Original Article

To Study Prevalence of Diabetes Mellitus in Adhesive Capsulitis of the Shoulder - A Cross-sectional Study in a Tertiary Care Center

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ABSTRACT

Adhesive capsulitis (AC) is a self-limiting condition, in which the patient has severe restriction of shoulder joint and pain. This study is about the association between AC and diabetes mellitus (DM), suggesting its co-relation and early detection of DM can prevent AC and other diabetic complications. Study shows. A cross-sectional study was performed in a tertiary care center and association of AC with DM was noted. Sample size was 54 and patients included were 40–70 years old. This study represented the relationship of different socio-demographic parameters like age, sex, education, occupation, and residence. Females were predominantly involved (70.37%). Majority of the subjects were of low socio-economic status, residing in rural areas, with primary school education.

Key words: Diabetes mellitus, adhesive capsulitis, stiffness

INTRODUCTION

Adhesive capsulitis (AC) (also known as frozen shoulder) is a painful and burdensome illness in which the shoulder capsule, the connective tissue that surrounds the glenohumeral joint, becomes inflamed and tight, severely limiting mobility and causing persistent discomfort. It is a condition in which the shoulder joint's global active and passive range of motion (ROM) is uncomfortable and restricted. AC is a self-limiting condition, patients typically present with a traumatic history of progressive and painful, restriction of movements of glenohumeral joints. They have a capsular restriction pattern, with external rotation being the most limited, followed by abduction in the plane of scapula, and finally flexion.[1] About 38.6 % of diagnosed cases of Diabetes mellitus (DM) have adhesive capsulitis. While, 71.5% of newly diagnosed cases of adhesive capsulitis have underlying diabetic condition.[1] The incidence of AC is approximately 3% in general population; it is rare in children.[2] Reeves *et al*.[3] classified it into three stages viz.

- Stage of pain (10–36 weeks)
- Stage of stiffness (4–12 months)
- Stage of recovery (5 months–2 years)

FREEZING PHASE
↓
FROZEN PHASE
↓
THAWING PHASE

It peaks in between 40 and 70 years of age and female population is at higher risk compared to males.[4] The three hallmarks for diagnosis of frozen shoulder are progressive shoulder stiffness, severe

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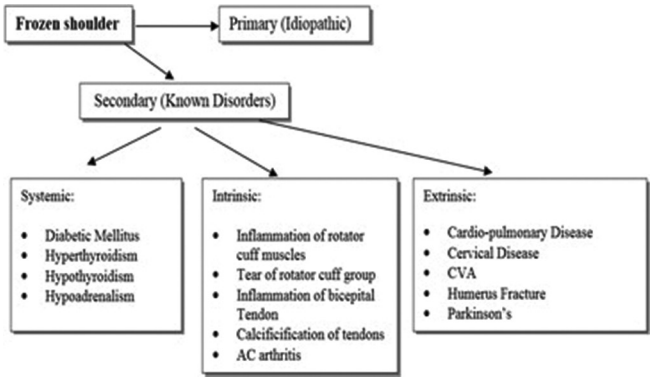

pain (especially at night), and near a complete loss of passive and active ROM.[5] The loss of passive ROM is a critical element in establishing the diagnosis of True AC from other conditions such as biceps tendinitis, subacromian bursitis, and partial rotator cuff tears which are associated with significant pain and loss of active ROM but passive ROM is preserved.[6,7]

Because the histology of afflicted specimens largely exhibits fibroblasts mixed with type I and type III collagen,[8] AC has long been thought to be a fibrotic condition comparable to Dupuytren's disease. The transformation of these fibroblasts into smooth muscle phenotype (myofibroblasts), which is thought to be responsible for capsular contracture, was seen.[8] DM in AC is important in guiding physicians and surgeons managing these conditions. Furthermore, understanding the relation between DM and AC may provide insights into the pathogenesis of AC.[9]

The three hallmarks for diagnosis of frozen shoulder are progressive shoulder stiffness, severe pain (especially at night) and near a complete loss of passive and active external rotation of the shoulder. [10]

Review of Literature

According to a meta-analysis of the prevalence of AC and DM, patients with DM were 5 times more likely to have AC.[1] AC has a high frequency in DM, while DM has a high prevalence in adhesive capsulitis. As a result, individuals with adhesive capsulitis should be screened for diabetes.[1]

In a study published by Mohanakrishnan and Mohanakrishnan,[3] the majority of those diagnosed with AC were women in their postmenopausal years. Because AC is connected with a 71.5% diabetic or pre-diabetic state, screening and monitoring the patient's general health is critical, as the effect of the disease plays a part in the resolution of AC. Both type I and type II diabetics are prone to shoulder capsulitis. Furthermore, non-dominant limbs are more harmed, and sedentary employees are more vulnerable. Female population is at a higher risk as compared to males.

According to an Australian study,[5] diabetics with present shoulder symptoms had worse shoulder discomfort and quality of life than non-diabetics. Furthermore, as compared to non-diabetics with AC, diabetics had inferior functional results as determined by disability and quality of life surveys [Shoulder Pain and Disability Score Index].[6]

In a research that looked at the prevalence of AC as a DM consequence, it was discovered that diabetics had a higher rate of bilateral shoulder capsulitis (10%) than control participants. Diabetic shoulder capsulitis appears at a younger age than non-diabetic shoulder capsulitis, is less severe, reacts poorly to therapy, and lasts longer.[9]

In a study conducted by Uddin *et al*.[11] to assess the amount of pain and handicap caused by frozen shoulder in diabetes and non-diabetic patients, 99 (71.4%) of 140 people with shoulder discomfort had frozen shoulder. There were 26 (65%) men and 14 (35%) females among the 40 frozen shoulder patients who took part in the study. 17 patients (42.5%) had diabetes, 2 patients (5%) had poor glucose tolerance, and 21 patients (52.5%) did not have diabetes. Mean disability scores shoulder pain and disability index (SPADI) was 51 ± 15.5 in diabetic and 57 ± 16 in non-diabetic persons.

Again, another study by Cole A. Gill T. K., Shanahan E. M. Is diabetes associated with shoulder pain or stiffness? Results from a population – based study, diabetics with frozen shoulder were shown to have worse mobility than patients without the disease. [12] This study will represent the perspective gathering of data on AC and is unique among other studies. It will actually confirm DM after the diagnosis of AC and can serve as screening test for DM. The findings will help us to understand the pathophysiology that may be seen in clinical situations.

Aim

The aim of the study is to evaluate the presence of DM in patients with AC.

Objectives

1. To study the prevalence of DM in AC
2. To study effect of glycemia and overall glycemic control in relation to development and outcome of AC.

MATERIALS AND METHODS

We designed a descriptive cross-sectional study and completed research goal in 60 days, in the month of June and July 2018. The patients who agreed to participate were explained the nature and objectives of this study and informed consent forms were obtained. No reference to the patient's identity was made at any stage during the study.

Participants

Outpatient department patients between 40 and 70 years of age.

Sample Size–54.

Initial sample size was calculated considering the prevalence of DM as 42.5%. Initial data of 25 patients of the present study showed the prevalence of DM up to 48%. Considering this keeping type I and type II errors fixed at 0.05 and 0.2, respectively, estimated sample size is 27 in each group. Considering design effect of two sample size is 54.

Selection Criteria

Inclusion criteria

1. All the patients above 40 years of age with Pain predominantly in one shoulder lasting for more than 3 months and <2 years
2. Limitation of passive movements at glenohumeral joint compared with unaffected side, more than 30° for at least two of these three movements- forward flexion, abduction, and external rotation.

Exclusion criteria

1. Patient with a history of shoulder trauma
2. Patient with any infection around shoulder joint
3. Known cardiorespiratory disease
4. Known central nervous system disorders
5. Known cervical spine disorders.

Study Tool

Patients meeting the inclusion and exclusion criteria were examined by relevant history taking and physical examination. The patients with AC were diagnosed clinically and referred for investigations. Patients with known DM and patients with no known history of DM were subjected to fasting and postprandial blood glucose. DM was diagnosed according to WHO criteria [Table 1]. Plain radiograph both Anterior Posterior view and Lateral view was taken to exclude other pathology. And the patients were assessed for pain and disability level with the help of a questionnaire based on the Shoulder pain and disability index spadi(SPADI) [Table 2]. Patient who had a history of DM and who were on oral hypoglycemic agents or Insulin or both at the time of data collection were considered to be "old DM" cases.[13] For the diagnosis of new DM cases, World Health Organization (WHO) was followed. Summary of WHO diagnostic criteria for DM and intermediate hyperglycemia is shown in [Table 1].[14]

Table 1: Blood sugar levels

DM	
Fasting plasma glucose or	≥7.0 mmol/l (126 mg/dl)
2 h plasma glucose	≥11.1 mmol/l (200 mg/dl)
Impaired glucose tolerance (IGT)	
Fasting plasma glucose and	≤7.0 mmol/l (126 mg/dl)
2 h plasma glucose	≥7.8 mmol/l and<11.1 mmol/l (140 mg/dl and 200 mg/dl)
Impaierd fasting glucose (IFG)	
Fasting plasma glucose	6.1–6.9 mmol/l (110–125 mg/dl) And (if measured)
2 h plasma glucose*	≤7.8 mmol/l (140 mg/dl)

*Venous plasma glucose 2 h after ingestion of 75 g oral glucose load. *If 2 h plasma glucose is not measured, status is uncertain as DM or IGT cannot be excluded, DM: Diabetes mellitus

Table 2: Association between diabetes mellitus and frozen shoulder with time and shoulder involvement

S. No.	Illness related parameter	Categories	Number of subjects
1	Duration of Illness	<3 months	3
		3–6 months	35
		7–12 months	12
		12–24 months	4
2	Involvement of shoulder	Right	12
		Left	39
		Both	3
3	X-ray shoulder both views findings	Normal; no any pathology found in all the patients	

Table 3: Blood sugar profile

Blood sugar profile	Categories	Number of subjects
Glycemic status [Figure 4]	Old DM	37
	New DM	1
	Impaired glucose tolerance	14
	Non diabetic	2

DM: Diabetes mellitus

Assessment Scale

As in previous investigations, the (SPADI)[15] was used to measure pain and impairment in frozen shoulder. SPADI is a self-reported assessment tool for assessing shoulder pathology. It is made up of (13 items) that are separated into two categories: pain (5 items) and disability (5 items) (8 items) [Table 2]. The SPADI score is a reliable tool for determining pain and disability. Minimum detectable change in score (90% confidence) = 13 points. Change less than this may be attributable to measurement error.

SPADI

The SPADI (Self-Administered SPADI) is a self-administered questionnaire with two dimensions: pain and functional activities. The pain dimension includes five questions on the degree of a person's suffering. The degree of difficulty an individual has with various activities of daily living that require upper-extremity usage is measured using eight questions designed to assess functional activities. The SPADI is the only accurate and valid region-specific assessment for the shoulder, and it takes a patient 5–10 min to complete.

Scoring Instructions

Patients respond to the questions by placing a mark on a 10cm visual analogue scale for each one. "No pain at all" and "worst agony conceivable" are verbal anchors for the pain dimension, while "no difficulty" and "so tough it required aid" are verbal anchors for the functional tasks. The overall score is calculated by averaging the results from both dimensions.

Interpretation of scores

Total pain score/50 × 100 = %

(Note: If a person does not answer all questions divide by the total possible score, e.g. if 1 question missed divide by 40)

Total disability score/80 × 100 = %

(Note: If a person does not answer all questions divide by the total possible score, e.g. if 1 question missed divide by 70)

Total SPADI score/130 × 100 = %

(Note: If a person does not answer all questions divide by the total possible score, e.g. if 1 question missed divide by 120)

The means of the two subscales are averaged to produce a total score ranging from 0 (best) to 100 (worst). Minimum Detectable Change (90% confidence) = 13 points (Change less than this may be attributable to measurement error).

SPADI

Please check the box next to the paragraph that best describes your experience in the previous week as a result of your shoulder condition.

Pain scale

How severe is your pain?

Circle the number that best describes your pain where: 0 = no pain and 10 = the worst pain imaginable.

At its worst?	1	2	3	4	5	6	7	8	9	10
When lying on the involved side?	1	2	3	4	5	6	7	8	9	10
Reaching for something on a high shelf?	1	2	3	4	5	6	7	8	9	10
Touching the back of your neck?	1	2	3	4	5	6	7	8	9	10
Pushing with the involved arm?	1	2	3	4	5	6	7	8	9	10

Disability scale

How much difficulty do you have?

Circle the number that best describes your experience where: 0 = no difficulty and 10 = so difficult it requires help.

Washing your hair?	1	2	3	4	5	6	7	8	9	10
Washing your back?	1	2	3	4	5	6	7	8	9	10
Putting on an undershirt or jumper?	1	2	3	4	5	6	7	8	9	10
Putting on a shirt that buttons down the front?	1	2	3	4	5	6	7	8	9	10
Putting on your pants?	1	2	3	4	5	6	7	8	9	10
Placing an object on a high shelf?	1	2	3	4	5	6	7	8	9	10
Carrying a heavy object of 10 pounds (4.5 kilograms)	1	2	3	4	5	6	7	8	9	10
Removing something from your back pocket?	1	2	3	4	5	6	7	8	9	10

Ethical clearance was taken from the Ethical Committee; Informed written consents were also taken from all the participants, and there were no conflicts of interest.

RESULTS

A total number of subjects who participated in this project were 54. The study represented the relationship

of different socio demographic parameters like age (Chart 1), sex (Chart 2), education (Chart 3), occupation (Chart 4), and residence (Chart 5). Females were predominantly involved (70.37%). Majority of the subjects were of low socio-economic status, residing in rural areas, with primary school education. Majority of the subjects were having symptoms from 3 to 6 months. (64.81%) with the non-dominant hand involvement (72.22%), without any pathology seen in the X-ray.

The prevalence of DM in patients with AC was 68.51% (37 out of 54). The prevalence of pre-diabetic patients was 25.92% (14 out of 54). The total prevalence of diabetic condition in patients with AC was 70.37% (38 out of 54). In this study, the newly diagnosed diabetic patient was 1, out of 54 patients (approximately 2%) (Table 3).

SPADI score			
Group	**Mean**	**SD**	**ANOVA**
Diabetics (*n*=38)	80.02	6.89	F=6.49947
Pre diabetics (*n*=14)	74.24	5.06	*P*=0.003
Non-diabetics (*n*=2)	68.4	4.12	

ANOVA: Analysis of variance, SPADI: Shoulder pain and disability index

There was a statistically significant difference between mean SPADI score of the groups with Diabetics showing mean score of 80.02 (SD = 6.89) followed by pre diabetics 74.24 (SD = 5.06) and non-diabetics 68.4 (SD = 4.12).

DISCUSSION

This study represents prospective gathering of the data on frozen shoulder and is unique among other studies in that it actually confirms the DM after the diagnosis of frozen shoulder. The findings help to understand pathophysiology that may be seen in clinical situations.[11]

Previous studies done by Yian *et al.*[16] have shown that the duration of DM is related to the development of frozen shoulder after controlling for insulin use (odds ratio:1.85 for the duration of more than 10 years of use compared to those with <5 years of use).[16]

In a study done by Tighe and Okaley;[17] they examined a subpopulation of 52 patients who had idiopathic frozen shoulder without a previous diagnosis of DM. Using 2 h glucose test, these authors found a prevalence of 3.8% for DM and 48% for pre diabetics in this group and concluded that patients with frozen shoulder should be routinely screened for DM. However, in our study the prevalence of DM were found to be 68.51% and pre diabetics were 25.92%.

38 out of 54 AC patients in this study were females (70%). So, in this study female predominance is more. However, in a recent study by Watson *et al.*, prevalence for male and female was equal; 57% of the population was female and 43% was male.[18]

A study in Turkey found the common age of frozen shoulder to be between 40 and 60 years.[19] which supports our finding. In our study, disease was found to be more prevalent in people of age group 40–

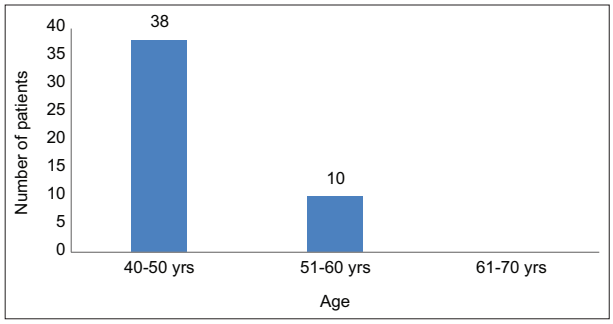

Chart 1: Age demographics

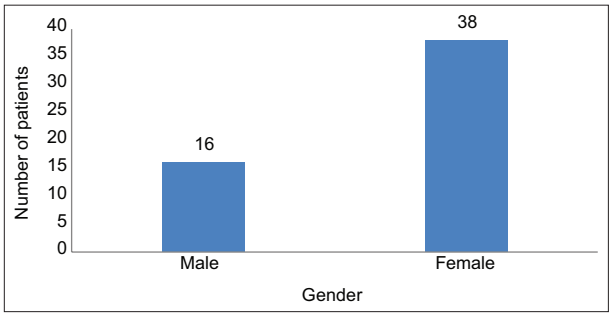

Chart 2: Distribution of patients according to gender of the patient

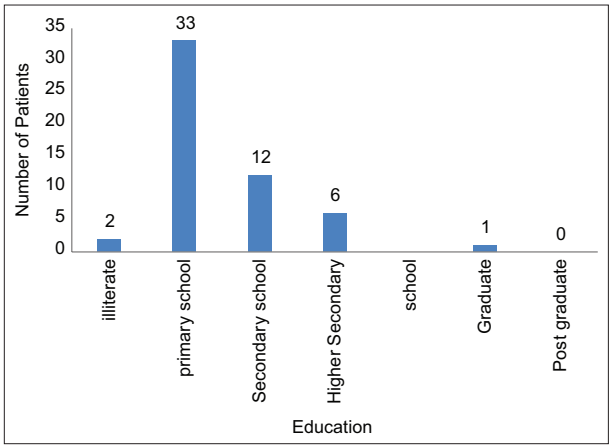

Chart 3: Education demographics

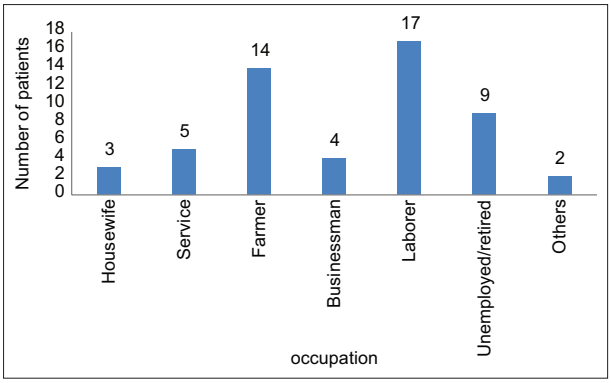

Chart 4: Distribution of patients according to occupation of the patient

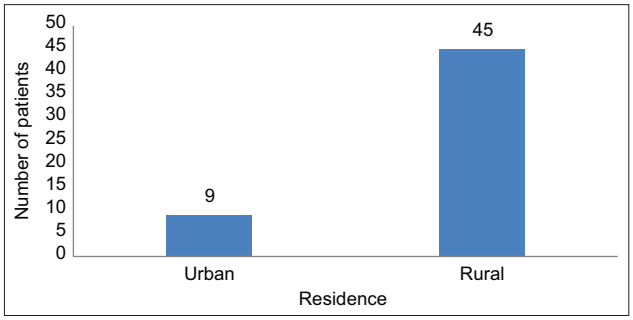

Chart 5: Distribution of patients according to their residence

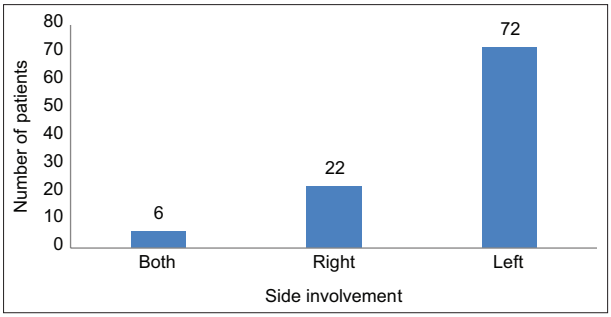

Chart 6: Side involvement

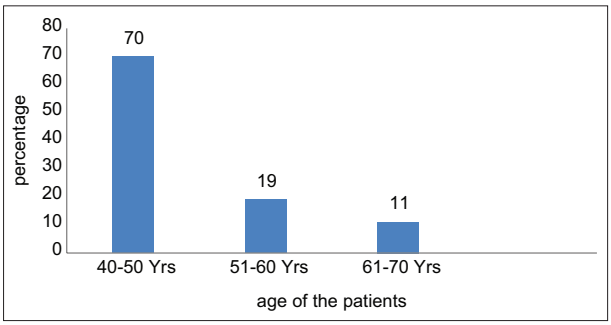

Chart 7: Percentage of cases according to age of the patient

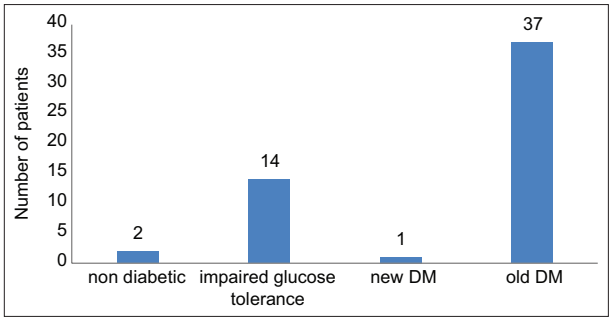

Chart 8: Glycemic index of patients

50 years. Some authors have postulated that the higher prevalence in older persons may be because frozen shoulder is an inflammatory response to aging changes in the shoulder joint and or tendons of the shoulder. However, there is no definite proof of this.[20]

According to the analysis, we found that all subjects were right-handed in this study. This (Chart 6) shows that 72% of the patients were affected with the non-dominant hand. 6% had bilateral involvement and 22 % of the subjects were affected on the dominant right hand.

Prevalence of AC was found to be more in 40–50 years (Chart 2) (70%) followed by (19%) in age group between 51 and 60 years and least during 61–70 years (11%). Prevalence of AC was found to be more among females 70% than in males 30% (Chart 2).

Out of 54 patients evaluated for DM 37 patients are old cases of DM, 14 have impaired glucose tolerance, only one new case is detected to have DM, and two were found to be non-diabetic (Chart 8). We could not find a significant association in our results with the duration of DM.

CONCLUSIONS

Effective glycemic control and early frozen shoulder management can promise a higher level of productivity in patients with DM.[21] Awareness programs should be launched targeting the population with DM, especially women at regular intervals to provide information about the increasing prevalence, symptoms, and risk factors of AC. Initial screening should be performed for patients with DM for AC, and early diagnosis with treatment favors good prognosis. Complications of DM like Dupuytren's contracture, Carpel tunnel syndrome, Flexor tenosynovitis (Trigger finger) can be avoided.[18]

Diagnosis of DM in patients with AC who have been screened for abnormal GTT can alert us for more severe form of AC and guide us towards more aggressive management of AC. Optimal physiotherapy program can

be implemented that do not exacerbate current symptoms and encourage physical activity in patients. Due to the smaller sample size, our study has its limitations, the need for future studies in this area is necessary. The purpose of this study is to find out the prevalence of DM in AC of the shoulder. So, the physicians should update their clinical knowledge regarding this association as it holds utmost importance in the diagnosis and management of frozen shoulder in patients with DM.

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