

A cross-sectional study to assess the prevalence of frozen shoulder among patients with diabetes mellitus

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Abstract

Purpose: Adhesive capsulitis (AC), is also known as frozen shoulder an insidious painful condition of the shoulder persisting more than 3 months. This inflammatory condition that causes fibrosis of the glenohumeral joint capsule is accompanied by gradually progressive stiffness and significant restriction of range of motion (typically external rotation).this study focusses on identifying frozen shoulder among diabetic patients as glycosylation process causes collagen in the shoulder to get stick which leads to frozen shoulder among type 2 diabetes patients.

Methods: This was a cross-sectional study with total of 501 participants with the diagnosis of Diabetic Mellitus (DM).The participants underwent range of motion testing and shoulder strength assessment and Pain assessment using Emoji based Visual Analogue Pain scale.

Results: Among 501 patients male were 49.9% and female were 50.9%. the value of HbA1c is categorized as uncontrolled diabetes with HbA1c value as >7 is 6.60% and controlled diabetes with Hba1c value as <7 is 93.4%. Through the preliminary assessment, the mean score for risk assessment is >4 , where 62.7% falls under high risk of frozen shoulder.

Conclusion: The study concluded that participants with uncontrolled diabetes have high risk towards developing frozen shoulder. Duration of pain in DM was directly proportional to the high risk of frozen shoulder and females were more affected than males.

Keywords: Diabetes mellitus; Frozen shoulder; Shoulder; Range of motion; Shoulder strength

1. Introduction

Diabetes mellitus (DM) is a chronic disease caused by insulin deficiency characterized by common symptoms of chronic hyperglycaemia with impaired carbohydrate, fat, and protein metabolism (1). In type 2 diabetes mellitus (T2DM) there is a resistance to insulin in which body fat, muscles, and liver cells do not use insulin appropriately (2,3). Largely due to genetic susceptibility combined with changing lifestyles of low physical activity and high-calorie diet may lead to morbidity and mortality in this population worldwide and diabetes-related 1/3rd of deaths occur under the age of 60 years (3).Frozen shoulder, or adhesive capsulitis, is a debilitating but normally temporary condition that is characterized by an extended period of pain and stiffness in your shoulder. Symptoms usually subside and functionality returns to normal after up to three years.A number of health conditions can increase your likelihood of developing frozen shoulder. A few of them include having surgery in which your arm was immobilized, suffering an arm fracture, having a thyroid issue, or having diabetes.(4)

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Frozen shoulder generally presents between the ages of 50 years and 60 years and rarely presents before 40 years. Women (58%) are more likely to develop frozen shoulder than men (42%). The contralateral shoulder is also affected in 6%–17% of patients. Although the exact aetiology remains unclear, several factors have been found to be associated with frozen shoulder, including trauma, thyroid dysfunction, cardiovascular disease, metabolic factors and other musculoskeletal conditions such as Dupuytren's contracture. The most common comorbidity in people with frozen shoulder is diabetes, both type 1 and type 2. The prevalence of frozen shoulder in the general population is around 0.75%, but the prevalence of frozen shoulder in people with diabetes is much higher. A meta-analysis of cross-sectional studies estimated the prevalence of frozen shoulder in populations with diabetes to be 13.4% (95% CI 10.2% to 17.2%). Previous reports showed that there is a higher prevalence rate (27.5%) of shoulder disorders in patients with diabetes as compared with the rate of 5.0% found in general medical patients. Two of the most common shoulder disorders are frozen shoulder, also known as 'adhesive capsulitis' and rotator cuff disease. Frozen shoulder is characterized by progressive pain, stiffness, limited active and passive range of motion of the shoulder joints, especially external rotation, and night pain. Although the exact causes of frozen shoulder are still underexplored, it is generally believed that frozen shoulder develops as a result of perivascular inflammation and fibroblastic proliferation, followed by capsular fibrosis and contracture.

2. Material and methods

2.1. Study design

This is a cross-sectional study, conducted over 6 months in 2024, the participants selected using purposive sampling technique. This study was approved by the Departmental Ethics committee in ACS Medical College and Hospital.

2.2. Settings and participants

Total of 501 diabetic participants were enrolled from various Out patient department and they were categorized as uncontrolled and controlled diabetic by the HbA1c values. the cut off of HbA1c value is >7 is considered as risk of developing frozen shoulder. All subjects provided informed consent in writing as well as verbally. The inclusion criteria was that patients were diagnosed with DM, aged between 35 to 75 years, both male and female were included in this study. Participants without confirmed diagnosis of diabetes, history of shoulder trauma and surgery in DM patients, known history of shoulder joint, pathologies other than frozen shoulder were excluded from the study. Before the assessment of outcome measures, all participants have given their history of occupation, BMI, duration of DM.

2.3. Methodology

A total of 501 participants who are diagnosed as diabetic is selected and were categorized as uncontrolled and controlled diabetes based on HbA1c value. The age group of the participants were 35 to 75 years. The BMI were categorized as normal, overweight, underweight and obese. The occupation were categorized as working and not working. Initially the participants were asked preliminary questions and physical examination to know their risk of acquiring frozen shoulder. Pain assessment, shoulder strength assessment and range of motion were assessed.

2.4. Statistical Analysis

Data was analysed with statistical software SPSS (version 21). Descriptive analysing of data was done to calculate frequency for variables like age, gender, and BMI. The significant level was set at a p-value ($p < 0.05$).

3. Results

3.1. Demographic Variables

This section describes background information of the respondents in the aspects of gender, age, occupation and BMI. such information is crucial, as it helps to know if the respondents met themorally acceptable standards to be involved in the research and provides required information regarding the study.

3.1.1. Age distribution

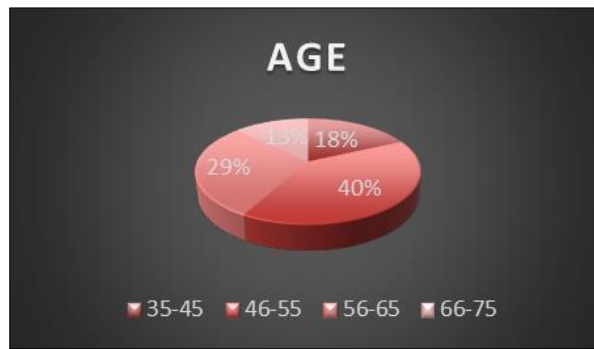


Figure 1 Total Age distribution chart

Figure 1 Depicts the specific percentage of participants who responded to the questionnaire. Age of the participants are categorized into four groups: The participants between 35-45 years are 18.20%, between 46-55 years are 39.90%, between 56-65 years 28.90%, between 66-75 years are 13%.The given analysis implies the majority age between 46-55 years are participated in the study.

3.1.2. Gender Distribution

Table 1 Total Gender distribution chart

GENDER	%
MALE	49.90%
FEMALE	50.90%

Table 2 Depicts the specific participants who responded to the questionnaire. Out of the 501 participants 250 are male (49.9%) and 255 are female (50.90%), This implies both male and female are involved in the study. The following analysis shows that more female participants are participated in the study than male participants.

3.1.3. Profession

Table 2 Total OCCUPATION distribution chart

PROFESSION	%
NON-WORKING	44.10%
WORKING	55.90%

Table 2 Depicts the specific participants who responded the questionnaire. Occupation of the participants are categorized into two categories. non-working participates are 221 (44.1%), working participates are 280 (55.9%) .The following analysis shows that workers are responded more than the non-workers.

3.1.4. SUGAR LEVEL [Hba1c]

Table 3 BLOOD SUGAR distribution chart

SUGAR LEVEL	%
UNCONTROLLED (Hba1c>7%)	6.60%
CONTROLLED (Hba1c<7%)	93.40%

Table 3 Depicts the specific participants who responded the questionnaire. Diabetic patients are participated and are categorized into two types. i e Un-Controlled participates are 33 (6.60%), Controlled are 468 (93.4%).The following analysis shows that Controlled Diabetes participates are responded more than the Un-Controlled Diabetes.

3.2. Shoulder strength assessment

3.2.1. Shoulder pain

Table 4 Shoulder Pain

Shoulder pain	%
NO	0.80%
YES	99.20%

Table 4 Represents various factors contributing to the risk of developing Frozen shoulder, such as age, gender, occupation, BMI, blood sugar level, signs, symptoms, preliminary assessment and pain scale. The overall mean value is 4. Through this mean value of less than 4 (0.80%) are considered as no risk of Frozen shoulder and mean value of more than 4 (99.2%) are considered as high risk of Frozen Shoulder.

3.2.2. Duration of shoulder pain

Table 5 Duration of Pain

Duration of pain	%
NONE	0.80%
<1YEAR (Low risk)	67.90%
>1YEAR (High risk)	31.30%

Table 5 shows the number of participants who responded the questions who suffered from shoulder pain with its duration. Out of 501 participants, 4 (0.80%) have experienced no pain, 340 (67.9%) have experienced pain for less than 1 year and are considered to be at low risk to be prone to FS, and 157 (31.3%) of participates have experienced pain for more than 1 year and are considered to have a high risk of being diagnosed with FS.

3.2.3. Preliminary assessment

Table 6 Preliminary Assessment

Preliminary assessment	%
<4 (Low risk)	37.30%
≥4 (High risk)	62.70%

Table 6 shows the number of participants who responded to the preliminary assessment question . The overall mean value is 4. Through this mean value , the questions to who responded as **NO** is less than 4 (37.3%) and are considered as low risk of Frozen shoulder and the question to who responded as **YES** are more than 4 (62.7%) and are considered as high risk of Frozen Shoulder.

3.2.4. FLEXION

Table 7 shows the percentage of participates who exhibit various degrees of flexion. It shows that majority of the participants have experienced a restricted range of motion that is, FLEXION BETWEEN 45 TO 90 DEGREES. Participants between the age of 46 –55 years have shown increased reduction in ROM.

Table 7 FLEXION

FLEXION	%
Less than 45 degrees	9.00%
Between 45 and 90 degrees	88.00%
More than 90 degrees	3.00%

3.2.5. EXTENSION

Table 8 EXTENSION

EXTENSION	%
Less than 30 degrees	99.20%
More than 30 degrees	0.80%

Table 8 shows the percentage of participants who showed various degree of Extension. It shows that majority of the participants have experienced a restricted range of motion that is, EXTENSION LESS THAN 30 DEGREES. Participants between the age of 46 –55 years have shown increased reduction in ROM.

3.2.6. ABDUCTION

Table 9 ABDUCTION

ABDUCTION	%
Less than 45 degrees	11.60%
Between 45 and 90 degrees	85.40%
More than 90 degrees	3.00%

Table 9. shows the percentage of participants who showed various degree of Abduction. It shows that majority of the participants have experienced a restricted range of motion that is, ABDUCTION BETWEEN 45 TO 90 DEGREE. Participants between the age of 46 –55 years have shown increased reduction in ROM.

3.2.7. External Rotation

Table 10 External rotation

External rotation	%
Less than 45 degrees	42.50%
Between 45 and 90 degrees	50.50%
More than 90 degrees	7.00%

Table 10. shows the percentage of participants who showed various degree of External Rotation. It shows that majority of the participants have experienced a restricted range of motion that is, EXTERNAL ROTATION BETWEEN 45 TO 90 DEGREE. Participants between the age of 46 –55 years have shown increased reduction in ROM.

3.2.8. Internal rotation

Table 11 shows the percentage of participants who showed various degree of Internal Rotation. It shows that majority of the participants have experienced a restricted range of motion that is, INTERNAL ROTATION BETWEEN 45 TO 90 DEGREE. Participants between the age of 46 –55 years have shown increased reduction in ROM.

Table 11 Internal Rotation

Internal rotaion	%
Less than 45 degrees	25.70%
Between 45 and 90 degrees	72.10%
More than 90 degrees	2.20%

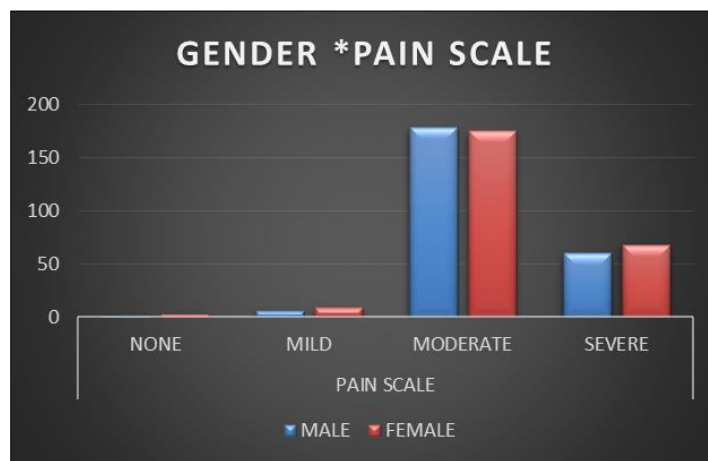


Figure 2 GENDER vs PAIN SCALE

Figure 2 depicts the comparison between the two GENDERS and PAINSCALE among the number of participants who responded to the questions. It shows that higher number of MALES has experienced MODERATE level of pain compared to females and higher number of FEMALES have experienced severe level of pain compared to male participants.

Table 12 Blood Sugar Level Vs Preliminary Assessment

Blood sugar level	Preliminary assessment	
	<4	>4
CONTROLLED (Hba1c <7%)	14	19
UNCONTROLLED (Hba1c >7%)	173	295

Table 12 depicts the comparison between BLOOD SUGAR LEVELS and PRELIMINARY ASSESSMENT among the number of participants who responded to the questions. It shows that participants with uncontrolled blood sugar (Hba1c) levels are at higher risk of being diagnosed with FROZEN SHOUDER (FN).

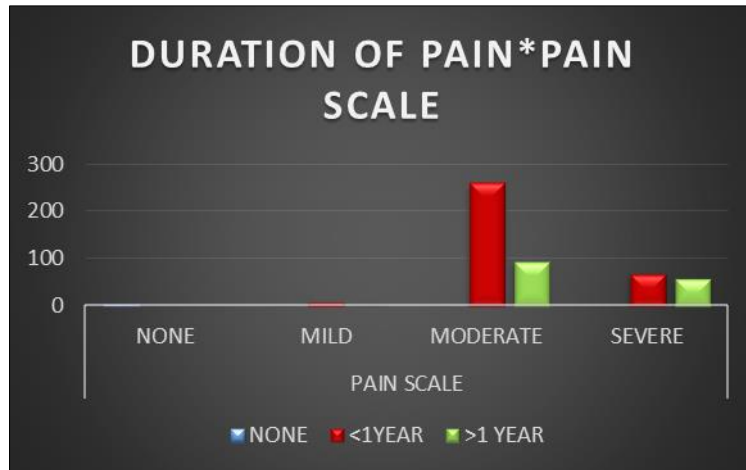


Figure 3 Duration of pain vs pain scale

Figure 3 depicts the comparison between DURATION OF PAIN and PAIN SCALE among the number of participants who responded to the questions. It shows that participants who have pain for both less than 1 year and more than 1 year have similarly experienced severe to moderate levels of pain.

4. Discussion

Objective 1 aims to determine the prevalence of frozen shoulder among patients diagnosed with diabetes mellitus. The comprehensive review delves into the prevalence of frozen shoulder, or adhesive capsulitis, highlighting its impact characterized by pain and stiffness in the shoulder joint(10). A thorough analysis of existing literature reveals a prevalence range of 2% to 5% in the general population, with higher incidences in individuals aged 40 to 60 years and females(11). The review underscores that diabetic patients are at a significantly higher risk, with some studies indicating up to a fivefold increased prevalence compared to non-diabetic individuals. This association is believed to be linked to chronic hyperglycemia's effects on collagen metabolism and joint inflammation(12). Further research is necessary to fully understand these mechanisms and to develop targeted interventions. Understanding the prevalence and associated risk factors is essential for healthcare providers to implement effective early detection and intervention strategies, ultimately improving patient outcome(13).

5. Conclusion

Frozen shoulder, or adhesive capsulitis, is a debilitating condition marked by pain, stiffness, and significant limitation in the range of motion of the shoulder joint. Affecting a notable portion of the population, particularly middle-aged individuals, women, and those with certain medical conditions like diabetes, frozen shoulder can severely impact daily activities and overall quality of life. The condition progresses through three distinct stages: freezing, frozen, and thawing, each characterized by varying degrees of pain and restricted movement. The entire course of the condition can last from several months to a few years

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest from authors.

Statement of Ethical Approval

The study is approved by Institutional Ethical committee NO.973/2023/IEC/ACSMCH Dt.17/11/2023.

Statement of informed consent

Written informed consent was obtained from all participants.

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