VOLUME - 12, ISSUE - 11, NOVEMBER - 2023 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

General Medicine

EVALUATING MUSCULOSKELETAL COMPLICATIONS AMONG INDIVIDUALS WITH DIABETES MELLITUS

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ABSTRACT

Introduction: Diabetes is a widespread chronic metabolic disorder associated with musculoskeletal complications that can lead to pain, disability, and reduced quality of life. Understanding the risk factors and mechanisms behind these complications is vital for comprehensive diabetes care. **Methods:** The study was conducted at MGM Medical College and Hospital in India, spanning various departments. It had a mixed retrospective and prospective design with 115 participants aged 18-60, focusing on diabetes mellitus cases without musculoskeletal disorders. Ethical approval and informed consent were obtained, and comprehensive medical histories and rheumatological exams were conducted, including radiographs. Laboratory investigations were carried out at MGM Hospital's Biochemistry Laboratory, and data were meticulously recorded and analyzed in Excel. **Results:** The study included 115 participants with a mean age of 40.45 years. Among the participants, 60.0% were male, and 40.0% were female. Addictions were reported, including alcohol consumption (19.1%), smoking (29.6%), and tobacco chewing (16.5%). Most participants had Type II diabetes (93.0%). The mean duration of diabetes was 8.08 years. General physical examination findings included pallor (59.13%), icterus (8.69%), pedal edema (38.26%), and lymph node involvement (5.21%). HbA1c levels varied, with 56.52% between <7-9, 19.13% between 9-12, and 24.34% >12, with a mean of 8.73. Significant differences are observed in weight, BMI, and Hb levels between males and females ($p<.05$). The results of the study reveal that gender and HbA1c levels do not significantly influence the prevalence of musculoskeletal conditions among participants. **Conclusion:** Diabetes-related musculoskeletal problems can impact patients' well-being. Still, timely interventions can improve their quality of life and functional independence, making it crucial for healthcare providers to incorporate musculoskeletal assessments into routine diabetes care.

KEYWORDS : Diabetes mellitus, Musculoskeletal complications, Glycemic control, HbA1c

INTRODUCTION

Diabetes mellitus, commonly referred to as diabetes, is a chronic metabolic disorder characterized by elevated levels of blood glucose (sugar). It affects millions of people worldwide and is associated with a multitude of complications affecting various organ systems in the body. While the primary focus in diabetes management has traditionally been on glycemic control and its impact on systemic health, there is growing recognition of the significant impact of diabetes on the musculoskeletal system.(1,2)

Musculoskeletal complications in diabetes encompass a wide range of issues that affect the bones, joints, muscles, and connective tissues. These complications can lead to pain, disability, reduced quality of life, and increased healthcare costs. Understanding the relationship between diabetes and musculoskeletal health is crucial for providing comprehensive care to individuals with diabetes.(3)

The purpose of this study is to investigate the various musculoskeletal complications associated with diabetes mellitus, explore their underlying mechanisms, and evaluate their clinical implications. Numerous factors have been identified as increasing the risk of musculoskeletal complications in individuals with diabetes mellitus (DM). These risk factors encompass the degree and duration of hyperglycemia, the type of diabetes (type 1 or type 2), the presence of chronic microvascular complications related to DM, obesity, hypertension, smoking, hyperuricemia, hyperlipidemia, elevated levels of C-reactive protein (CRP), pro-inflammatory cytokines, advanced glycosylation end-products (AGE), infections, patient age and sex, genetic predisposition, and specific medications such as insulin, statins, thiazolidinediones, and sulfonylureas. Understanding the interplay of these factors is crucial in assessing and managing the heightened susceptibility to musculoskeletal complications in individuals living with diabetes mellitus.(4,5)

Douloumpakas et al. (2007) conducted a pilot study with 208 patients having type 2 diabetes mellitus, identifying that 82.6% of them had musculoskeletal abnormalities, primarily degenerative and noninflammatory.(6) Thomas et al. (2007) investigated frozen shoulder in diabetes patients and found shoulder pain in 25.7% of diabetic patients compared to 5.0% in the general medical population.(7) Mathew et al. (2011) reported a prevalence of rheumatic musculoskeletal disorders (RMSD) in 42.58% of 310 cases with T2DM, with osteoarthritis of the knee (20.64%) being the most common. (8) Attar et al. (2012) found musculoskeletal manifestations in 18% of diabetic cases, with vascular complications and retinopathy predicting their development. (9) Larkin et al. (2014) observed that cheiroarthropathy was present in 66% of subjects with type 1 diabetes, associated with age, diabetes duration, HbA1c, and microvascular complications. (10)

Gupta et al. (2015) reported a higher prevalence of rheumatic diseases in individuals with diabetes, affecting muscles, bones, and connective tissues, including unique conditions like diabetic myonecrosis.(11) Pai et al. (2015) found that diabetes patients had a higher 10-year cumulative incidence of musculoskeletal pain and more doctor visits for such pain.(12) Fatemi et al. (2015) observed a higher prevalence of musculoskeletal manifestations in diabetic and prediabetic patients, with knee osteoarthritis and shoulder involvement being more common in diabetics.(13) Bhat et al. (2016) noted a significant involvement of the upper limb in diabetic patients. (4) Mustafa et al. (2016) found a high prevalence of hand disorders in type 2 diabetes, with associations to factors like age, duration of diabetes, and hypertension.(13) Neki et al. (2018) discussed the under-recognized musculoskeletal manifestations in diabetes and recommended early

management. (14) Sozen et al. (2018) highlighted the impact of musculoskeletal problems on the quality of life in diabetic patients. (15) Majjad et al. (2018) reported a significant prevalence of musculoskeletal disorders, especially in those with long-duration diabetes and dyslipidemia.(5) Bashit et al. (2019) conducted a meta-analysis showing a high prevalence of musculoskeletal disorders in diabetic patients, with the hand being the most affected area.(16) Ghosal et al. (2020) emphasized the association of diabetes with musculoskeletal disorders and pain, recommending proper identification and management. (17) Kudsi et al. (2020) reported a high prevalence of musculoskeletal conditions in type 2 diabetics.(18) Prakasa (2020) reviewed various musculoskeletal complications associated with diabetes, highlighting their impact on morbidity and disability. (19)

MATERIAL AND METHOD

The study was conducted at the Department of Medicine, MGM Medical College and Hospital in Navi Mumbai, Maharashtra, India. The study included various departments within the Mahatma Gandhi Mission Medical College, such as the Male Medicine Ward, Female Medicine Ward, Medicine Intensive Care Unit, and Medicine OPD. The study design involved both retrospective and prospective aspects, with a sample size of 115 participants. The study took place from 2020 to 2022 and had specific inclusion and exclusion criteria, including participants being known cases of diabetes mellitus, aged between 18 and 60 years, and free from trauma or pre-existing musculoskeletal disorders. Prior approval from the Institutional Ethics Committee and written informed consent was obtained from all participating patients. Children under 18 years old were excluded due to differences in growth and development compared to adults.

The current complaints and personal and past medical histories, were documented. Rheumatological examinations were conducted, encompassing both general and specific musculoskeletal assessments. General observations included gait abnormalities, functional loss, joint deformities, subcutaneous nodules, and joint swelling. Specific assessments involved palpation for swelling, effusions, tenderness, crepitus, and warmth in joints and peri-articular structures. Active and passive joint mobility assessments were performed, and special tests like Tinel's and Phalen's tests, Finkelstein's test, and others were conducted as needed. For definitive diagnosis and to rule out alternative conditions, plain radiographs of affected joints were taken in some cases. Radiograph reports were reviewed by both the researcher and radiologists. Standard definitions were employed to categorize type 1 and type 2 diabetic cases and assess glycemic control, obesity, abdominal obesity, anemia, leukocytosis, elevated ESR, and elevated CRP in all subjects. Venous blood samples were collected for laboratory investigations, which were conducted in the Biochemistry Laboratory of MGM Hospital, Kamothe. Data were recorded in an Excel spreadsheet and analyzed accordingly.

Statistical Analysis

The data was analyzed using IBM SPSS statistical software (IBM Corporation, Armonk, NY, USA). Continuous and categorical data were presented appropriately. Continuous data were assessed using the 'Unpaired t-test,' and categorical data were analyzed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1 illustrates the demographic characteristics and relevant medical history of the study's 115 participants. The age distribution reveals a diverse range, with the mean age of the patients being 40.45 years, ranging from a minimum of 18 to a maximum of 60 years. Among the patients, 60.0% were male, and 40.0% were female. Addictions were reported, with 19.1% being alcohol consumers, 29.6% smokers, 34.8% non-smokers, and 16.5% engaged in tobacco chewing. Regarding diabetes type, 93.0% had Type II diabetes, while 7.0% had Type I diabetes. The duration of diabetes varied, with 37.4% having diabetes for less than 5 years, 29.6% for 5-10 years, 27.8% for 11-15 years, and smaller percentages for 16-20 years (4.3%) and over 20 years (0.9%). The mean duration of diabetes was 8.08 years, ranging from 1 to 25 years. General physical examination findings included 59.13% with pallor, 8.69% with icterus, 38.26% with pedal edema, and 5.21% with lymph node involvement. Lastly, HbA1c levels showed 56.52% of patients with levels between <7-9, 19.13% with levels between 9-12, and 24.34% with levels >12, with a mean HbA1c level of 8.73.

Table 1. Distribution according to demographic characteristics, addictions and Past history

Variable		No. of patients	Percentage
Age (Years)	<20	8	7.0%
	21-30	24	20.9%
	31-40	16	13.9%
	41-50	37	32.2%
	51-60	30	26.1%
	Mean ± SD= 40.45±13.01, Min = 18, Max = 60		
Gender	Male	69	60.0%
	Female	46	40.0%
Addictions	Alcoholic	22	19.1%
	Smoker	34	29.6%
	Non-smoker	40	34.8%
	Tobacco chewing	19	16.5%
Type of diabetes	Type I	8	7.0%
	Type II	107	93.0%
Duration of diabetes	<5	43	37.4%
	5-10	34	29.6%
	11-15	32	27.8%
	16-20	5	4.3%
	>20	1	0.9%
	Mean ± SD= 8.08±5.08, Min = 1, Max =25		
General physical examination	Pallor	68	59.13%
	Icterus	10	8.69%
	Pedal edema	44	38.26%
	Lymph nodes	9	5.21%
HbA1c	<7-9	65	56.52%
	9-12	22	19.13%
	>12	28	24.34%
	Mean ± SD= 8.73±3.32		

Table 2 presents descriptive statistics for various anthropometric, hematological, and lipid profile parameters of the study participants. Anthropometric parameters include systolic blood pressure (SBP) with a mean of 118 mmHg and a standard deviation (SD) of 21.85 mmHg, diastolic blood pressure (DBP) with a mean of 76.19 mmHg and an SD of 14.12 mmHg, weight with a mean of 64.41 kg and an SD of 11.21 kg, height with a mean of 5.42 feet and an SD of 0.27 feet, and BMI (Body Mass Index) with a mean of 21.84 kg/m^2 and an SD of 3.45 kg/m^2.

Biochemical and hematological examination parameters include hemoglobin (Hb) with a mean of 8.98 g/dl and an SD of 1.12 g/dl, total leukocyte count (TLC) with a mean of 6771.83/mm^3 and an SD of 1679.59/mm^3, absolute platelet count (APC) with a mean of 2.59 lacs/mm^3 and an SD of 0.82 lacs/mm^3, fasting sugar with a mean of 163.98 mg/dl and an SD of 27.72 mg/dl, postprandial sugar with a mean of 272.89 mg/dl and an SD of 50.81 mg/dl, blood urea with a mean of 77.71 mg/dl and an SD of 20.09 mg/dl, serum creatinine with a mean of 8.21 mg/dl and an SD of 2.04 mg/dl, serum uric acid with a mean of 7.14 mg/dl and an SD of 2.53 mg/dl, aspartate aminotransferase (AST) with a mean of 34.05 U/L and an SD of 20.7 U/L, and alanine aminotransferase (ALT) with a mean of

29.77 U/L and an SD of 15.97 U/L.

Lipid profile parameters consist of triglycerides with a mean of 144 mg/dl and an SD of 47.33 mg/dl, cholesterol with a mean of 148.29 mg/dl and an SD of 43.66 mg/dl, high-density lipoprotein (HDL) with a mean of 35.4 mg/dl and an SD of 27.24 mg/dl, low-density lipoprotein (LDL) with a mean of 101.11 mg/dl and an SD of 38.59 mg/dl, and very-low-density lipoprotein (VLDL) with a mean of 43.43 mg/dl and an SD of 24.18 mg/dl.

Table 2. Descriptive Statistics for Anthropometric, hematological and lipid profile parameters

Parameter		Mean	SD
Anthropometric parameters	SBP (mmHg)	118	21.85
	DBP (mmHg)	76.19	14.12
	Weight	64.41	11.21
	Height	5.42	0.27
	BMI (kg/m2)	21.84	3.45
Biochemical / hematological examination	Hb (g/dl)	8.98	1.12
	TLC (/mm3)	6771.83	1679.59
	APC (lacs/mm3)	2.59	0.82
	Fasting sugar	163.98	27.72
	Postprandial sugar	272.89	50.81
	Blood urea	77.71	20.09
	Serum creatinine	8.21	2.04
	Serum uric acid	7.14	2.53
	AST	34.05	20.7
	ALT	29.77	15.97
Lipid profile	Triglycerides	144	47.33
	Cholesterol	148.29	43.66
	HDL	35.4	27.24
	LDL	101.11	38.59
	VLDL	43.43	24.18

Table 3 presents the distribution of musculoskeletal examination findings among the study participants. The table includes various musculoskeletal conditions affecting different parts of the body. In the hand, conditions such as Cheiroarthropathy were observed in 16.52% of patients, Dupuytren's contracture in 7.82%, Flexor tenosynovitis in 11.30%, De Quervain's tenosynovitis in 9.56%, Carpal tunnel syndrome in 11.30%, and Sclerodactyly in 5.21%.

For the elbow, the table shows Olecranon bursitis in 5.21% of cases, Lateral epicondylitis in 10.43%, and Medial epicondylitis in 10.43%. In the shoulder region, Rotator cuff tear was observed in 6.08% of patients, Bicipital tendinitis in 7.82%, and Adhesive capsulitis in 10.43%. For the hip, knee, and foot, the table includes Trochanteric bursitis in 3.47% of cases, Prepatellar bursitis in 5.21%, Anserine bursitis in 17.39%, Neuroarthropathy in 3.47%, Osteoporosis in 37.39%, Diabetic osteolysis in 4.34%, Amyotrophy in 5.21%, and Diabetic muscle infarction in 1.73%.

Table 3. Distribution according to the Musculoskeletal Examination

Hand	Chieroarthropathy	19	16.52%
	Dupuytrens contracture	9	7.82%
	Flexor tenosynovitis	13	11.30%
	Dequervains tenosynovitis	11	9.56%
	Carpal tunnel syndrome	13	11.30%
	Sclerodactyly	6	5.21%
Elbow	Olecranon bursitis	6	5.21%
	Lateral epicondylitis	12	10.43%
	Medial epicondylitis	12	10.43%
Shoulder	Rotator cuff tear	7	6.08%
	Bicipital tendinitis	9	7.82%
	Adhesive capsulitis	12	10.43%
Hip/knee/ Foot	Trochanteric bursitis	4	3.47%
	Prepatellar bursitis	6	5.21%
	Anserine bursitis	20	17.39%
	Neuroarthropathy	4	3.47%
	Osteoporosis	43	37.39%
	Diabetic osteolysis	5	4.34%
	Amyotrophy	6	5.21%
	Diabetic muscle infarction	2	1.73%

Table 4 provides a gender-wise comparison of various quantitative study parameters between male and female participants. The table includes the mean values and p-values for each parameter, indicating whether there are statistically significant differences between males and females.

There is no significant difference in age between males (40.34 years) and females (40.60 years) with a p-value of 0.915. The disease duration in males (8.43 years) and females (7.56 years) is not significantly different, with a p-value of 0.374. Both systolic (SBP) and diastolic (DBP) blood pressure measurements show no significant gender-based differences, with p-values of 0.448 and 0.49, respectively. There is a significant difference in weight between males (66.91 kg) and females (60.67 kg) with a p-value of 0.003, indicating that males tend to have higher weights. The body mass index (BMI) also shows a significant difference, with males having a higher BMI (22.48 kg/m2) compared to females (20.87 kg/m2), and a p-value of 0.01. Hb levels are significantly higher in males (9.19 g/dl) compared to females (8.67 g/dl), with a p-value of 0.01. Other parameters such as TLC, APC, fasting and postprandial sugar, blood urea, serum creatinine, serum uric acid, AST, ALT, triglycerides, cholesterol, HDL, LDL, VLDL, and HbA1c show no significant gender-based differences.

Table 4. Gender-wise comparison of quantitative study parameters

Parameters	Male (n=69)	Female (n=46)	p-value
Age	40.34±13.43	40.60±12.49	0.915
Disease duration	8.43±5.02	7.56±5.18	0.374
SBP	116.69±20.60	119.95±23.69	0.448
DBP	75.43±13.75	77.32±14.73	0.49
Weight	66.91±10.95	60.67±10.64	0.003**
Height	5.45±0.30	5.38±0.23	0.178
BMI	22.48±3.35	20.87±3.40	0.01 **
Hb (g/dl)	9.19±1.15	8.67±1.0	0.01**
TLC (/mm3)	6598.41±1488.11	7031.96±1919.62	0.199
APC (lacs/mm3)	2.62±0.87	2.54±0.76	0.591
Fasting sugar	161.52±27.11	167.67±28.51	0.25
Postprandial sugar	274.55±49.38	270.41±53.34	0.675
Blood urea	76.21±21.21	79.21±18.41	0.502
Serum creatinine	8.02±2.05	8.49±2.02	0.236
Serum uric acid	7.11±2.55	7.18±2.53	0.877
AST	34.43±21.53	33.47±19.59	0.805
ALT	29.47±16.63	30.21±15.10	0.805
Triglycerides	142.05±50.27	146.93±42.92	0.578
Cholesterol	149.89±45.31	145.89±41.45	0.625
HDL	35.52±25.32	35.21±30.19	0.955
LDL	106.13±38.03	93.58±38.60	0.08
VLDL	40.82±21.70	47.34±27.26	0.177
HbA1c	8.92±3.26	8.44±3.42	0.456

Table 5 presents a gender-wise comparison of qualitative study parameters among male and female participants. The table includes the number (n) and percentage (%) of participants in each category for various musculoskeletal conditions and their corresponding p-values.

Chieroarthropathy, Dupuytren's contracture, Flexor tenosynovitis, De Quervain's tenosynovitis, Carpal tunnel syndrome, Sclerodactyly, Olecranon bursitis, Lateral epicondylitis, Medial epicondylitis, Rotator cuff tear, Bicipital tendinitis, Adhesive capsulitis, Trochanteric bursitis, Prepatellar bursitis, Anserine bursitis, Neuroarthropathy, Osteoporosis, Diabetic osteolysis, Amyotrophy, and Diabetic muscle infarction are the musculoskeletal conditions considered. Based on the p-values, none of the musculoskeletal conditions listed in the table show statistically significant gender-based differences. Therefore, there are no significant variations in the prevalence of these conditions between male and female participants in the study.

Table 5. Gender-wise comparison of qualitative study parameters

Parameters	Male (n=69)		Female (n=46)		p-value
	n	%	n	%	
Chieroarthropathy	10	14.5%	9	19.6%	0.473, NS
Dupuytrens contracture	7	10.1%	2	4.3%	0.256, NS
Flexor tenosynovitis	9	13.0%	4	8.7%	0.47, NS
Dequervains tenosynovitis	8	11.6%	3	6.5%	0.364, NS
Carpal tunnel syndrome	8	11.6%	5	10.9%	0.904, NS
Sclerodactyly	2	2.9%	4	8.7%	0.17, NS
Olecranon bursitis	4	5.8%	2	4.3%	0.732, NS
Lateral epicondylitis	6	8.7%	6	13.0%	0.455, NS
Medial epicondylitis	7	10.1%	5	10.9%	0.9, NS
Rotator cuff tear	4	5.8%	3	6.5%	0.873, NS
Bicipital tendinitis	9	13.0%	0	0.0%	0.01, NS
Adhesive capsulitis	8	11.6%	4	8.7%	0.618, NS
Trochanteric bursitis	2	2.9%	2	4.3%	0.677, NS
Prepatellar bursitis	2	2.9%	4	8.7%	0.17, NS
Anserine bursitis	14	20.3%	6	13.0%	0.315, NS
Neuroarthropathy	2	2.9%	2	4.3%	0.677, NS
Osteoporosis	25	36.2%	18	39.1%	0.753, NS
Diabetic osteolysis	3	4.3%	2	4.3%	0.999, NS
Amyotrophy	3	4.3%	3	6.5%	0.607, NS
Diabetic muscle infarction	1	1.4%	1	2.2%	0.77, NS

Table 6 presents a comparison of qualitative study parameters based on HbA1c levels, with participants divided into two groups: those with HbA1c levels less than 7 and those with HbA1c levels equal to or greater than 7. Based on the p-values, none of the musculoskeletal conditions listed in the table show statistically significant differences in prevalence between the two HbA1c groups. Therefore, there are no significant variations in the prevalence of these conditions based on HbA1c levels, and the differences observed are not statistically significant.

Table 6. Comparison of qualitative study parameters according to HbA1C

Parameters	HbA1c <7 (n=54)		HbA1c ≥7 (n=61)		p-value
	n	%	n	%	
Chieroarthropathy	10	18.5%	9	14.8%	0.587, NS
Dupuytrens contracture	3	5.6%	6	9.8%	0.393, NS
Flexor tenosynovitis	3	5.6%	10	16.4%	0.06, NS
Dequervains tenosynovitis	6	11.1%	5	8.2%	0.595, NS
Carpal tunnel syndrome	8	14.8%	5	8.2%	0.263, NS
Sclerodactyly	5	9.3%	1	1.6%	0.06, NS
Olecranon bursitis	3	5.6%	3	4.9%	0.878, NS
Lateral epicondylitis	6	11.1%	6	9.8%	0.823, NS
Medial epicondylitis	6	11.1%	6	9.8%	0.823, NS
Rotator cuff tear	2	3.7%	5	8.2%	0.314, NS
Bicipital tendinitis	1	1.9%	8	13.1%	0.02, NS
Adhesive capsulitis	3	5.6%	9	14.8%	0.107, NS
Trochanteric bursitis	1	1.9%	3	4.9%	0.370, NS
Prepatellar bursitis	4	7.4%	2	3.3%	0.320, NS
Anserine bursitis	12	22.2%	8	13.1%	0.198, NS
Neuroarthropathy	3	5.6%	1	1.6%	0.252, NS
Osteoporosis	20	37.0%	23	37.7%	0.941, NS
Diabetic osteolysis	3	5.6%	2	3.3%	0.550, NS
Amyotrophy	3	5.6%	3	4.9%	0.878, NS
Diabetic muscle infarction	0	0.0%	2	3.3%	0.179, NS

DISCUSSION

Musculoskeletal conditions are more commonly found in individuals with diabetes mellitus compared to those without diabetes. Various clinical and biochemical factors, including inadequate glycemic control, have been strongly linked to the occurrence of musculoskeletal issues in people with diabetes. In this study, most of the 115 diabetic patients fell within the 41-50 years age group, comprising 37 (32.17%) individuals, followed by 30 (26.08%) in the 51-60 years range. The mean age of the patients was 40.452±13.01 years, with an age range spanning from 18 to 60 years.

Similarly, studies like Edis et al. (2021) reported an average age of 702 diabetic patients as 55.9±13.2 years, while Bhat et al. (2016) found a mean age of 47.5±10.2 years in their diabetic group, and Kudsi et al. (2020) reported a mean age of 46.8±9.7 years. (18,20,21) The variation in mean age between their studies and the present one can be attributed to differences in sample size. In our study, 69 (60%) patients were male, while 46 (40%) were female. Among the patients, 107 had type I diabetes, and only 8 had type II diabetes mellitus. A study by Kamiab et al. (2021) involving 273 patients with type II diabetes showed a similar gender distribution, with 52.4% (n = 143) being male and 47.6% (n = 130) being female. (22) In another study conducted by Bhat et al. (2016), the gender distribution showed that 144 (35.7%) were males, and 259 (64.3%) were females. Edis et al. (2021) reported a gender distribution of 55.1% females (n=387) and 44.9% males (n=315), with 8.1% (n=57) diagnosed with type 1 diabetes and 91.9% (n=645) with type 2 diabetes. Kudsi et al. (2020) found that their study included 187 females (62.3%) and 113 males (34.3%), with only 73 patients (24.3%) achieving controlled diabetes, including 48 females and 25 males. (18,20,21)

In this study, 22 (19.13%) patients were identified as alcohol consumers, 34 (29.56%) as smokers, 40 (34.78%) as non-smokers, and 19 (16.52%) as tobacco chewers. The majority of patients, 107 (93.05%), were diagnosed with type II diabetes, while only 8 (6.95%) had type I diabetes. Additionally, 33 (28.69%) patients had a family history of diabetes. Among the patients, 5 (4.34%) had a diabetes duration of 15-20 years, with a mean diabetes duration of 8.08±5.08 years, ranging from 1 to 25 years. Bhat et al. (2016) found a mean diabetes duration of 6.9 years in their study. In Majjad et al.'s (2018) research, the median duration of diabetes was reported to be 8 years, with a range of 4 to 13 years. Attar et al. (2012) reported a mean duration of diabetes as 11.21±8.5 years in their study. Similarly, Kudsi et al. (2020) reported a mean diabetes duration of 7.6 years in their research. (5,9,18,21)

In the present study, the mean systolic blood pressure was 118.21±21.85 mmHg, and the diastolic blood pressure was 76.19±14.12 mmHg. The mean body mass index (BMI) was 21.84±3.45 kg/m2. In contrast, Bhat et al. (2016) reported a higher BMI in diabetic patients, with a mean of 27.1±5.2. Similarly, Kudsi et al. (2020) found a mean BMI of 26.9±4.8 kg/m2 in their study, and Majjad et al. (2018) reported a mean BMI of 26.4 ± 3.6 kg/m2. (5,18,21)

In the present study, a total of 65 (56.52%) patients had HbA1c levels between <7-9, 22 (19.13%) had HbA1c levels ranging

from 9-12, and 28 (24.34%) had HbA1c levels >12. The mean HbA1c level was found to be 8.73±3.32. In contrast, Kudsi et al. (2020) reported that the mean HbA1c level was below 8.1 in their study. Bhat et al. (2016) found that 61 patients (14.9%) had controlled diabetes, with a mean HbA1c level of 8.1. Similarly, Majjad et al. (2018) reported a mean HbA1c value of 8.5 ± 2. Attar et al. (2012) reported a mean HbA1c level of 8.6±2.3 mmol/L.(5,9,21)

In our study, musculoskeletal examinations revealed various findings. On hand examination, we observed Chieroarthropathy in 19 (16.52%) patients, Dupuytren's contracture in 9 (7.82%), Flexor tenosynovitis in 13 (11.30%), De Quervain's tenosynovitis in 11 (9.56%), Carpal tunnel syndrome in 13 (11.30%), and Sclerodactyly in 6 (5.21%) patients. In comparison, Kudsi et al. (2020) reported that the elbow was affected in 30 patients (15.6%) in the diabetic group and 24 patients (9.6%) in the non-diabetic group. They diagnosed Medial epicondylitis in 12 patients and lateral epicondylitis in 18 patients. Hand involvement was observed in 22% (66 patients) in the diabetic group and 15 (5%) patients. Diabetic chieroarthropathy was diagnosed in 38 patients, and Flexor tenosynovitis was confirmed in 28 patients. Bhat et al. (2016) found that hand involvement occurred in 80 patients (19.8%) in the diabetic group and 15 (5%) patients in the control group.(18) Majjad et al. (2018) reported hand disorders in 54 (14.4%) patients. (5) On elbow examination in our study, we found that Olecranon bursitis was present in 6 (5.21%) patients, Lateral epicondylitis in 12 (10.43%), and Medial epicondylitis in 12 (10.43%) patients. Bhat et al. (2016) reported that the elbow was affected in 56 patients (14%) in the diabetic group and 24 patients (5.9%) in the non-diabetic group. Shoulder involvement was diagnosed in 61 patients (15%) in the diabetic cohort and 15 patients in the non-diabetic cohort.(21) Additionally, we observed rotator cuff tear in 7 (6.08%) patients, Bicipital tendinitis in 9 (7.82%) patients, and adhesive capsulitis in 12 (10.43%) patients. Kudsi et al. (2020) reported that 61 patients (31.7%) in the diabetic group and 15 (6%) patients in the non-diabetic group had shoulder involvement. Adhesive capsulitis was found in 51 (83.6%) diabetic patients, and Rotator's cuff tendinitis was found in 8 (13.1%) diabetic patients. Bicipital tendinitis was found in 2 (3.27%) diabetic patients.(18)

Furthermore, our study identified trochanteric bursitis in 4 (3.47%) patients, prepatellar bursitis in 6 (5.21%), Anserine bursitis in 20 (17.39%), Neuroarthropathy in 4 (3.47%), Osteoporosis in 43 (37.39%), diabetic osteolysis in 5 (4.34%), Amyotrophy in 6 (5.21%), and diabetic muscle infarction in 2 (1.73%) patients. Other studies have also reported various musculoskeletal manifestations associated with diabetes. Attar et al. (2012) found musculoskeletal disorders in 45 (17.9%) of 252 patients, with a higher prevalence in type 2 diabetes. The most common manifestations included carpal tunnel syndrome and shoulder capsulitis. Edis et al. (2021) reported musculoskeletal complications in 45.9% of their patients, with carpal tunnel syndrome being the most common. Mathew et al. (2011) observed a high prevalence of rheumatic and musculoskeletal disorders in their study, with knee osteoarthritis and frozen shoulder being notable conditions. Kamiab et al. (2021) found that 62.6% of their patients with diabetes had rheumatologic complications, with carpal tunnel syndrome being the most common. Mustafa et al. (2016) reported a high prevalence of hand disorders in patients with type 2 diabetes, with limited joint mobility being the most prevalent condition.(8,9,20,22)

In our study, we also conducted comparisons based on gender and HbA1c levels. We found statistically significant differences in mean weight, mean body mass index, and mean Hb levels between males and females ($p < 0.01$), with these parameters being higher in males. However, musculoskeletal parameters did not significantly differ between genders, except for Bicipital tendinitis ($p < 0.05$). Additionally, when comparing various musculoskeletal parameters based on HbA1c levels, we found no statistically significant differences ($p > 0.05$), except for Bicipital tendinitis ($p < 0.05$). Overall, these findings suggest that poor control of blood sugar levels and diabetes-related complications may influence musculoskeletal signs and symptoms, emphasizing the need for comprehensive management of diabetes and its associated musculoskeletal manifestations.

CONCLUSION

In summary, musculoskeletal complications are prevalent in individuals with type 2 diabetes. Our study found a high frequency of musculoskeletal disorders in diabetes patients, emphasizing the importance of controlling glucose levels to reduce such complications. Diabetes commonly affects the musculoskeletal system, leading to significant morbidity, but many of these issues can be treated, improving patients' quality of life and independence. Healthcare providers should be aware of these potential complications and include musculoskeletal examinations as part of routine diabetes care to provide the best possible treatment and support to patients.

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