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Research Article

Incidence of Diabetes Mellitus Type II and Pre-Diabetes among Shoulder Impingement Syndrome Patients and Related Modifying Factors: Epidemiological Study

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ABSTRACT

Objective: Measure the incidence of Diabetes Mellitus (DM) among patients with shoulder impingement syndrome and the factors that can modify that disease.

Design: Prospective.

Setting: Outpatient.

Participants: 412 patients presented with unilateral or bilateral shoulder pain suspecting shoulder impingement neuromuscular diseases, or syndrome.

Exclusion criteria: Those having manifestations suggesting of cervical radiculopathy, shoulder trauma history.

Interventions: Each patient was subjected to the following; demographic data including occupation, body mass index, detailed medical history including DM history. Shoulder exam including impingement provocative tests; Hawkin test, Neer's sign. Neck exam including Spurling test. Full neurological exam.

Main outcome measures: Laboratory testing including glycosylated hemoglobin (HgA1c), liver and kidney functions. Shoulder MRI if possible.

Results: Mean age 59.4 ± 11.123. All patients were right-handed, Male 37.1%, female 62.9%, Mean body mass index (BMI) 32.2 ± 8.2. Majority were manual workers (55.1%). No significant relationship between shoulder impingement sex but significant with BMI and age. HgA1c <5.5 has the fewest patients (7.3%), highest number of patients with HgA1c 5.5-6.0. significant incidence of shoulder impingement with rising category of HgA1c with highest among Hga1c >7 (p=0.0001) with significant bilateral disease. Significant incidence of shoulder impingement (unilateral or bilateral among diabetics (HgA1c >6) compared to non- diabetics (p=0.011).

Conclusions: High incidence of DM /prediabetes among shoulder impingement patients. Level of HgA1c significantly proportionate to incidence and laterality. This suggests that it is part of musculoskeletal complication of DM. that can evidently occur with prediabetes status. Body mass index and age significantly affected the incidence but not the sex.

Keywords: Frailty; Locomotive syndrome; Musculoskeletal Ambulation Disability Sarcopenia (MADS); Symptom complex

INTRODUCTION

A variety of musculoskeletal diseases have been found to have high incidence among diabetic patients compared to healthy control subjects [1-7].

These conditions including several disorders affecting the hands such as limited joint mobility, stenosing flexor tenosynovitis, dupuytren's contractures and diabetic sclerodactly. The shoulders such as frozen shoulder (adhesive capsulitis) and rotator cuff tendinopathy, disorder with major neurologic component including Carpal Tunnel Syndrome (CTS) and neuropathic

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arthropathy and several other conditions [1,2].

These musculoskeletal conditions lead to pain and disability. Recognition and treatment of such conditions is very important for quality of life improvement of such patients [1,2].

The etiology of occurrence of musculoskeletal disorders in long standing diabetes mellitus may be due to various modification of connective tissue ranging from glycosylation of protein with accumulation of advanced Glycation End Products (AGEs) to microvascular damage of blood vessels and nerves and deposition of extracellular matrix protein in the skin and periarticular tissue. This could potentially affect tendon strength and repair and play a role in microvascular complication and inflammation [1,2,8,9].

Shoulder pain among diabetic are very common. Two types of shoulder problems usually complicate diabetes mellitus, adhesive capsulitis (frozen shoulder) and shoulder impingement syndrome (rotator cuff tendinopathy) [1,2].

Shoulder impingement syndrome i.e. Rotator cuff tendinopathy occurs three times more often in those patients with diabetes Mellitus compared to non- diabetics. Most commonly affecting supra-spinatous tendon [10-15]. These typically result in pain with overhead activities [16,17].

The suggested mechanism involving periarticular calcium hydroxyapatite deposition predominantly in the area of rotator cuff tendons [10].

The exact incidence of diabetes among patients with shoulder impingement which diabetic stage as well as modifying factors need further in-depth study.

Objective

Measure the incidence of Diabetes Mellitus (DM) among patients with shoulder impingement syndrome and the factors that can modify that disease.

MATERIALS AND METHODS

Design

Prospective cross -sectional study.

Participants

412 patients presented with unilateral or bilateral shoulder pain suspecting shoulder impingement syndrome.

Exclusion criteria

Those having manifestations suggesting of cervical radiculopathy, neuromuscular diseases, or shoulder trauma history.

Interventions

Each patient was subjected to the following; demographic data including occupation, body mass index, detailed medical history including DM history. Shoulder exam including impingement provocative tests; Hawkins test, Neer's sign. Neck exam including Spurling test. Full neurological exam.

Main outcome measures

Laboratory testing including glycosylated hemoglobin (HgA1c), liver and kidney functions. Shoulder MRI if possible.

Statistical analysis

Data were fed to the computer using IBM SPSS software package version 24.0.

Qualitative data were described using number and percent. Comparison between different groups regarding categorical variables was tested using Chi-square test.

Quantitative data were described using mean and standard deviation for normally distributed data.

For normally distributed data, comparison between two independent population were done using independent t-test while more than two population were analyzed F-test (ANOVA) to be used.

Significance test results are quoted as two-tailed probabilities. Significance of the obtained results was judged at the 5% level.

RESULTS

Demonstrates demographic data of the included patients. Mean age 59.4 ± 11.123. All patients were right-handed, Male 37.1%, female 62.9%, Mean body mass index (BMI) 32.2 ± 8.2. majority were manual workers (55.1%). Presents the incidence of shoulder impingement with different sexes. No significant relationship between shoulder impingement and sex (Tables 1 and 2).

Table 1: Demographic and clinical data of the studied group.

	Number	Percent
	Sex	
Male	153	37.1
Female	259	62.9
	Age (years)	
<50	69	16.4
50-60	125	29.7
60-70	157	37.3
More than 70	61	14.5
Range	23-90	Code 71
Mean ± S.D.	59.4 ± 11.123	Code 71
	Occupation	
Clerk	3	0.7
Housewife	123	29.9
Labor	45	10.9
Manual	227	55.1
Retired	11	2.7
Security	3	0.7
	HgA1c category	
<5.5	30	7.3
5.5-6.0	162	39.3
6.0-7.0	104	25.2
>7	115	28.2
Total	412	100

Table 2: Relation between incidence of sex and shoulder impingement.

Shoulder impingement	Female		Male		Total	
	No.	%	No.	%	No.	%
No	39	15.1	22	14.4	61	14.8
Unilateral	51	19.7	37	24.2	88	21.4
Bilateral	35	13.5	31	20.3	66	16
Total	134	51.7	63	41.2	197	47.8
X2	5.916					
P	0.116 N.S.					

Note: Significant p>0.05

Demonstrates the relationship between shoulder impingement, BMI, age and HgA1c, with positive significant relationship between BMI, age, and HgA1c (Table 3).

Presents the relationship between different categories of HgA1c and shoulder impingement. HgA1c <5.5 has the fewest patients (7.3%), highest number of patients with HgA1c 5.5-6.0. significant incidence of shoulder impingement with rising category of HgA1c with highest among Hga1c >7 (p=0.0001) with significant bilateral disease (Table 4).

Demonstrates the incidence of shoulder impingement among diabetics and non-diabetics. Significant incidence of shoulder impingement (unilateral or bilateral among diabetics (HgA1c >6) compared to non- diabetics (p=0.011) (Table 5).

DISCUSSION

This study was aimed to evaluate the incidence of diabetes mellitus and prediabetes among patients diagnosed with shoulder impingement syndrome. We have used HgA1c as a qualifying measure for the diabetic status and related the incidence of shoulder impingement to different categories of HgA1c. There was significantly high incidence of shoulder impingement with rising levels of HgA1c. Also, the laterality of the disease significantly increased with the rising categories of HgA1c. The categories of HgA1c that represents prediabetes still have shown significant high incidence of shoulder impingement syndrome. Whereas HgA1c below 5.5 showed non- significant occurrence of shoulder impingement, which actually could highly suggest

Table 3: Relation between age, BMI, HgA1c and shoulder impingement.

	Shoulder impingement			
	Right	Left	Bilateral	Total
		Age		
Range	36.0-79.0	23.0-78.0	23.0-90.0	23.0-90.0
Mean ± S.D.	59.6 ± 10.5	56.9 ± 13.1	59.8 ± 11.3	59.4 ± 11.1
ANOVA		1.54		
P value		0.02*		
		Body mass index		
Range	22.4-67.0	24.6-51.9	14.9-55.4	14.9-67.0
Mean ± S.D.	34.1 ± 9.4	33.1 ± 7.0	30.5 ± 7.1	32.2 ± 8.2
ANOVA		2.01		
P value		0.03*		
		Hga1c		
Range	5.5-14.0	5.1-8.9	5.3-10.6	5.1-14.0
Mean ± S.D.	6.3 ± 1.1	6.2 ± 1.0	6.3 ± 1.0	6.3 ± 1.1
ANOVA		1.13		
P value		0.01*		

*Significant p >0.05

Table 4: Relation between HgA1c category and shoulder impingement.

HgA1c category	Shoulder impingement								Total
	No		Right		Left		Bilateral		
	No.	%	No.	%	No.	%	No.	%	
<5.5	22	36.1	4	4.5	4	6.1	0	0	30
5.5-6.0	17	27.9	42	47.7	36	54.5	67	34	162
6.0-7.0	18	29.5	33	37.5	21	31.8	32	16.2	104
>7	4	6.6	9	10.2	5	7.6	98	49.7	116
Total	61		88		66		197		412
X2	53								
P value	0.0001*								

Table 5: Relation between incidence of diabetes mellitus and shoulder impingement.

Shoulder impingement	Non-diabetic		Diabetic		Total
	No.	%	No.	%	
No	30	22.6	31	11.1	61
Unilateral	48	36	106	38	154
Bilateral	55	41.4	142	50.9	197
Total	133	100	279	100	412
X^2	11.197				
p	0.011*				

X^2=Chi square test; P was significant if <0.05; *Significant difference

cause effect relationship between diabetes mellitus and shoulder impingement syndrome.

In this study, there was significant relationship between incidence of shoulder impingement and BMI and age but not with sex.

Regarding risk factors of shoulder impingement, Sayamapanathan et al. in their study suggested that male gender, age and hand dominance are among the risk factors of rotator cuff tendinopathy [18].

In this study, there was significant relationship between BMI and different categories of HgA1c and shoulder impingement syndrome.

Wendelboe et al. concluded in his study to evaluate the association between body mass index and surgery for rotator cuff tendinitis, that there is association between obesity and shoulder repair surgery in men and women who are fifty-three to seventy -seven years of age and body mass index represent a risk factor for rotator cuff tendinitis [19].

Sisodia et al. reported significant correlation between body mass index and glycemic control as measured by HgA1c in type 2 DM [20].

Gumina et al. reported significant association between body fat, body mass index and rotator cuff tear, but did not explain the possible underlying etiological factors [21].

Revising literature, there is high prevalence of shoulder disorders among diabetic patients and it is considered the highest musculoskeletal complications [22].

The pathogenic mechanisms of chronic tendinopathy are not fully understood and several major non-mutually exclusive hypotheses including activator of hypoxia-apoptosis- pro-inflammatory cytokines cascade, Neurovascular ingrowth, increased production of neuro-mediators and erroneous stem cell differentiation have been proposed. Diabetes is important risk factors [23].

BMI the suggested mechanism of shoulder impingement or rotator cuff tendinopathy in case of diabetes mellitus due to various modification of connective tissue ranging from glycosylation of protein with accumulation of advanced glycation end products (AGEs) to microvascular damage of blood vessels and nerves and deposition of extracellular matrix protein in the skin and periarticular tissue. This could potentially affect tendon strength and repair and play a role in microvascular complication and inflammation [1,2,8,9].

Leong et al. conducted meta-analysis and concluded that age above 50 years, diabetes and overhead activities were associated with increased risk of rotator cuff tendinopathy [24].

In this study, we have chosen HgA1c as a measure of the diabetic status.

Revising literature regarding HgA1c, and how accurate it is as a tool to measure the diabetic status;Hemoglobin A1c is the measurement of glycosylated hemoglobin and can aid in both the diagnosis and continued management of diabetes mellitus. Accurate Hg A1c is an essential part of decision making in the diagnosis and treatment of type 2 diabetes. Although national standards exist to eliminate technical error with HgA1c testing.

Multiple errors whether elevated or decreased HgA1c sometimes happen. Also, some variation with ethnicity and even normal aging have been reported [25].

Another study to assess the accuracy of HgA1c suggested that hgA1c >6.5 demonstrates a moderate agreement with fasting glucose and 2-hour post prandial for diagnosing diabetes among adult Italian Caucasian subjects [26].

Another study comparing between HgA1c and fructosamine which of them is better index of glycemic control in type ii diabetes, serum fructosamine assay can better reflect average blood glucose concentration over the previous 3-6weeks and Hg A1c is better reflective over the previous 8-10 weeks. HgA1c measurement correlate more significantly with home capillary blood glucose levels than the fructosamine assay, even over the previous 2-3 weeks [27].

Another study assessed how A1c reflect glycemic control, it evaluated whether interindividual heterogeneity in the erythrocyte transmembrane glucose gradient might explain discordances between A1c and glycemic control based on measured fractosamine. They concluded that interindividual heterogeneity in glucose gradients across RBC membranes that affect hemoglobin glycation and have implication for diabetes complication risk and risk assessment [28].

Among adults in China, the estimated overall prevalence of Diabetes was 10.9% and that for prediabetes was 35.7% difference from previous estimate for 2010 may be due to an alternate method of measuring HgA1c [29].

Regarding Pre-diabetes (intermediate hyperglycemia) is a high-risk state of diabetes that is defined by glycemic variables that are higher than normal but lower than diabetes thresholds [30].

In this study we had detected significant incidence of shoulder impingement among the categories of patients' prediabetes status, this suggests that the musculoskeletal complications of diabetes particularly shoulder impingement syndrome could take place prior to the discovery of overt diabetic status.

In conclusion; High incidence of DM/prediabetes among shoulder impingement patients. Level of HgA1c significantly proportionate to incidence and laterality. This suggests that it is part of musculoskeletal complication of DM. that can evidently occur with prediabetes status. Body mass index and age significantly affected the incidence but not the sex.

CONCLUSION

High incidence of DM/prediabetes among shoulder impingement patients. Level of HgA1c significantly proportionate to incidence and laterality. This suggests that it is part of musculoskeletal complication of DM. that can evidently occur with prediabetes status. Body mass index and age significantly affected the incidence but not the sex.

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