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ASSOCIATION BETWEEN DIABETES MELLITUS DURATION AND MUSCULOSKELETAL DISORDERS: A CROSS-SECTIONAL ANALYSIS OF DISORDER DISTRIBUTION IN DIABETIC PATIENTS

Medicine

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ABSTRACT

Background: Diabetes Mellitus (DM) is a chronic condition leading to various complications, including musculoskeletal disorders, which significantly affect patient quality of life. Understanding the relationship between diabetes duration, type, and these disorders is crucial for better management. **Aims & Objectives:** This study aims to investigate the association between the duration and type of diabetes with the prevalence of musculoskeletal disorders and analyze their distribution among diabetic patients. **Methods:** A cross-sectional study was conducted on 374 diabetic patients aged 18-50 years. Data were collected through clinical examinations and laboratory investigations, focusing on diabetes duration, type, and musculoskeletal disorders. Statistical analysis was performed using SPSS version 25. **Results:** Musculoskeletal disorders were more prevalent in Type 1 diabetics (62.2%) compared to Type 2 (37.1%). Significant associations were found with longer diabetes duration (>10 years), higher BMI (≥25), and complications like dyslipidemia, nephropathy, and retinopathy. **Conclusions:** The study highlighted the need for early detection and comprehensive management of musculoskeletal disorders in diabetic patients, particularly those with Type 1 diabetes, longer disease duration, and higher BMI.

KEYWORDS

Diabetes Mellitus; Musculoskeletal Disorders; Diabetes Duration; Type 1 Diabetes.

INTRODUCTION

Diabetes Mellitus (DM), a chronic condition characterized by persistent hyperglycemia, has been recognized throughout history, with its earliest descriptions dating back to ancient civilizations.1 Notably, in 5th or 6th century BC, the Indian surgeon Sushruta referred to it as "madhumeha," describing its hallmark symptom of sweet-tasting urine.2 The term "diabetes" was later coined by Aretaeus of Cappadocia in the 2nd century AD, with "mellitus" added by Thomas Willis in the 17th century to differentiate the sweet urine found in diabetes from other conditions.3 Over the centuries, significant advancements in the understanding and treatment of diabetes have been made, particularly following the discovery of insulin by Frederick Banting and Charles Best in the early 20th century.4 Despite these advancements, the management of diabetes remains complex, particularly due to the numerous complications that can arise, including those affecting the musculoskeletal system.[5]

Musculoskeletal disorders in diabetic patients are both prevalent and debilitating, often leading to reduced mobility, chronic pain, and increased disability. These conditions, which include joint stiffness, tendinopathies, and carpal tunnel syndrome, can significantly impact a patient's quality of life and complicate diabetes management.6,7 The relationship between the duration of diabetes and the occurrence of musculoskeletal disorders, however, remains underexplored. Understanding this association is crucial for early diagnosis and intervention, which can prevent or mitigate the progression of these disorders and improve overall patient outcomes.[8,9]

This study seeks to investigate the association between the duration of diabetes and the presence of musculoskeletal disorders, as well as to analyze the distribution of these disorders among diabetic patients. By systematically examining these relationships, the research provides insights that can guide clinical practices, enhance patient education, and lead to more comprehensive management strategies that address both glycemic control and musculoskeletal health. The findings will contribute to a deeper understanding of the interplay between diabetes and musculoskeletal disorders, ultimately helping to improve the quality of life for individuals living with diabetes.

MATERIALS & METHODS

The present cross-sectional study was conducted in the Department of Medicine at Heritage Institute of Medical Sciences, Varanasi, Uttar Pradesh, from November 2022 to May 2024. A total of 374 patients diagnosed with Diabetes Mellitus were selected for the study after thorough screening. The patients were either inpatients or outpatients attending the Departments of Medicine at the institute. The study aimed to investigate the association between the duration of diabetes mellitus and the presence of musculoskeletal disorders, as well as the distribution of these disorders among diabetic patients.

Patients were selected based on specific inclusion and exclusion criteria. The inclusion criteria included patients aged between 18 and 50 years, with a history of diabetes mellitus for at least five years, and meeting the diagnostic criteria for diabetes as defined by the American Diabetes Association (ADA). These criteria included fasting blood glucose levels greater than 126 mg/dl, postprandial blood glucose levels greater than 200 mg/dl, random blood glucose levels greater than 200 mg/dl along with classic symptoms of diabetes, or HbA1c levels greater than 6.5%. Patients were excluded if they had a history of musculoskeletal injuries, end-stage renal disease with an eGFR below 30 ml/min/1.73m², chronic liver disease, rheumatoid arthritis, or overlap syndrome, were pregnant, or had established musculoskeletal disorders before the onset of diabetes.

The sample size was calculated using a formula that considered a 95% confidence interval and an estimated prevalence of musculoskeletal disorders in diabetic patients at 58%. The final sample size required was 374 patients. Data collection involved detailed clinical examinations and interviews, focusing on the duration of diabetes and the presence of musculoskeletal complications. Comprehensive medical histories were taken, and various laboratory investigations, including complete blood count, blood glucose levels, lipid profiles, and HbA1c, were performed. X-rays and other imaging studies were conducted as necessary to confirm the diagnosis of musculoskeletal disorders.

Data were analyzed using the Statistical Package for the Social Science (SPSS) version 25. Descriptive statistics were employed to summarize the data, and the Chi-square test was used to compare categorical variables. A p-value of less than 0.05 was considered statistically significant. Ethical clearance for the study was obtained from the Institutional Ethical Committee, and informed consent was secured from all participants. The study adhered to the ethical standards of research and ensured the confidentiality of patient data throughout the research process.

RESULTS

Table 1 presents the demographic characteristics of the study population, including gender distribution, age range, types of diabetes, duration of diabetes, BMI, hypertension status, and smoking habits. The data highlights key variables essential for understanding the population under study.

DEMOGRAPHIC CHARACTERISTICS	RESULTS
Gender - Female	202
Gender - Male	172
Age (Mean ± SD)	41.21 ± 7.79
Age Range	18 - 50 years
Type 1 Diabetes Mellitus (T1DM)	37 (9.9%)
Type 2 Diabetes Mellitus (T2DM)	337 (91.1%)
Duration of Diabetes (Mean ± SD)	11.62 ± 4.42
Duration Range (Years)	5.5 - 24 years
BMI (Mean ± SD)	26.71 ± 4.14
BMI Range	16.5 - 42.1
Hypertensive	113 (30.2%)
Normotensive	261 (69.8%)
Smoking	39 (10.4%)

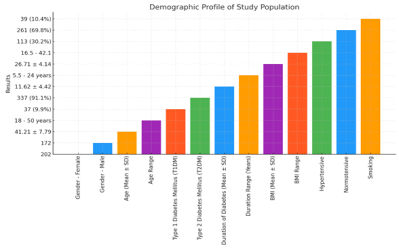


Table 2 This table highlights the association between diabetes type and musculoskeletal disorders, showing a higher prevalence of these disorders in Type 1 diabetic patients.

TYPE OF DIABETES		MUSCULOSKELETAL DISORDERS		TOTAL	P VALUE
		YES	NO		
Type 1	N	23	14	37	0.003 linear by linear association
	%	62.2%	37.8%	100.0%	
Type 2	N	125	212	337	
	%	37.1%	62.9%	100.0%	
Total	N	148	226	374	
	%	39.6%	60.4%	100.0%	

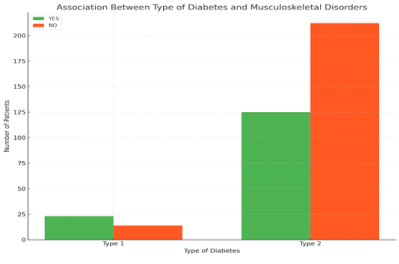


Table 3 presents significant associations with BMI, dyslipidemia, nephropathy, retinopathy, and neuropathy, where higher percentages of musculoskeletal disorders are evident.

Variable		MSK Disorder (YES)	Percentage (YES)	MSK Disorder (NO)	Percentage (NO)	Total	P Value
Age Group	<20	4	2.7%	0	0.0%	4	-
	21-30	13	8.8%	0	0.0%	13	-
	31-40	42	28.4%	0	0.0%	42	-
	41-50	89	60.1%	0	0.0%	89	-
BMI	<25 (Under/normal)	39	23.6%	126	76.4%	165	0.000
	≥25	109	52.2%	100	47.8%	209	-
HbA1c	<7	49	29.7%	116	70.3%	165	0.001
	≥7	99	47.4%	110	52.6%	209	-
Dyslipidemia	Present	73	57.9%	53	42.1%	126	0.000
	Absent	75	30.2%	173	69.8%	248	-
Nephropathy	Present	47	50.5%	46	49.5%	93	0.013
	Absent	101	35.9%	180	64.1%	281	-
Retinopathy	Present	62	51.2%	59	48.8%	121	0.001
	Absent	86	34.0%	167	66.0%	253	-
Neuropathy	Present	35	53.8%	30	46.2%	65	0.010
	Absent	113	36.6%	196	63.4%	309	-

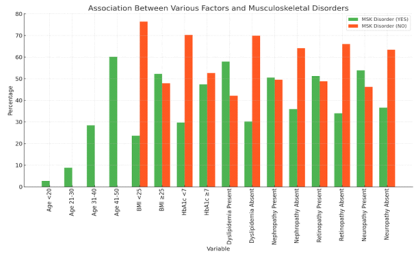
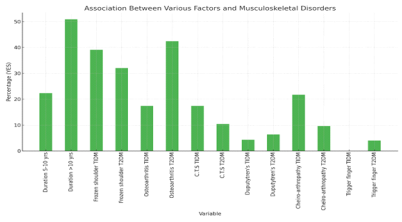


Table 4 summarizes the association between the duration of diabetes and various musculoskeletal disorders in diabetic patients. It also includes the distribution of specific musculoskeletal disorders according to the type of diabetes (T1DM and T2DM), highlighting significant findings.

VARIABLE	MSK DISORDER (YES)	PERCENTAGE (YES)	MSK DISORDER (NO)	PERCENTAGE (NO)	TOTAL	P VALUE
Duration of Diabetes 5-10 years	33	22.3%	115	77.7%	148	0.000
Duration of Diabetes >10 years	115	50.9%	111	49.1%	226	-
Total Duration	148	39.6%	226	60.4%	374	-
Frozen shoulder TIDM	9	39.1%	-	-	9	0.504
Frozen shoulder T2DM	40	32.0%	-	-	40	0.024
Osteoarthritis TIDM	4	17.4%	-	-	4	0.334
Osteoarthritis T2DM	53	42.4%	-	-	53	0.705
C.T.S TIDM	4	17.4%	-	-	4	0.334
C.T.S T2DM	13	10.4%	-	-	13	0.093
Duputytren's contracture TIDM	1	4.3%	-	-	1	0.093
Duputytren's contracture T2DM	8	6.4%	-	-	8	0.705
Cheiro-arthropathy TIDM	5	21.7%	-	-	5	0.093
Cheiro-arthropathy T2DM	12	9.6%	-	-	12	0.329
Trigger finger TIDM	0	0.0%	-	-	0	0.329
Trigger finger T2DM	5	4.0%	-	-	5	0.093



DISCUSSION

The study presents a comprehensive analysis of the association between various factors and musculoskeletal disorders (MSK) in diabetic patients, emphasizing the significance of demographic characteristics, the type of diabetes, and the duration of the disease. The study provides a detailed demographic profile of the study population, highlighting the prevalence of musculoskeletal disorders. The population consisted of 374 patients, with a mean age of 41.21 years. The majority were Type 2 diabetic patients (91.1%), with a notable proportion of patients having a BMI above 25, indicating overweight or obesity—a known risk factor for musculoskeletal complications. Hypertension was prevalent in 30.2% of the population, and 10.4% were smokers, further emphasizing the need for a multifaceted approach in managing diabetes and its complications. Bhat et al.[10], who reported a 33% prevalence of musculoskeletal disorders among 403 diabetic patients compared to 300 non-diabetic controls. Similarly, Majjad et al.[11] observed a 34.4% prevalence of musculoskeletal d isorders in a study involving 376 diabetic patients. Mathew et al.[12] also found a slightly higher prevalence of 42.58% among 310 patients, while Cagliero et al.[14] reported a 36% prevalence among 200 diabetic patients in a cohort of 300 adults. These studies collectively emphasize the high burden of musculoskeletal complications among diabetic patients, particularly in those with longer disease duration and poor glycemic control.

This study shows a higher prevalence of musculoskeletal disorders in Type 1 diabetic patients (62.2%) compared to Type 2 diabetic patients (37.1%). This finding is consistent with the study by Cagliero et al.[14], who observed a 67% prevalence of musculoskeletal disorders in Type 1 diabetics versus 34% in Type 2 diabetics. Agrawal et al.[15] also found a significant association, with a 62.7% prevalence in Type 1 diabetics and 56.1% in Type 2 diabetics. These studies suggest that Type 1 diabetes, often associated with earlier onset and more aggressive disease progression, may contribute to a higher risk of musculoskeletal complications.

Our study highlights the significant associations between musculoskeletal disorders and factors such as BMI, HbA1c levels, dyslipidemia, nephropathy, retinopathy, and neuropathy. A higher BMI (≥25) was strongly associated with musculoskeletal disorders (52.2%, p-value = 0.000), corroborating findings from **Majjad et al.[11]** who reported a prevalence of 40% and 70.1%, respectively, among patients with higher BMI. Agrawal et al.[15] further supported this association, reporting a significant correlation between BMI and specific musculoskeletal disorders, including frozen shoulder and osteoarthritis.

The study also observed that poor glycemic control (HbA1c ≥7) was associated with a higher prevalence of musculoskeletal disorders (47.4%, p-value = 0.001). This finding is consistent with studies by Majjad et al.[11] who reported musculoskeletal disorder prevalences of 37.9% and 65.9%, respectively, among patients with elevated HbA1c levels. The study's findings regarding dyslipidemia and musculoskeletal disorders are in line with research by Mustafa et al.[15], who reported a 70.2% prevalence of diabetic hand syndrome among dyslipidemic patients, highlighting the role of lipid metabolism in the development of musculoskeletal complications.

Our study discusses the association between the duration of diabetes and the prevalence of musculoskeletal disorders, revealing that patients with a disease duration of over 10 years had a significantly higher prevalence (50.9%) compared to those with less than 10 years (22.3%). This result is supported by Majjad et al.[11], who found prevalences of 43.7% in patients with more than 10 years of diabetes and 26.2% in those with a shorter duration. Agrawal et al.[15] also reported similar findings, with a 49.6% prevalence in patients with over 11 years of diabetes. The study also analyzed specific musculoskeletal disorders, such as frozen shoulder and osteoarthritis, and found that these were more prevalent in Type 2 diabetic patients, particularly with longer disease durations. We observed that osteoarthritis was the most common musculoskeletal disorder among the study population, with a prevalence of 15.24%, consistent with findings by Majjad et al.[11] (19.4%), Mathew et al.[12] (20.64%), and Singh et al.[18] (14%). However, the study's results differed from those by Aloayan et al.[16], who reported a much higher prevalence of 72.1%, likely due to differences in sample size and age group inclusion. We also observed that frozen shoulder was more common among females, with a prevalence of 13.10%, aligning with findings by Bellary et al.[17] (12.7%), Cagliero et al.[14] (12%), and Majjad et al.[11] (12.5%). In short, this study reinforces the findings of previous studies on the prevalence and risk factors associated with musculoskeletal disorders in diabetic patients. The significant associations with type of diabetes, BMI, glycemic control, and duration of the disease underscore the importance of comprehensive management strategies to prevent and mitigate these complications, ultimately improving the quality of life for diabetic patients.

CONCLUSION

The study reveals a significant association between diabetes and the prevalence of musculoskeletal disorders, particularly highlighting that Type 1 diabetic patients are more prone to these complications compared to Type 2 diabetics, with a prevalence of 62.2% versus 37.1%. The data also underscore the impact of various factors, including age, BMI, glycemic control, and the duration of diabetes, on the likelihood of developing musculoskeletal disorders. Notably, longer diabetes duration (over 10 years) and higher BMI were strongly correlated with increased prevalence, with musculoskeletal disorders affecting 50.9% of those with over 10 years of diabetes and 52.2% of those with a BMI over 25. Additionally, complications such as dyslipidemia, nephropathy, and retinopathy were also associated with a higher incidence of musculoskeletal issues, emphasizing the need for early detection and comprehensive management to improve the quality of life in diabetic patients.

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