Original Article

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Observing patients' blood glucose levels after shoulder pain complaint

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Abstract

Objective: *Several studies have shown a link between MSK issues and Diabetes Mellitus [DM]. Additionally, we made a similar finding in our clinic for shoulder disorders: many patients who came in with shoulder discomfort had diabetes or had blood sugar levels that were bordering on prediabetes. To ascertain the occurrence of prediabetes and diabetes in these individuals, we set out to analyze the patient's blood glucose levels who complained of shoulder discomfort.*

Methods: *Patients who presented with shoulder discomfort to a clinic for shoulder disorders between August 2022 and December 2022 were included in the current cross-sectional investigation [4 months]. Patients with acute trauma-related shoulder discomfort who had had surgery or fractured the afflicted limb in the past were not included. Before enrolment, all of the patients provided their informed permission. Data on the patients, including demographic and clinical information, were gathered using a checklist created by the researcher. SPSS v.26 was used to analyze the data.*

Results: *Of the 564 individuals who matched the study's eligibility requirements and were included, 18.8% had diabetes mellitus [DM], 25.9% had prediabetes, and 55.3% had fasting blood sugar levels that were within the normal range. In addition, the odds of having abnormal FBS levels were higher in men [54% vs. 33.9%] than in women. Additionally, there was no association between blood sugar levels and any particular underlying disease for shoulder discomfort [P-value =0.191].*

Conclusions: *Based on the findings of the current study, it was determined that patients with shoulder discomfort had a greater frequency of DM than the general population, necessitating additional research in this area. Additionally, it is important to highlight the detection of DM risk factors, particularly in cultures lacking regular DM screening.*

Keywords: *diabetes, shoulder, glucose*

Introduction:

There may be a connection between DM and musculoskeletal issues, according to many research [1-3]. Previous research has shown that DM patients had a greater frequency of shoulder issues than the overall population [3, 4]. According to research, people with diabetes had a higher likelihood [63%] of upper extremity deficits [5]. All DM-related musculoskeletal ailments have shoulder issues at the forefront. For instance, adhesive capsulitis affects 11% to 30% of people with type 2 diabetes mellitus [6]. However, in comparison to other diabetic complications, this one has gotten less attention. Numerous research has looked at musculoskeletal issues in DM patients. However, there is research examining the glucose levels in individuals with diabetes who first appear with musculoskeletal issues [7, 8]. To ascertain the occurrence of prediabetes and diabetes in these individuals, the current cross-sectional research sought to examine the levels of blood glucose of those patients who presented to our shoulder dysfunction clinic with symptoms of shoulder discomfort. In particular, in countries without regular DM screening, we expect that the findings of the current research may assist doctors in the early identification and treatment of diabetes in individuals with shoulder discomfort as their first DM presentation.

METHODS:

From August 2022 to December 2022, patients coming to Mayo Hospital with shoulder discomfort were included in the current cross-sectional research [4 months]. First, a thorough history and physical examination were conducted on the patients, and imaging tests like plain radiography and/or MRI were used to identify the underlying disease causing their shoulder discomfort.

One assessor, who was unaware of the study's goals and other information, such as the patient's blood glucose levels at the time of presentation, used a goniometer to measure the range of motion [ROM] of the affected shoulder in External Rotation [ER], Internal Rotation [IR], and Forward Flexion [FF]. The patients were then divided into 4 groups according to the ROM. Normal ROM was defined as having a passive FF of more than 160 °, an ER of more than 30 °, and an IR greater than the L1 level. Restricted ROM was defined as not meeting these parameters. The patients were further divided into three groups depending on their FBS levels: those with diabetes [FBS>126 mg/dL], those with prediabetes [100 mg/dL–FBS125 mg/dL], and those with normal [FBS100 mg/dL].

Patients with acute trauma-related shoulder discomfort and those who have had surgery or fractured treatment on the afflicted arm in the past were not included in the research. Additionally, each patient provided informed permission before enrolment. A researcher-made checklist was used to gather information on gender, age, body mass index [BMI], the afflicted shoulder's side [left or right], the associated diagnosis, DM family history, fasting blood glucose levels, and the range of motion [ROM]. The hospital's Ethics Committee gave the current research it's a blessing, and SPSS version 26 was used for data analysis. Finally, comparisons were carried out with the statistical tests of cross-tabulation, chi-squared test, one-way ANOVA, and Spearman's correlation.

Results:

Our research revealed that 564 patients in total were included in the current study because they matched the eligibility requirements. The participants' average age was 51.24 11.12 years, with the majority of them falling between the ages of 40 and 60. In addition, women made up 59.6% of the cases. Men were also older than women when it came to patients. In contrast to the 16.1% of female patients who were over 60, 28.9% of male patients were.

Table 1: Patients' distribution based on their BMI

| BMI group	Frequency [%]
Less than or Equal to 19.00	18 [3.20%]
19.01 to 25.00	144 [25.50%]
25.01 to 30.00	306 [54.30%]

More than 30.01	96 [17%]
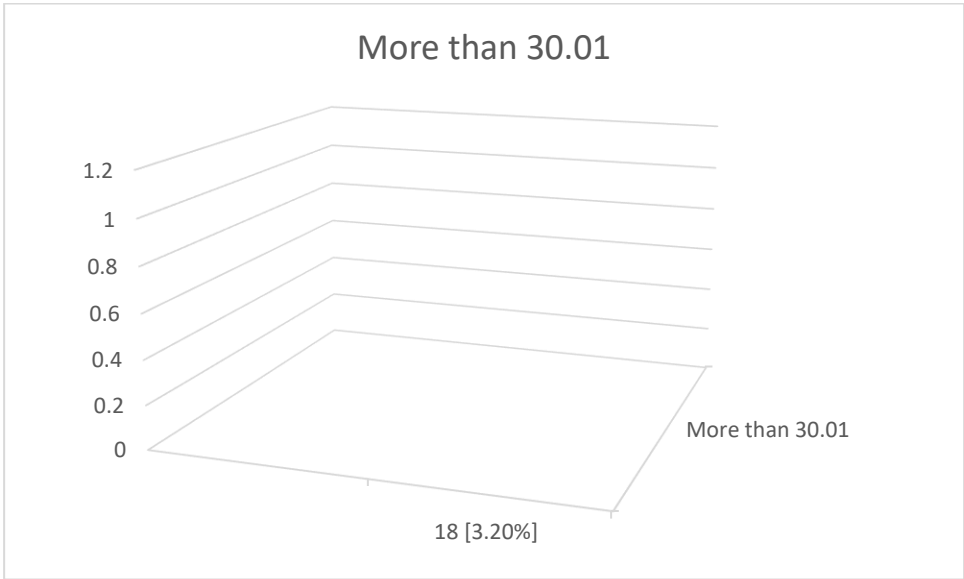
The majority of patients [25 kg/m2 BMI 30 kg/m2, Table 1] were overweight, and their average FBS was 108.28 mg/dL, with a range of 69-285 mg/dL. Additionally, 18.8% of the patients had diabetes mellitus [DM], 25.9% had prediabetes, and 55.3% had FBS levels that were within the normal range. In addition, the likelihood of abnormal FBS levels was higher in the male subjects [54% vs. 33.9%].

Table 2: Different FBS group patients' distribution based on the diagnosis

		FBS			Total
		More than 125	**100 to 125**	**Less than or Equal to 99**	
Diagnosis	**Non- specific**	12	12	48	72
	Glenoh umeral DJD	0	0	6	6
	Rotator Cuff Tendinitis	6	12	48	66
	Frozen Shoulder	24	6	18	48
	Rotat or Cuff Tear	48	102	132	282

Chart Title

■ Increase ■ Decrease ■ Total
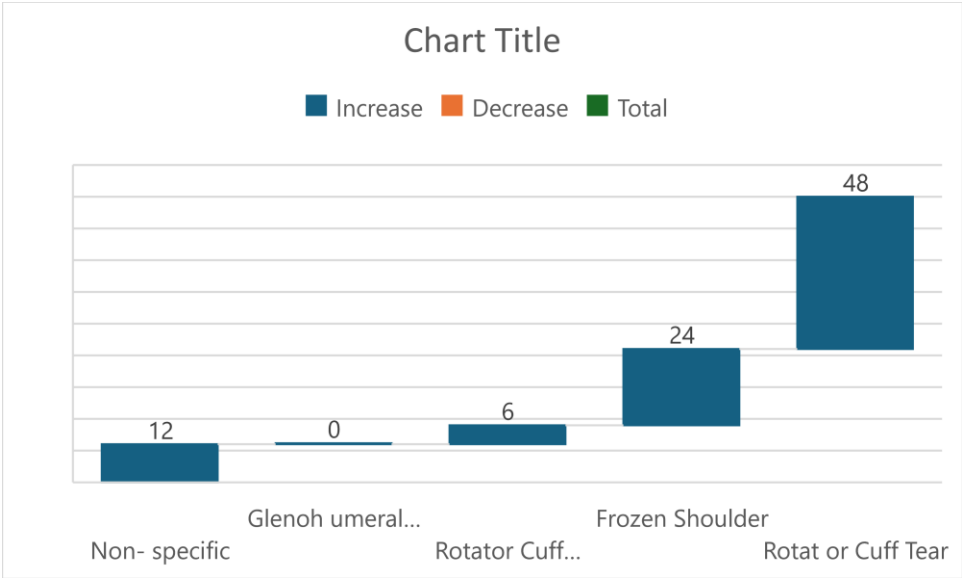
Our research indicates that impaired FBS was more common in older age groups. For instance, prediabetes and diabetes impacted 46 and 37 percent, respectively, of individuals over 55. Prediabetes and diabetes, however, were more common in those under the age of 55, with prevalence rates of 16.9% and 13.5%, respectively. Additionally, 43% of the diabetic patients [8.8% of all patients] had just received their diagnosis. Additionally, diabetes and prediabetes were newly diagnosed in 73.7% of all patients who had unusual blood glucose levels.

Table 3: Pre diabetes and diabetes prevalence among patients according to ROM

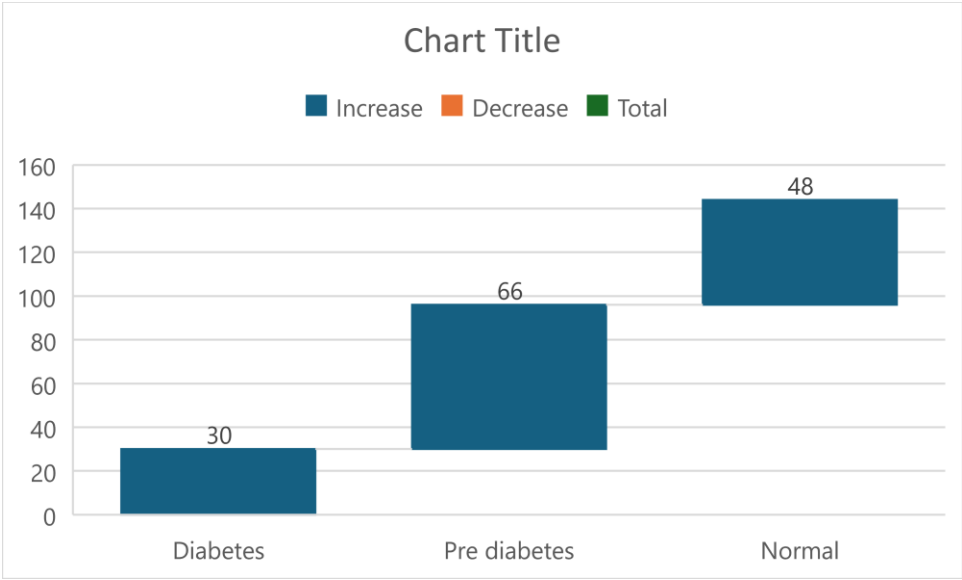| BS status	Diabetes	Pre diabetes	Normal
Restricted ROM	30	66	48
Normal ROM	42	54	198

Table 4: Comparison of pre diabetes and diabetes in normal population vs those suffering from shoulder pain.

		Normal Population	Study Population
Diabetes Prevalence	**Male**	7.10%	26.30%
	Female	8.30%	10.70%
	Total	7.70%	18.80%
Prediabetes Prevalence	**Male**	17.40%	23.70%
	Female	16.30%	23.20%
	Total	16.80%	25.90%
diabetes Prevalence [age group]			
56 to 65		16.8	27.7
46 to 55		12.9	19.4
36 to 45		6.8	5.8
26 to 35		3	0
Pre diabetes Prevalence [age group]			0
56 to 65		24.3	44
46 to 55		21.4	19.4
36 to 45		17.3	11.7
26 to 35		11.9	0
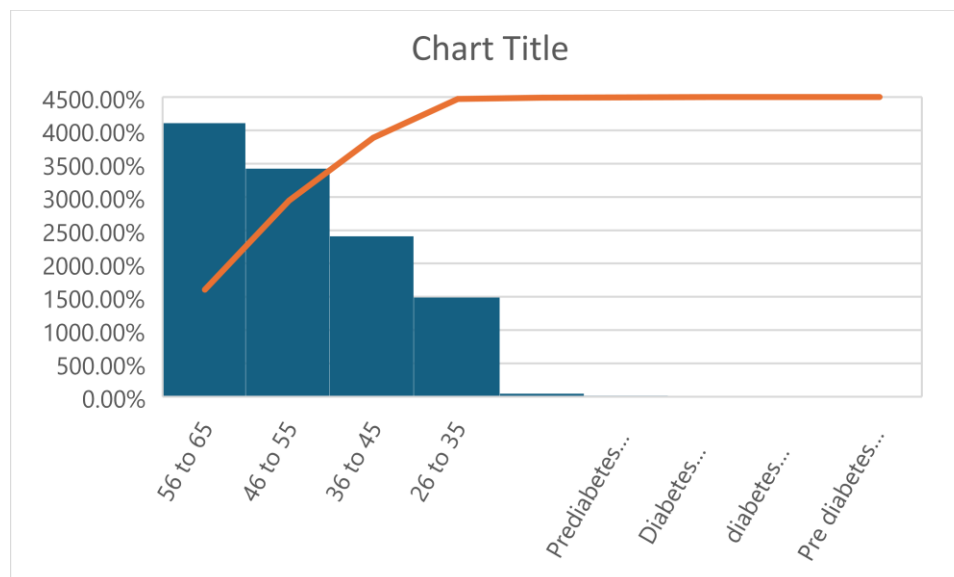
Our findings showed no association between blood glucose levels and any particular underlying pathology for shoulder discomfort, including rotator cuff rupture, glenohumeral joint osteoarthritis, frozen shoulder, rotator cuff tendinitis, and non-specified shoulder pain [P-value = 0.191]. Table 2 displays the participant distribution according to the relevant diagnosis. We could not find a significant correlation between the patient's blood glucose levels and the side of the afflicted shoulder [left or right] using Pearson's chi-squared test [P-value = 0.092]. However, using Spearman's correlation, we discovered that the mean FF [P-value = 0.022] and IR [P-value = 0.038] were substantially different between the patients with normal FBS and abnormal FBS, whereas the ER [P-value = 0.121] did not vary significantly between the groups. The incidence of impaired blood glucose was also 62% in individuals with adhesive capsulitis, compared to 66% in patients with limited range of motion and a diagnosis other than cellulitis [Table 3].

Discussions:

Numerous research has looked at musculoskeletal issues in DM patients, including shoulder discomfort. As far as the previous studies are concerned, there have been few research examining the diabetes prevalence in individuals who have shoulder symptoms. So, the purpose of the current research was to look at patients complaining of shoulder discomfort and their blood glucose levels. The subject of diabetes mellitus is dynamic, nevertheless, and new knowledge is always being produced [9]. Published recommendations advise that clinical judgment and patient choice be used to decide on FBS testing due to the absence of sufficient data [10]. Additionally, some recommendations advocate regular DM screening for everyone over the age of 40[11,12], whilst others only advocate screening for people with DM risk factors [13,14,15].

Prevalence estimates for prediabetes and diabetes in Pakistan range from 5.1% to 7.7% and 2.5% to 16.8%, respectively [16,17]. Additionally, several research has shown that the Pakistani population over 60 has a greater frequency of low blood glucose [14.4%]. [18]. The frequency of prediabetes and diabetes was thus compared between patients with shoulder discomfort and the overall Pakistani population, revealing a substantial difference that increased with age [Table 4], highlighting the need of monitoring blood glucose levels in the elderly. The findings of the current investigation, however, cannot support this conclusion since we included less than 40 of the afflicted

individuals. Additionally, several investigations have shown the connection between idiopathic frozen shoulder and diabetes, supporting the need for DM screening in these individuals. However, newly released research did not back up this advice [19].

We concur with the guidelines for DM screening in these patients given the results of the current investigation in the population of patients with shoulder discomfort, including those with frozen shoulders and other shoulder diseases. Moreover, shoulder discomfort must be taken into account as a potential cause for DM due to the high incidence of glucose metabolism impairment in these individuals. Particularly crucial are cultures lacking regular DM screening. As discussed earlier, 73.7% of our participants showed abnormal blood glucose levels, but prior research indicated that around one-third of this diabetes, individuals had not previously received a diagnosis [20,21,22].

Prior research indicates that around 50% of diabetes patients go undetected [22-26]. Additionally, these studies advise DM screening for all people with a family history of DM, males with a BMI >25 or hypertension, women with adiposity, and men with either condition. Additionally, several research has shown a connection between diabetes, shoulder issues, and BMI [17]. In light of all this research, many risk score models, such as the Colombian Diabetes Risk Score and the Finnish Diabetes Risk Score [FINDRISC], have been created to broaden the scope of DM diagnosis [ColDRISC]. Additionally, compared to other research, our study included an incidence of individuals with undiagnosed DM that was almost twice as high. We advise integrating shoulder issues in these risk score models as a result.

We discovered a strong correlation between reduced ROM and impaired glucose levels, even though the link between a frozen shoulder and diabetes is widely recognized. Our results showed that limited FF and IR were substantially connected with impaired glucose levels, however, the restricted ER was not significantly correlated with this measure. Because we evaluated the passive ROM in all patients, independent of diagnosis, these results do have some limitations. Furthermore, the evaluation was subjective, and there was no established examination technique utilized to distinguish between scapulothoracic motions and glenohumeral joint range of motion [27,28]. These results may be useful to doctors treating shoulder issues since they demonstrate that individuals with DM are more likely to have shoulder stiffness and reduced ROM as a result of any shoulder disease. The cross-sectional design of the current investigation and the existence of several confounding factors, however, restrict the applicability of our findings. While it is quite likely that an early diagnosis of DM might aid in better treatment planning, it is unclear in general if it can enhance the patients' results and future quality of life. Our findings suggest that shoulder discomfort may be a possible DM risk factor. To support our results, more research with bigger sample numbers and confounding variable control is required.

Conclusions:

In light of the findings of the current study, it was determined that patients with shoulder pain had a higher prevalence of diabetes mellitus [DM] than the general population. This calls for further research to establish shoulder pain as a risk factor for DM, particularly in societies without regular DM screening.

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