestation (35%). Shoulder hand syndrome and cheiropathy was present in 15.3% and 5.3% of the patients respectively. Dupuytrenes' contracture (1.3%) and Charcot's joint (0.7%) were infrequent. Further analysis revealed that the prevalence of musculoskeletal manifestations were more as the duration of diabetes increases. Among a total of 15 persons with history of DM for 15-20 years, 11 were having musculoskeletal manifestations. It was also seen that prevalence of complications were high in patients with higher HbA_{1c}. Among the 7 persons with HbA_{1c} more than 10%, six were having musculoskeletal manifestations.

Conclusion: Prevalence of musculoskeletal manifestations is high among diabetic patients attending OPD (>40%). Poor glycaemic control and longer duration of diabetes increases the prevalence of musculoskeletal manifestations.

Keywords: diabetes; musculoskeletal; prevalence; HbA_{1c}; adhesive capsulitis.

Introduction

India has nearly 66.8 million cases of diabetes and these numbers are expected to rise to 120.9 million in 2035. India is set to become the diabetic capital of the world. Diabetes predisposes to microvascular complications and macrovascular complications. Indian diabetics are more prone for complications. Diabetes predisposes to other complications also; they include infections, gastrointestinal complications and musculoskeletal complications. Though data regarding the typical micro and macrovascular complications are available in abundance, data regarding these atypical manifestations are not that widely available. Musculoskeletal manifestations of diabetes include adhesive capsulitis of shoulder, flexor tenosynovitis, shoulder hand syndrome, Dupuytren's contracture etc. These manifestations produce significant morbidity for the patient. We always tend to ignore the impact of these complications on the personal and social life of a diabetic patient. The etiopathogenesis of musculoskeletal complications is similar to other complications. It is chiefly the AGEs and polyol pathway playing the role in the causation of these complications. Hyperglycemia may accelerate non-enzymatic glycosylation and abnormal collagen deposition in periarticular connective tissues, which alters the structural matrix and mechanical properties of these tissues leading to diffuse arthrofibrosis. So naturally it can be assumed that these complications are related to the duration of diabetes and degree of glycaemic control. Musculoskeletal manifestations are common but under-recognised and under-reported complications in diabetes mellitus. Although the precise aetiology of diabetes-associated musculoskeletal disorders remains uncertain, it is likely to be due to non-enzymatic glycosylation and abnormal collagen deposition in periarticular connective tissues, which alters the structural matrix and mechanical properties of these tissues leading to diffuse arthrofibrosis. When compared with the general population, patients with type 2 diabetes mellitus are 5 times more likely to have frozen shoulder and they have an increased risk

for bilateral carpal tunnel syndrome. Proper history and physical examination often leads to the diagnosis of these conditions. Some simple lab tests and radiological examinations will help us in confirming the diagnosis and excluding any other co-existing rheumatologic disease. Once we diagnose these conditions, these patients can be helped by achieving and maintaining euglycemic state, analgesics when required and physiotherapy. As we know, the treatment options are limited. So the best treatment strategy would be preventive- to prevent the occurrence of these complications by aggressively controlling hyperglycemia and other co-morbidities from the beginning. Since there are not much data regarding this aspect of diabetes from this part of the country, we thought we will conduct a study on this particular complication- musculoskeletal complications- at an era in which diabetes is growing in epidemic proportion.

Dupuytrens Disease: Idiopathic Duputren disease (DD) is seen in persons of European origin with a 6 to 1 male predominance. Thickening of the subcutaneous tissue in the palms is seen due to fibrosis of the palmar aponeurotic space with contractures of the fourth and fifth digits. The condition was recognized for nearly 100 years before an association with diabetes was suggested in 1932. The true incidence in adults with diabetes approaches 40% and the presence of diabetes abolishes the sex difference in prevalence seen in the idiopathic form.

Carpal Tunnel Syndrome: This condition is the result of compression of the median nerve within the carpal tunnel at the wrist and is the most common entrapment neuropathy, with paraesthesia of the thumb, index finger, and little finger. Pain is often worse at night. Diabetes is the most common associated disorder, accounting for 5% to 16% of cases.

Flexor Tenosynovitis: Approximately one third of palmar flexor tenosynovitis in adults is associated with women being more frequently affected than men. There is preferential involvement of the right hand, typically involving the thumb, middle, and index fingers. Fibrous tissue proliferating in the tendon sheath results in constriction where the tendon passes through

fibrous rings or pulleys or over bony prominences, causing swelling distally and pain with movement. Adhesive Capsulitis of the Shoulder The classic presentation involves thickening of the joint capsule with adherence to the head of the humerus, severe reduction in the volume of the glenohumeral joint, and frozen shoulder. Diffuse swelling, coldness, erythema, tenderness, and hyperhidrosis of the hand may precede, accompany, or follow the shoulder changes, comprising the so-called "reflex dystrophy" or "shoulder and syndrome. In a large study of 800 patients with diabetes, 11% had frozen shoulder compared with 2.3% of controls stiff hand syndrome is one of only two joint limitation syndromes (the other is limited joint mobility) seen exclusively in patients with diabetes. Initially described in 1957, it is a "severe and sometimes incapacitating form of vascular diseases of the hands. The five patients described initially had long-standing type1 DM when they experienced tingling or burning sensations in the hands and increasing symptoms and pain aggravated by movement, with progression to invalidism in two cases, there were marked changes in the nails.

Cheiroarthropathy (Limited Joint Mobility) Since the initial description of striking limitation of extension and flexion of the IP, MP and wrist and other large joints associated with, thick tight waxy skin, and early microvascular complications in three older teenagers with long diabetes limited joint mobility (LJM) has been recognized as a common early complication of both type1 DM and type2 DM. There are studies showing association between retinopathy and hand changes in type 1 Changes begin in the MP and proximal IP joints of the fifth finger and extend radially with involvement of the distal IP joints as well. Larger joints maybe involved, most commonly the wrist and elbow but also the ankles and the cervical and thoracolumbar spine. The limitation is painless and only mildly disabling when severe. foot involvement can contribute to abnormal foot pressure and damage. Thick tight waxy skin most prominent over the dorsum of the hands and forearms was noted in the original patients and in

one third of those association with microvascular complications. an 83% risk for retinopathy or nephropathy, LJM was found to be associated with a 4.3-fold relative risk of clinical neuropathy in type1 DM, limited joint mobility identifies a population exceptionally at risk for the early development of microvascular complications.

Aims and Objectives

The chief aim of the study was to find out the prevalence of these complications in the OPD setting of a tertiary referral hospital and to find out the association between these complications and the duration and degree of glycemic control.

- 1) To assess the prevalence of musculoskeletal manifestations of type 2 diabetes among the patient attending in diabetic clinic of Govt Medical College Thiruvananthapuram
- 2) To find out the association between musculoskeletal manifestations and the duration of diabetes mellitus.
- 3) To find out the association between musculoskeletal manifestations and the degree of glycemic control

Study Design: Cross sectional, observational study

Study Setting: Diabetic clinic of Government medical college Thiruvananthapuram.

Study Subjects: 150 consecutive diabetic patients attending diabetic clinic

Inclusion criteria

Type 2 Diabetic patients above 30years of age

Exclusion criteria

Patients with known

1. Rheumatological diseases
2. Patients with significant renal / hepatic impairment
3. Acutely ill patients
4. Pregnancy

Study Period: 1 year (2015-2016)

Methodology

After taking written informed consent, data was collected using a semi-structured questionnaire by

interview technique. It contained detailed history regarding duration and degree of glycemic control. Specific questions were asked about joint symptoms and recorded. Symptoms of neuropathy were specifically asked and recorded.. In addition to general examination, anthropometry (including BMI) and vital statistics, detailed rheumatology examination was conducted – chiefly inspection and palpation of joints. The joint mobility of hands was assessed by prayer sign. Detailed neurological examination was done to exclude associated neuropathy. FBS, PPBS and HBAIC were done to assess the present and past glycemic control, S. Cr and LFT were done to exclude co- morbid illness, CBC, ESR, RA factor and Uric acid were done to exclude any pre-existing rheumatological disease in patients who had rheumatological manifestations. Xrays of hand, shoulder, spine and other involved joints were done to assess bone and joint changes in affected patients.

Variables Under Study- Musculoskeletal manifestation of diabetic patients, duration of diabetes mellitus, present glycemic control,

Ethical Concerns- Study started only after getting approval of institutional research committee and ethical committee.

Statistical Analysis: Data were entered into Microsoft Excel and analysis done using SPSS software. Quantitative variables are expressed in terms of Mean, Standard deviation and qualitative variables will be analyzed using proportions. Relations between the variables were analyzed using Chi square. For test of significance p value <0.05 was considered statistically significant.

Results

A Cross-sectional study was done in Diabetic clinic of Government Medical College Thiruvananthapuram, among 150 consecutive diabetic patients.

Socio Demographic Profile of the Study Subjects

Table 1 Age wise distribution of study participant

Age Group	Number	Percent
30-34	6	4
35-44	22	4.7
45-54	28	18.7
55-64	59	39.3
>64	35	23.3
TOTAL	150	100

Mean age (SD) of study participants were 56 (11.4). It was seen that 39.3% of study subjects fall in the age group 55-64 age. There is also a tendency for the earlier diabetes (28% less than 45 years of age).

Table 2 Gender wise distribution of study subjects

Sex	Number	Percent
Male	47	31.3
Femle	103	68.7
Total	150	100

Fig 1: Gender wise distribution of study subjects

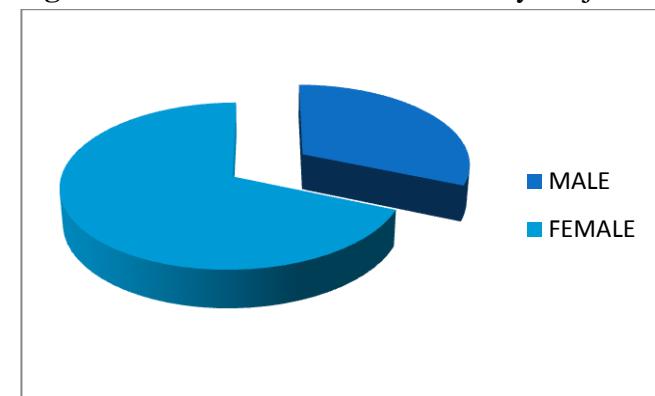


Table 3 Distribution based on history of Diabetes mellitus in the family

Frequency	Percent
Present	69.4
Absent	30.6
Total	100

In 150 study participants 104 (69.4%) were having history of diabetes mellitus in first degree relative

Table 4: Distribution based on HbA_{1C} Status

HbA _{1C}	Frequency	Percent
<7	4	2.67
7-8	78	52
8.1-10	61	40.67
>10	7	4.6
total	150	100

72 persons were having HbA_{1C} between 7 to 8, but 7 persons were having HbA_{1C} more than 10.

Table 5: Distribution based on current FBS status

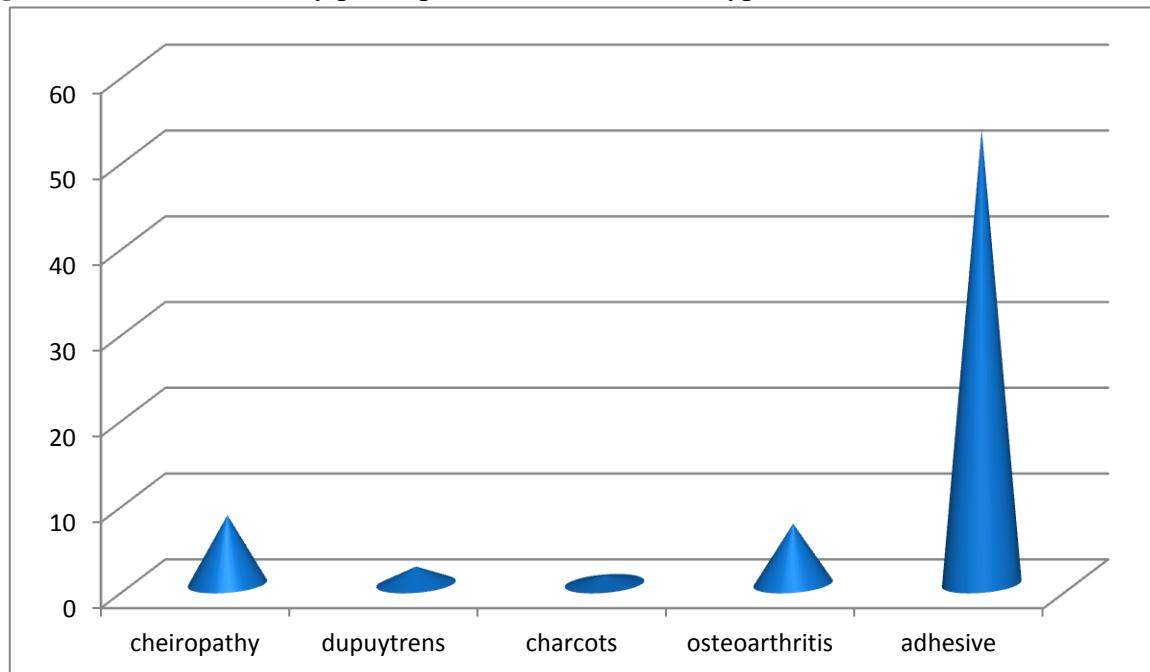
FBS	Number	Percent
upto 130	51	34
>130	99	66
total	150	100

66% of the study subjects were having a FBS of more than 130mg/dl.

Table 6: Distribution of study participants based on musculoskeletal manifestation

Manifestation	Number No Cases	Percent
Present	66	44
Absent	84	56

Among the 150 study participants, on examination 66 were having musculoskeletal manifestations. So the prevalence of musculoskeletal manifestation with 95% CI was 44 % (35.2-52.8).

Fig 2: Distribution of Study participants based on various type of musculoskeletal manifestation**Table 7 :** Distribution of Study participants based on various type of musculoskeletal manifestation

Musculoskeletal Manifestation	Frequency	Percent
Adhesive	53	35.3
Shoulder hand	23	15.3
Cheiropathy	8	5.3
Dupuytrens	2	1.3
Charcot's	1	0.7
Osteoarthritis	7	4.7

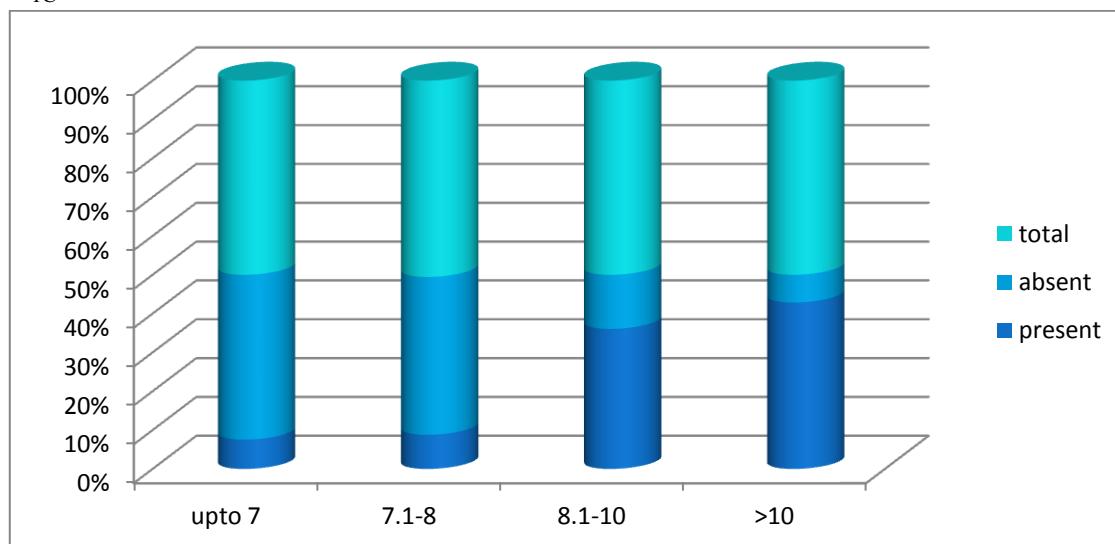
The study participants 53(35.3%) were having frozen shoulder. One person was suffering from Charcot joint and two had Dupuytren's contracture. Cheiropathy was seen in >5% of patients. There was significant overlap between patients having shoulder hand syndrome and adhesive capsulitis. 5% of the people were suffering from osteo arthritis. All of them were obese (BMI>27) and were females.

Table 8: HbA1C and overall Musculoskeletal manifestations

HbA _{1c}	Present	Absent	Total
Upto 7	8	45	53
7.1to8	8	37	46
8.1 to 10	44	17	61
>10	6	1	7
	66	84	150

P value= 0.0005

Chi square 44.6

Fig 3 : HbA_{1C} and overall Musculoskeletal manifestations

It has been found that those who were having HbA_{1C} more than 8 have more chance to develop musculoskeletal manifestation. Among the 7 persons with HbA_{1C} more than 10 ($p=0.000$)

Discussion

The prevalence of diabetes in the young population is rising. Majority of the study participants were females. Around 36% of the study subjects had diabetes in their first degree relatives reiterating the fact that diabetes mellitus has strong genetic predilection. Regarding HbA_{1C} targets, more than 50% had HbA_{1C} more than 8. Very poor glycemic control with HbA_{1C}>10 were seen only in very less number of patients (4.6%). Duration of diabetes in majority of the patients was less than 10 years. It was seen that hypertension and dyslipidemia are very common among diabetics. A large number of patients are having musculoskeletal manifestations (44%). This prevalence is less when compared to the study done by RP Agarwal et al (61%). Among the musculoskeletal manifestations, frozen shoulder (adhesive capsulitis) was the most common (35.3%). Among the other manifestations, diabetic cheiroarthropathy as manifested by positive prayer sign was seen in 5.3% of the patients. This contributes to significant morbidity amongst diabetic patients. The other manifestations included shoulder hand syndrome (15.3%), Dupuytren's contracture (1.3%) and Charcot's joint (0.7%).

There was statistically significant correlation between HbA_{1C} and musculoskeletal manifestations (adhesive capsulitis, Cheiropathy and shoulder hand syndrome).

When we analyse the musculoskeletal manifestations, it was seen that 14 out of 15 diabetics who had diabetes more than 20 years duration had musculoskeletal manifestations, reemphasizing the fact that these manifestations are related to duration of diabetes. The prevalence was significantly less in those with duration less than 5 years. There was statistically significant association between different musculoskeletal manifestations (Frozen shoulder, cheiropathy, shoulder hand syndrome and Dupuytren's contracture) and duration of diabetes.

Conclusions

Prevalence of musculoskeletal manifestations among diabetics is very high in South Kerala (>40%). There is a strong inverse association between glycemic control and the presence of musculoskeletal manifestations. There is a strong direct association between duration of diabetes and musculoskeletal manifestations.

Bibliography

1. International Diabetes Federation: IDF Diabetes Atlas Sixth Edition. 2013. Update

2014. www.idf.org/sites/default/files/Atlas-poster-2014_EN.pdf (accessed December 22, 2015).
2. India Diabetes Management Algorithm proposal group, A proposed India specific algorithm for management of type 2 Diabetes, Diabetes technology and therapeutics, 1-5, Volume 18, Number 5, 2016
 3. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes care 20:1183-1197, 1997.
 4. Expert Committee on the Diagnosis and classification of Diabetes Mellitus: Follow-up report Diabetes care 26:3160-3167, 2003.
 5. Standards of Medical Care in Diabetes— 2010 American Diabetes Association, Diabetes Care 2010 Jan; 33(Supplement 1): S11-S61
 6. American Diabetes Association: Consensus statement on self-monitoring of blood glucose. Diabetes Care 10:95-99, 1987.
 7. American Diabetes Association: self-monitoring of blood glucose. Diabetes Care 17:81-86, 1994.
 8. Sacks DB, Bruns DE, Goldstein DE, Maclaren NK, McDonald JM, Parrott M: Guidelines and recommendations for laboratory analysis in the diagnosis and management of diabetes mellitus. ClinChem 48:436-472, 2002.
 9. Rohlfing CL, Wiedmeyer HM, Little RR, England JD, Tennill A, Goldstein DE: Defining the relationship between plasma glucose and HbA1C: Diabetes care 25:275-278, 2002.
 10. The Diabetes Control and Complications Trial Research Group: N Engl J Med 329:977-986, 1993.