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Original Research Article

Prevalence of Undiagnosed Diabetes in Patients with Idiopathic Frozen Shoulder: A Prospective Study

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Conflict of interest: Nil

Abstract

Introduction: Idiopathic frozen shoulder (IFS) is a common musculoskeletal condition characterized by progressive shoulder stiffness and pain. Diabetes mellitus is a known risk factor for adhesive capsulitis, yet many cases of diabetes remain undiagnosed in patients presenting with IFS. This study aimed to determine the prevalence of undiagnosed diabetes among patients with idiopathic frozen shoulder.

Materials and Methods: This prospective observational study was conducted over a period of one year in the Department of Orthopedics at R G Kar Medical College and Hospital. The study included patients presenting to the orthopedic outpatient clinic with idiopathic frozen shoulder who had no prior diagnosis of diabetes. A total of 116 patients meeting the inclusion criteria were enrolled and evaluated during the study period.

Results: The mean random blood sugar (RBS) levels differed significantly among the three glycemic groups ($p < 0.001$). Patients in the nondiabetic group ($n = 26$) had a mean RBS level of 101.58 ± 18.58 mg/dL, whereas the prediabetic group ($n = 59$) showed a higher mean value of 112.64 ± 30.80 mg/dL. The diabetic group ($n = 31$) demonstrated a markedly elevated mean RBS level of 175.54 ± 93.31 mg/dL.

Conclusion: A substantial proportion of patients with idiopathic frozen shoulder may have undiagnosed diabetes. Routine screening for hyperglycemia in patients presenting with IFS is recommended to enable early diagnosis and management, potentially improving shoulder outcomes and overall health.

Keywords: Idiopathic frozen shoulder, Adhesive capsulitis, Undiagnosed diabetes, Fasting blood glucose, HbA1c, Prevalence.

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Introduction

Idiopathic frozen shoulder, also referred to as adhesive capsulitis (AC), is a common musculoskeletal condition characterized by progressive pain, stiffness, and restricted range of motion in the glenohumeral joint without a clear precipitating cause such as trauma or surgery [1]. The condition typically evolves through three clinical phases: the painful (freezing) phase, a phase of marked stiffness (frozen), and finally a gradual resolution (thawing), with an overall disease course often extending from several months to years [2]. Frozen shoulder affects approximately 2%–5% of the general population, with a slightly higher prevalence in women and a mean age of onset in the mid-fifties [3]. Despite its prevalence, the pathogenesis remains poorly understood and is considered multifactorial, involving inflammatory and fibrotic changes in the joint capsule [4]. Systemic conditions have been consistently implicated as risk factors for frozen shoulder. Among these, endocrine disorders—particularly diabetes mellitus—have emerged as one of the strongest associations [5]. Diabetes mellitus is a chronic metabolic disease defined by persistent hyperglycemia and is associated with widespread microvascular damage, low-grade systemic inflammation, and changes in connective tissue

metabolism [6]. The prevalence of adhesive capsulitis among individuals with diabetes has been reported to be significantly higher than in the general population. Meta-analytic evidence suggests that the frequency of frozen shoulder in people with diabetes is around 13.4%, and conversely, the prevalence of diabetes among patients with adhesive capsulitis may approach 30% . Additionally, diabetes is associated with worse clinical outcomes in frozen shoulder, including prolonged pain, reduced range of motion, and less favorable response to conservative or surgical interventions compared with non-diabetic patients [7].

While the link between diabetes and frozen shoulder has been well documented, much of the existing literature focuses on known diabetic patients. However, a substantial proportion of individuals remain unaware of their glycemic status at the time of musculoskeletal presentation. Undiagnosed diabetes and prediabetes represent significant public health challenges worldwide due to the asymptomatic nature of early metabolic dysregulation and its insidious complications . In general populations, it is estimated that a sizable fraction of individuals with diabetes are undiagnosed until routine screening or presentation with complications [8]. Given the heightened risk of adhesive capsulitis in persons with hyperglycemia, the concept of frozen shoulder as a potential early clinical indicator of dysglycemia has been increasingly investigated [9].

The primary aim of this study was to determine the prevalence of undiagnosed diabetes in patients presenting with idiopathic frozen shoulder. The study also aimed to identify the proportion of patients with impaired glucose tolerance, assess the association between demographic factors such as age, sex, and body mass index with undiagnosed diabetes, and highlight the importance of routine diabetes screening in this patient population to improve both systemic and musculoskeletal outcomes.

Materials and Methods

Study Design: Prospective observational study.

Study Place: Department of Orthopedics, Senior Resident R G Kar Medical College and Hospital.

Study Duration: 1 Year.

Study Population: Patients presenting with idiopathic frozen shoulder attending the outpatient orthopedic clinic during the study period, who have no prior diagnosis of diabetes.

Sample Size: 116 patients.

Inclusion Criteria

1. Patients aged 30–70 years.
2. Diagnosed with idiopathic frozen shoulder (adhesive capsulitis) clinically and radiologically.
3. No prior history of diabetes or prediabetes.
4. Willing to give informed consent for participation.

Exclusion Criteria

1. Secondary frozen shoulder due to trauma, surgery, or other shoulder pathology.
2. Patients with known diabetes or on antidiabetic medications.
3. Patients with systemic inflammatory diseases (e.g., rheumatoid arthritis).
4. Patients with severe comorbidities preventing participation or follow-up.
5. Pregnancy.

Statistical Analysis: For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. Paired t-tests were a form of blocking and had greater power than unpaired tests. A chi-squared test ($\chi 2$ test) was any statistical hypothesis test wherein the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate. Explicit expressions that can be used to carry out various t-tests are given below. In each case, the formula for a test statistic that either exactly follows or closely approximates a t-distribution under the null hypothesis is given. Also, the appropriate degrees of freedom are given in each case. Each of these statistics can be used to carry out either a one-tailed test or a two-tailed test. Once a t value is determined, a p-value can be found using a table of values from Student's t-distribution .If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favour of the alternative hypothesis. P-value $\leq$ 0.05 was considered for statistically significant.

Result

Table 1: Mean HbA1c value in 3 groups

Values	Nondiabetic (n = 26)	Prediabetic (n = 59)	Diabetic (n = 31)	P value
Mean HbA1c (± SD)	5.39 ± 0.22	5.97 ± 0.21	7.98 ± .92	<0.001
Range (min–max)	4.9–5.6	5.7–6.4	5–13.3	

Table 2: Gender distribution in 3 groups

Gender	Nondiabetic (%)	Prediabetic (%)	Diabetic (%)	Total (%)	P value
Male	13 (50.0)	34 (57.6)	19 (50.0)	66 (56.9)	0.685
Female	13 (50.0)	25 (42.4)	19 (50.0)	57 (43.1)	
Total	26 (100.0)	59 (100.0)	38 (100.0)	116 (100.0)	

Table 3: Duration of symptoms of frozen shoulder in 3 groups

Duration (months)	Nondiabetic (n = 26)	Prediabetic (n = 59)	Diabetic (n = 31)	P value
Mean (±SD)	4.04 ± 3.87	3.54 ± 2.61	4.36 ± 4.21	0.192
Range (min–max)	1–12	1–12	1–24	

Table 4: Mean RBS value in 3 groups

RBS (mg/dL)	Nondiabetic (n = 26)	Prediabetic (n = 59)	Diabetic (n = 31)	P value
Mean (±SD)	101.58 (18.58)	112.64 (30.80)	175.54 (93.31)	<0.001
Range (min–max)	79–152	71–251	87–489	

Table 5: Pair wise comparison of 3 groups regarding mean values of random blood sugar

Comparison	P value
Diabetic vs Nondiabetic	<0.001
Diabetic vsPrediabetic	<0.001
Nondiabetic vsPrediabetic	0.355

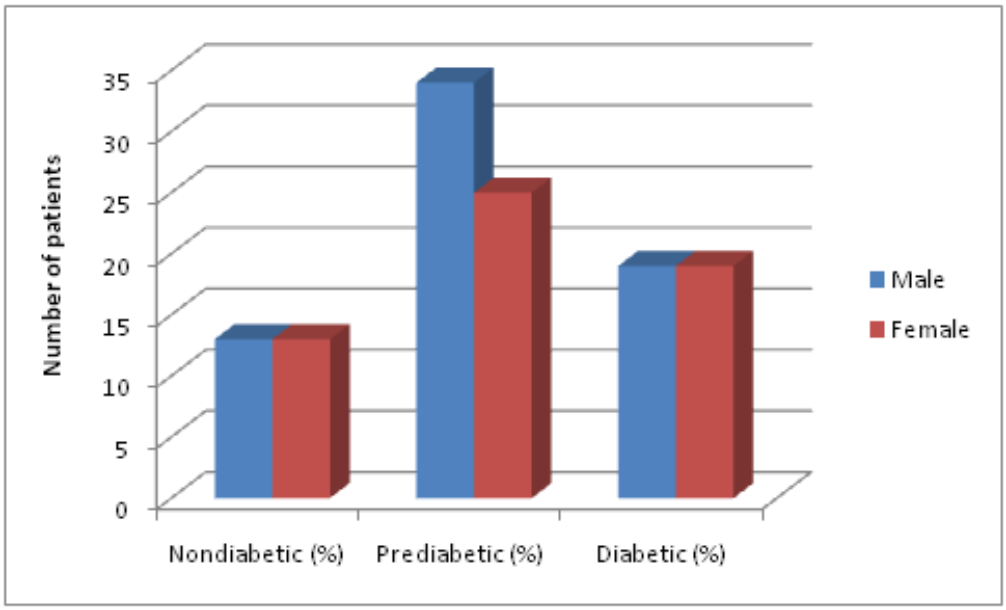

Figure 1: Gender distribution in 3 groups

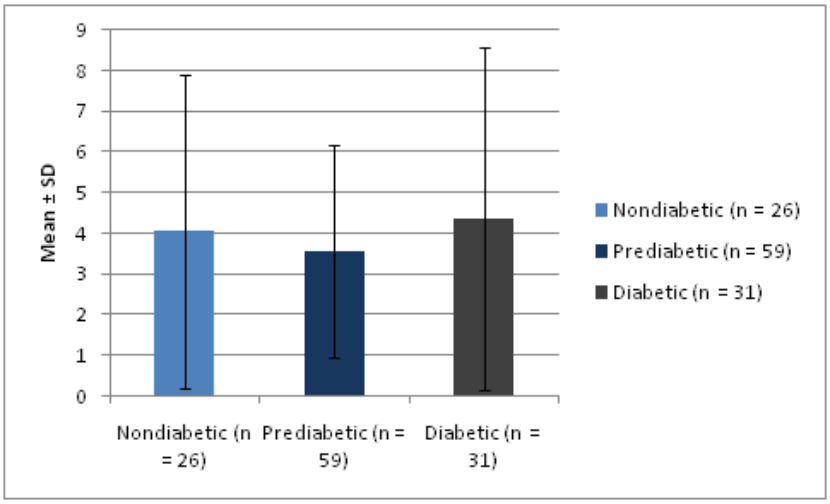

Figure 2: Duration of symptoms of frozen shoulder in 3 groups

The mean HbA1c levels showed a statistically significant difference among the three glycemic groups ($p < 0.001$). Patients in the nondiabetic group ($n = 26$) had a mean HbA1c of 5.39 ± 0.22, while those in the prediabetic group ($n = 59$) had a higher mean value of 5.97 ± 0.21. The diabetic group ($n = 31$) demonstrated a markedly elevated mean HbA1c level of 7.98 ± 0.92.

The distribution of gender across the glycemic groups showed no statistically significant difference ($p = 0.685$). In the nondiabetic group, males and females were equally distributed, with 13 (50.0%) patients each. Similarly, in the diabetic group, both males and females accounted for 19 (50.0%) patients each. In the prediabetic group, males constituted a slightly higher proportion at 34 (57.6%) compared to females at 25 (42.4%).

The mean duration of symptoms did not differ significantly among the three glycemic groups ($p = 0.192$). Patients in the nondiabetic group ($n = 26$) had a mean duration of 4.04 ± 3.87 months, while those in the prediabetic group ($n = 59$) had a slightly shorter duration of 3.54 ± 2.61 months. The diabetic group ($n = 31$) showed a mean duration of 4.36 ± 4.21 months.

The mean random blood sugar (RBS) levels differed significantly among the three glycemic groups ($p < 0.001$). Patients in the nondiabetic group ($n = 26$) had a mean RBS level of 101.58 ± 18.58 mg/dL, whereas the prediabetic group ($n = 59$) showed a higher mean value of 112.64 ± 30.80 mg/dL. The diabetic group ($n = 31$) demonstrated a markedly elevated mean RBS level of 175.54 ± 93.31 mg/dL. Pairwise comparison of random blood sugar (RBS) levels between the glycemic groups revealed statistically significant differences between diabetic and nondiabetic patients ($p < 0.001$), as well as between diabetic and prediabetic patients ($p < 0.001$). However, no statistically significant difference was observed between the nondiabetic and prediabetic groups ($p = 0.355$).

Discussion

Association between HbA1c and Frozen Shoulder: In the present study, a statistically significant difference in mean HbA1c levels was observed among the three glycemic groups ($p < 0.001$), with the highest levels seen in diabetic patients. This finding is consistent with Zreik et al. [10], who reported a strong association between adhesive capsulitis and diabetes, highlighting elevated HbA1c levels in affected individuals. Similarly, Dyer et al. [11] demonstrated that poor glycemic control significantly increases the risk and severity of frozen shoulder.

Gender Distribution: The present study found no significant difference in gender distribution across glycemic groups ($p = 0.685$). This observation aligns with Milgrom et al. [12], who concluded that although frozen shoulder may be slightly more common in females, gender does not significantly influence its association with diabetes. Bunker and Anthony [13] also emphasized that metabolic factors play a more crucial role than gender in the development of adhesive capsulitis.

Duration of Symptoms: The duration of symptoms did not differ significantly among the three groups in our study ($p = 0.192$). This finding is supported by Hand et al. [14], who reported that the clinical course of frozen shoulder is relatively similar regardless of glycemic status.

Random Blood Sugar (RBS) Levels: A statistically significant difference in RBS levels was observed among the groups ($p < 0.001$), with diabetic patients showing markedly higher values. This is in agreement with Tighe and Oakley [15], who reported a strong relationship between hyperglycemia and musculoskeletal disorders, including adhesive capsulitis. Furthermore, Wang et al. [16] found a higher prevalence of undiagnosed glucose intolerance in patients presenting with idiopathic frozen shoulder.

Pairwise Comparison of Glycemic Groups: Pairwise analysis revealed significant differences between diabetic and nondiabetic as well as diabetic and prediabetic groups ($p < 0.001$), while no significant difference was observed between nondiabetic and prediabetic groups ($p = 0.355$). Similar findings were reported by Rai et al. [17], suggesting that prediabetes represents an intermediate metabolic state that may not always differ significantly from normoglycemia in clinical parameters.

Pathophysiological Mechanism: The association between diabetes and frozen shoulder can be explained by the role of chronic hyperglycemia in the formation of advanced glycation end products (AGEs), leading to collagen cross-linking, capsular fibrosis, and reduced joint mobility. Brownlee [18] described these biochemical mechanisms as key contributors to diabetic complications, including musculoskeletal disorders.

Clinical Implications: The findings of this study emphasize the importance of routine screening for diabetes in patients presenting with idiopathic frozen shoulder. As supported by Zreik et al. [4] and Dyer et al. [11], early identification of undiagnosed diabetes can improve both metabolic control and musculoskeletal outcomes, reducing long-term complications.

Conclusion

The present study demonstrates a significant prevalence of undiagnosed diabetes and prediabetes among patients with idiopathic frozen shoulder. HbA1c and random blood glucose were significantly higher in patients with frozen shoulder compared to nondiabetic and prediabetic groups, confirming a strong association between glycaemic status and adhesive capsulitis. However, factors such as gender distribution and duration of symptoms did not show any significant differences across the glycemic categories. These findings highlight that idiopathic frozen shoulder may serve as an important clinical indicator of underlying dysglycemia. Therefore, routine screening for diabetes using HbA1c and blood glucose levels is recommended in all patients presenting with frozen shoulder. Early detection and management of undiagnosed diabetes can not only improve metabolic control but may also positively influence the clinical course and outcomes of frozen shoulder.

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