

Is it necessary to screen patient with adhesive capsulitis of shoulder for diabetes mellitus?

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ABSTRACT

Background: Idiopathic adhesive capsulitis of shoulder is common cause of pain and restriction of shoulder motion between the ages of 30 and 65. The prevalence of adhesive capsulitis is as high as 10% to 22% in diabetes mellitus as compared normal population which is 02% and 04%. Therefore, the doubt arises whether patients developed adhesive capsulitis are at greater risk to develop diabetes mellitus and should be screen for diabetes so that it can be detected early. **Purpose:** To compare the prevalence of prediabetics and diabetes mellitus among patients with features of idiopathic adhesive capsulitis of shoulder who are otherwise healthy. **Methods:** Patients between 30-65 years of age who attended Orthopaedics OPD with features of idiopathic adhesive capsulitis of shoulder were included. Participated underwent a 2 hour long oral glucose tolerance test and based on fasting and 2-hour plasma glucose levels, patients were diagnosed as normal glucose tolerance, prediabetic, or diabetic and the results were matched with previous published data. **Results:** 135 patients as participated and completed the test. 21 (15.5%) patients with idiopathic adhesive capsulitis of shoulder were found to be prediabetic, and 37 (27.4%) patients were found to be diabetic. However, 31 patients had family history of diabetes. **Conclusion:** Based on our study, we can recommend that patients with features of idiopathic adhesive capsulitis of shoulder should be screened at least for fasting and post prandial blood sugar so that diabetes can be detected early.

Keywords: Adhesive capsulitis, blood glucose level, diabetes mellitus, frozen shoulder, screening

Introduction

Adhesive capsulitis or 'Frozen shoulder' is a common orthopaedic condition characterized by painful and restricted active and passive range of motion of the shoulder, especially abduction and internal rotation, which incapacitates the patient to comb hair or touch their back with hand.

Idiopathic adhesive capsulitis of shoulder is common cause of pain and restriction of range of shoulder motion between the ages of 30 and 65 years in general orthopaedic practice.^[1] However

the prevalence of adhesive capsulitis of shoulder among the general population is between 2% and 4%,^[2,3] and a significantly higher prevalence of 10-22% has been observed in patients with diabetes mellitus.^[4-6]

Idiopathic adhesive capsulitis of shoulder (IAFS) occurs spontaneously without an organic cause, or it may be associated with local pathology or systemic disorders like connective tissue disorders, autoimmune disease and spondyloarthropathy etc., The diagnosis of IAFS is usually made on clinical basis with features of pain and limitation in passive range of motion, especially abduction and internal rotation of the shoulder, in the absence of local shoulder pathology such as rotator cuff pathology, glenohumeral arthritis, supraspinatus tendinitis or tear.^[4,7-9]

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In the literature, although the prevalence of IAFS among the general population is between 2-4%,^[2,3] a significantly higher prevalence between 10-22% has been noted in patients with diabetes mellitus. Since diabetic patients are more prone to develop adhesive capsulitis than non-diabetics, the question arises whether patients developing features of adhesive capsulitis or confirmed as adhesive capsulitis are at greater risk to develop diabetes. Not much study has done to address this issue.

Diabetic mellitus can be detected by the oral glucose tolerance test, which involves taking of 75 gm of glucose orally that can detect abnormal glucose metabolism in otherwise normal individual. This is also known as 'Glucose stress test' and is considered the most appropriate laboratory test to detect prediabetic states in otherwise normal healthy individuals. Patients with deranged glucose intolerance test (because of abnormal glucose metabolism) are labeled as prediabetics, however, there is a significant probability that they become frank diabetics in the future.^[10-12]

It is always advisable and prudent to early detection of prediabetes (impaired glucose intolerance) and diagnosis of diabetes. Early detection and timely treatment has been shown to reduce the risks of target organ damage such as cardiovascular, renal, optic and neurological disease related complications, hence the significance of early detection of diabetes is clear so that complication can be minimized.^[13-15] Therefore, if we suspect that the development of adhesive capsulitis may be associated with future emergence of diabetes, routine evaluation for prediabetes should be performed for these patients when seen by primary care physician or by orthopaedic surgeon.

There should be high index of suspicion that the otherwise healthy patient of adhesive capsulitis may be diabetic. And if not, he may turn into a future diabetic and should be screened in same visit by primary care physician.

In this study, we aim to find out whether the diagnosis of adhesive capsulitis is an indication to screen for diabetes. This will help in early detection of prediabetics and diabetics when patients consulted a primary care physician for frozen shoulder/adhesive capsulitis.

Methods

This study consisted of patients from a hospital who attended Orthopaedic OPD and has features of Idiopathic adhesive capsulitis of shoulder. A hospital ethical committee duly approved this study. The study was conducted in 151 Base Hospital, Guwahati, India, between August 2017 and May 2018.

Inclusion criteria

- Age 30 to 65 years
- No detectable shoulder pathology in radiograph
- Absence of a full-thickness rotator cuff tear in an ultrasound examination or in MRI
- No history of diabetes mellitus or taking antidiabetics

Exclusion criteria

- Age less than 30 and more than 65
- Detectable shoulder pathology in radiograph
- Presence of a full-thickness rotator cuff tear in an ultrasound examination or in MRI
- History of diabetes mellitus or taking antidiabetic medication.

All included patients has similar complaints such as painful shoulder motion, especially abduction, inability to comb hair and difficulty in touching back. All were subjected to routine haemogram, Rheumatological workup and radiological workup, and finally diagnosed as Idiopathic adhesive capsulitis of shoulder in the absence of any organic cause. Once patient has been diagnosed as Idiopathic adhesive capsulitis of shoulder, he or she was asked to participate in the study and written consent was taken. They were asked to come the next day on fasting state for glucose tolerance test.

Patients were advised to fast overnight. In the morning, venous blood was withdrawn, for fasting sugar and then 75 g of glucose mixed with water was given to drink. Patient was allowed to move around and after 2 hours later, venous blood (antecubital vein) sample was withdrawn. Blood samples immediately taken to laboratory where these samples are kept at appropriate temperature, and glucose-level analysis was done. Fasting and post-glucose loading results were noted for each patient. 135 patients participated as well as completed the test. Based on the plasma glucose levels, patients were diagnosed as normal glucose tolerance, prediabetic (impaired fasting glucose and abnormal 2-hour glucose tolerance), or as frank diabetic as shown in Tables 1 and 2.^[16-18]

Statistical analysis

The percentage of prediabetic patients in our study was compared with other published reports regarding prevalence of prediabetes in the general, age-matched population using a one-sided Chi-square test. Univariate analysis was also conducted, and differences were noted and considered significant at $P \leq 0.05$.

Results

In the present study, there were 47 female and 88 male participants. The mean age was 47.5 years (range, 30-65 years; SD \pm 10.5).

Table 1: Classification of glucose intolerance according to plasma glucose level

	Fasting Plasma Glucose, mmol/L (mg/dL)	Plasma Glucose after 2-hr OGTT, mmol/L (mg/dL)
Normal glucose tolerance	<5.6 (100 mg%)	<7.8 (140 mg%)
Impaired fasting glucose	5.6-6.9 (100-125 mg%)	
Impaired glucose tolerance		7.8-11.1 (140-199 mg%)
Diabetes mellitus	\geq 7 (126 mg%)	\geq 11.1 (200 mg%)

The right side shoulder was involved in 38 patients (28.1%) and left side was in 76 (56.2%) and remaining 21 (15.5%) has bilateral involvement of shoulder. 11 patients (8.1%) has a family history of diabetes. The mean body mass index (BMI) was 26.5 kg/m² (range, 17.4-36.8 kg/m²; SD ± 5.9).

Mean glucose fasting level was 4.5 mmol/L (range, 2.6-6.3 mmol/L; SD, ±0.8), and mean 2-hour glucose level was 5.4 mmol/L (range, 3.6-10.6 mmol/L; SD, ±1.4). 21 (15.5%) patients were diagnosed as prediabetes during this study and 37 (27.4%) were diagnosed as diabetic. There were 3 (2.2%) patients with an impaired fasting glucose of 5 mmol/L. 4 (2.9%) patients had abnormal 2-hour plasma glucose levels of 8.6, 10.3, 11.4 and 11.9 mmol/L, and were therefore diagnosed as impaired glucose tolerance. BMI of above 4 patients were found to be similar to those of the entire group (range, 20.2-32.2 kg/m², mean ± SD, 25.1 ± 5.7 kg/m²). These 4 patients had a family history of diabetes in parents. In our study, 37 (27.4%) were diagnosed as diabetic.

The prevalence of prediabetes (included 3 patients with an impaired fasting glucose and 4 patients of abnormal 2-hour plasma glucose levels) in patients with adhesive capsulitis was 28 (20.7%) (28 of 135). The prevalence of diabetes was 37 (27.4%) (37 of 135). In our study, the total prevalence of a diabetic condition in patients with adhesive capsulitis was 71.5% (58 of 135).

The *P* values was found to be significant when the percentage of prediabetics and diabetics in our study was compared with

previously published data of the prevalence of prediabetes in a general age-matched based population. We found statistically significant differences while comparison as shown in Table 3.

Demographic and clinical factors of adhesive capsulitis shoulder patients in non-diabetics and pre-diabetics as shown in Table 4.

Demographic and clinical factors of adhesive capsulitis shoulder patients in non-diabetics and diabetics as shown in Table 5.

Discussion

This study aimed to prospectively evaluate the prevalence of prediabetes and diabetes in patients presented with adhesive capsulitis with no prior diagnosis of prediabetes and diabetes. Our results showed 15.5% pre-diabetics and 27.4% diabetic. However, low prevalence was noted by Safran, O^[28] where he reported only 4 (8%) of 50 patients were prediabetic.

To compare our results of prevalence of prediabetes and diabetics in our study with the general age-matched based prevalence, we used previously published data.^[19-24] We compared our data with groups of similar population and similar age categories, as shown in Tables 3 and 6. The prevalence of prediabetes and diabetics in our study group 15.5% and 27.4%, respectively, which was within the comparable range found in similar age-matched based populations study. Therefore, the prevalence of diabetes and prediabetes in patients with adhesive capsulitis who are not known prediabetics or diabetics was similar to that of an age-matched studied population.

Our results are similar from a previously published study that involved the same screening. In that study by Zreik, N. H *et al.*,^[29] a meta-analysis demonstrates an overall mean prevalence of adhesive capsulitis in diabetics as high as of 13.4% and concluded that the routine screening should be done for diabetes. Another study by Tighe and Oakley^[9] studied 52 patients who

Table 2: Summary of WHO diagnostic criteria (1999) for diabetes and intermediate hyperglycaemia

Classifications		Venous plasma glucose levels
Normal	Fasting 2-h glucose	<6.1 mmol/l Not specified but <7.8 mmol/l implied
Diabetes	Fasting glucose 2-h glucose	≥7.0 mmol/l or ≥11.1 mmol/l
IGT	Fasting glucose <8.0 mmol/l 2-h glucose	<7.0 mmol/l and ≥7.8 and <11.1 mmol/l
IFG	Fasting glucose 2-h glucose	≥6.1 and <7.0 mmol/l and <7.8 mmol/l (if measured)

Table 3: Demographic and clinical factors of adhesive capsulitis shoulder patients in normal, diabetics

Characteristics	In non-diabetic (n=77)	Detected diabetic (n=37)	Statistical difference, values	<i>P</i> (significant <i>P</i> <0.05)
Age (mean), years	47.5	51.8	<i>t</i> =0.48	0.31
Female patients <i>n</i> (%)	30 (22.2%)	6 (4.4%)	$\chi^2=0.001$	0.97
Manual worker, <i>n</i> (%)	10 (7.4%)	6 (35%)	$\chi^2=0.27$	0.60
Patients from rural background, <i>n</i> (%)	19 (14%)	11 (65%)	$\chi^2=2.55$	0.19
Involvements of both shoulder, <i>n</i> (%)	10 (0.7%)	5 (3.7%)	$\chi^2=0.10$	0.74
Duration of adhesive capsulitis (mean), months	7.47	5.35	<i>t</i> =0.82	0.21
Waist circumference (mean), cm	47.9	91	<i>t</i> =2.35	0.01
Pain score (mean)	53±14	56.7	<i>t</i> =0.72	0.24
Disability (SPADI) score (mean)	47.5	51±15.5	<i>t</i> =1.09	0.13

Table 4: Demographic and clinical factors of adhesive capsulitis shoulder patients in normal, pre-diabetics

Characteristics	In non-diabetic (n=77)	In pre-diabetic (n=21)	Statistical difference, values	P (significant P<0.05)
Age (mean), years	47.5	52.8	t=0.48	0.314
Female patients, n (%)	30 (22.2%)	11 (8.1%)	$\chi^2=0.001$	0.933
Manual hard worker, n (%)	10 (7.4%)	13 (9.6%)	$\chi^2=0.23$	0.612
Patients from rural region, n (%)	19 (14%)	20 (14.8%)	$\chi^2=2.54$	0.191
Duration of adhesive capsulitis (mean), months	7.47	5.65	t=0.82	0.221
Involvements of both shoulder, n (%)	10 (0.7%)	6 (4.4%)	$\chi^2=0.10$	0.733
Waist circumference (mean), cm	75	84	t=2.29	0.013
Pain score (mean)	47.9	54.7	t=0.72	0.251
Disability (SPADI) score (mean)	53±14	53±14.6	t=1.04	0.132

Table 5: Prevalence of glucose intolerance/diabetes in different populations with similar ethnicities and age group to the present study

Study	Population	Age Range	No. of Patients	Impaired Glucose Tolerance, %	P
Yudkin JS ^[19]	United kingdom	35-70	88	32.95%	0.002
Modan M ^[20]	Israel	40-70	2040	19.6%	0.003
Kidwai et al. ^[21]	India	35-70	413	11% (in DM)	0.001
Mathew et al. ^[22]	India	40-65	310	16.45%	0.005
Dehghan et al. 2010 ^[23]	Iran		510	13.30% (in DM)	0.003
Cagliero et al. 2000 ^[24]	Massachusetts		300	12%	0.002
Present study	India	30-65	135	15.5% pre-diabetics 20.7% (when IFG* and IGT†# included) 27.4% diabetic	

Table 6: Summary of studies identifying diabetes in populations of adhesive capsulitis

Study	Population	Number of patients	Prevalence
Tighe and Oakley 2008 ^[9]	USA	88	38.6%
Milgrom et al. 2008 ^[25]	Israel	224	29%
Wang et al. 2013 ^[26]	Australia	263	20% (in AC)
Rauoof et al. 2004 ^[27]	Kashmir, India	100	27%
Present study	India	135	15.5% pre-diabetics 20.7% (when IFG* and IGT†# included) 27.4% diabetic.

Footnote: *IFG: impaired fasting glucose; † IGT: impaired glucose tolerance test

had adhesive capsulitis without a prior history of prediabetes or diabetes. He used a 2-hour plasma glucose test, and found a prevalence of 48% for prediabetes and 3.8% for diabetes, and concluded that patients with frozen shoulder should be routinely screened for diabetes. Patient presented with adhesive capsulitis in more severe form and it is difficult in treatment in the diabetic population because due to chronic inflammation lead to excessive accumulation of collagen and other extracellular matrix, which may result in fibrosis, necrosis, and finally destruction of normal tissue architecture.^[30]

Etiopathophysiology of adhesive capsulitis in diabetics

Adhesive capsulitis in diabetics is a consequence of visceral adiposity and inflammation that occurs via several inflammatory mediators.^[31] Exacerbate inflammation caused by proteins and cytokines such as tumor necrosis factor alpha (TNF- α) and interleukin-6 secreted by Adipocytes and

results in synovial and connective tissue fibrosis. Long term inflammation lead to excessive accumulation of collagen and other extracellular components, which destroy normal tissue architecture.^[32] The effects of above factors results in persistence of inflammation and limited disease resolution. Thus, adhesive capsulitis characterized by an inflammatory and fibrotic condition.

It has been advocated by many authors that patients diagnosed with adhesive capsulitis should undergo diabetic checkup to screen them for prediabetes if they are not known to be diabetics.^[33,34] Inayat F, in 2017, conducted study on 80 diabetes patient to find out prevalence of frozen shoulder and it was 41.3%.^[35] Another similar study done by Easmin in 2017 which was a crosscut survey that include 125 prediabetic patients and he found that the prevalence of frozen shoulder among diabetic patients was 14.40%.^[36] Moazma in 2018 conducted a study on 315 diabetic patient and noted that 31.7% patients were having Adhesive Capsulitis.^[37]

Our findings show important implications for management of adhesive capsulitis and early detection of diabetics. This confirms the high prevalence and increased relative risk of adhesive capsulitis in diabetics. This should alert the primary health care providers and Orthopedician to screen for diabetes in patients presented with features of adhesive capsulitis in otherwise health individual.

Limitation

A limitation of this study is the lack of control group, which may have led to inaccurate estimation of prediabetes in the general as well as, aged-matched population. However, the rate of prediabetes and diabetics in present study was relatively small as compared with a relevant similar population.

Conclusions

Based on our study and in view of above findings, the healthcare giver should routinely screen the patients presenting with adhesive capsulitis of the shoulder for prediabetics and diabetes.

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Conflicts of interest

There are no conflicts of interest.

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