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# Comparison of Sonographic Findings of the Rotator Cuff Between Diabetic and Non-diabetic Patients with Shoulder Pain

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## ABSTRACT

**Background:** The aim of study is to evaluate the shoulder by sonography in patients presenting with shoulder pain and correlate the findings observed with the diabetic patient.

**Methods:** Study was done in 60 patients who presented in the Department of Orthopedics with a history of the shoulder pain. Shoulder ultrasound was performed according to standard protocol, thickness of the supraspinatus tendon, presence of the tear, biceps tendon subacromial subdeltoid effusion and subacromial impingement were assessed.

**Results:** Of the 60 patients, 46 were male and 14 were female. Among them 15 patients were diabetics, 12 patient were male and 3 patient were female. Supraspinatus(SST) tendon thickness was greater in diabetics than in non-diabetics. Similarly, Subacromial bursal effusion, Biceps tendon effusion and Subacromial impingement were also seen in greater frequency in diabetic patients. However, no significant correlation was found between tear and the diabetes.

**Conclusions:** There was increased supraspinatus tendon thickness, subacromial impingement, subacromial bursal effusion and biceps tendon effusion in diabetic patient compared to non-diabetic patient.

**Keywords:** Diabetes; rotator cuff; supraspinatus tendon; ultrasound

## INTRODUCTION

It has been found that tendon related disorders and tears increases with age and these changes along with tendon thickness are more common in the diabetics.<sup>1</sup> The disease can affect as part of its effect on the glycation of musculoskeletal system.<sup>2-4</sup> The lesions identifiable on shoulder USG include rotator cuff tear, subacromial/subdeltoid bursa, biceps tendon effusion along with tendon thickening and tear.<sup>5</sup> These findings are due to microscopic collagen fiber failure and a failed healing response.<sup>6</sup> Ultrasound is less expensive and more accessible than MRI, which is a very important factor to be considered in evaluation of patients.<sup>7,8</sup>

Rotator cuff disease is a group of diverse conditions with multiple causes and mechanisms of injury, some symptomatic and others non symptomatic. The most commonly involved tendon in the rotator cuff tendinosis is supraspinatus tendon. It is well known that diabetes is a strong risk factor for rotator cuff pathologies, as shown by studies performed in symptomatic subjects.<sup>9-11</sup> The objectives were to measure supraspinatus tendon

thickness and to compare the sonographic findings observed between non diabetic and diabetic patients.

## METHODS

Cross-sectional study was done in 60 patients according to non-probability convenience sampling, coming to the orthopedic and general health checkup outpatient department with complaint of shoulder pain and referred to the Department of Radiology and Imaging between November 2018 to November 2019. An informed consent was taken from patients after explaining about the study. No extra cost was charged from the patients for the study. Study was done after ethical clearance from the Institutional Review Board.

Inclusion criteria were age 50 yrs and above, this contradictory words together can be a inclusion criteria. presenting with shoulder pain, shoulder pain duration of at least 2 weeks. (Intensity of pain in the range of 1-10 calculated via 10 point numeric rating scale where 1-3 mild pain, 4-6 moderate pain, 7-10 severe pain. Previous histories of trauma, rheumatoid arthritis, surgery of

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shoulder, history of steroid use, malignancy were the exclusion criteria.

Patients coming with complaint of shoulder pain were enrolled in the study. Real time grey- scale USG using a high frequency linear array transducer (5-10MHZ) of shoulder was done using a standardized procedure. Patient was seated on chair in front of USG machine at an appropriate height for comfortable examination. Patient was asked to place his or her hand up on lap. Transducer placed in axial plane over the anterior shoulder. Bicipital groove was identified where lies the biceps tendon.

For SST patient was seated in Crass position where dorsal aspect of the ipsilateral hand was placed behind the back. This hyperextended and internally rotated position pulls the SST out from under the acromion. In this position, the GT is located directly anterior; to obtain a long axis view of SST, the transducer is simply placed in the sagittal plane over the anterior shoulder. SST thickness was measured on the longitudinal image from the cortical outline of the greater tubercle of the humerus to the superficial outline of the SST. For subacromial impingement dynamic study was conducted in which patient shoulder is in neutral position. Then after the transducer was placed in the coronal plane and patient was advised to abduct his/her shoulder.

Sequential steps was applied which included :Identifying tendon of interest; imaging the tendon in two planes; eliminating artifact ie anisotrophy (misdiagnosis) by directing the USG beam perpendicular to the tendon;evaluation of subacromial- subdeltoid bursa.

Following USG examination the study variables were recorded which included SST tendon thickness, tendon tear, SAD and BT effusion and Comparison was done between the diabetic and non diabetic group.

Data were collected in predesigned proforma and entered in Statistical Package of Social Services (SPSS) IBM version 23. The discrete data were represented in frequency (%) and categorical data were represented in Mean±SD and analytical statistics was performed using independent sample “t” test. Pearson chi square test was used to test the association between the qualitative datas. The p-value of <0.05 shows the statistical significance difference. Pearson’s correlation coefficient was used to see the correlation between two continuous variable.

**RESULTS**

A total of 60 patients were included in the study who met the inclusion criteria. Among them 46(76.7%) were

males and 14(23.3%) were females. Maximum patients (N=24 patients, 40%) were in age group of 50-55 years, followed by 23 patients (38.3%) in age group 56-60 years. Mean age of patient was 57.5±5years for males and 56.7±4.8 years for females. A total of 15 patients(25%) were diabetics among them 3 were female and 12 were male. The mean duration of diabetes was 8±3.8 yrs. 37 patients had mild pain, 18 patients had moderate pain and 5 patients had severe pain (Figure 1).

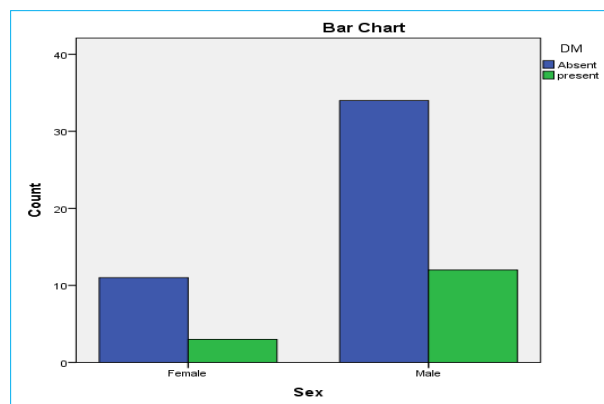


Figure 1. Bar Diagram showing frequency of diabetes among the sample age groups.

The SST thickness was greater in diabetics than in the non diabetics 6.5±0.8mm vs 5.9±0.6mm. (p<0.002) (Figure 2).

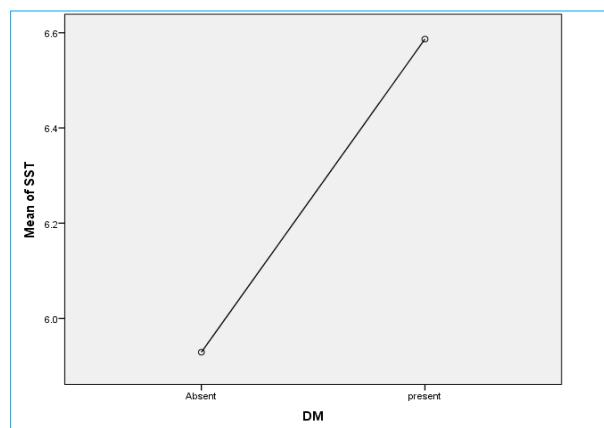


Figure 2. Mean Plot of the SST thickness among diabetics and non diabetics.

Regarding SA effusion 9 patients with diabetes had evidence of SA effusion and 13 patients with diabetes didn’t have SA effusion. In non diabetic group 6 patients presented with SA effusion while 32 patients didn’t have sonological evidence of effusion. More effusions in subacromial bursa were observed in diabetics (40.9% vs 15.8%, p<0.03). Odds ratio was 3.69 which suggest that diabetic patients has 3.7 times increased risk for

development of SA effusion compared to non diabetic (Table 1).



Figure 3. Image showing subacromian-subdeltoid bursal effusion.

Table 1. Association between diabetes and SA effusion.

		SA_effusion		Total	
		Absent	present		
DM	Absent	Count	32	13	45
		% within DM	71.1%	28.9%	100.0%
	present	Count	6	9	15
		% within DM	40.0%	60.0%	100.0%
Total	Count	38	22	60	
% within DM		63.3%	36.7%	100.0%	

11 patients with diabetes had sonological evidence of biceps tendon [BT] effusion while 4 patients with diabetes didn't have BT effusion. 6 patients having no diabetes had BT effusion while 39 patients without diabetes didn't have BT effusion. Applying the Pearson chi square test it was found that there was significant correlation between diabetes and BT effusion since more effusion was found in diabetes compared to non diabetics. (64.7% vs 9.3%, p<0.00). Odds ratio was 17.

Among 60 patients, 5 patients without diabetes mellitus had subacromial impingement [SAI] and 40 patients without diabetes didn't have SAI. 8 patients with diabetes had sonological evidence of SAI whereas 7 patients with diabetes didn't have sonological evidence of SAI. There was significant correlation between DM and SAI. (53.3% vs 11.1%, p<0.001). The Odds ratio was 9.1.

Among the 60 patients 8 patients without diabetes had partial thickness tear of SST while 37 patients didn't have sonological evidence of tear. 6 patients with diabetes had partial thickness tear of SST and 9 patients with diabetes didn't have any tear in SST. In this study no patients was found to have full thickness tear of SST. Although 40% of patients had partial thickness of SST compared to 17.8%

in non diabetics patients, no significant correlation was found between DM and tear of the SST (p>0.05). Applying Pearson correlation coefficient there was weak positive correlation between SST thickness and age with r value of 0.095 and p value of 0.4. However, the correlation was not significant.

## DISCUSSION

Rotator cuff disease is a group of diverse conditions with multiple causes and mechanisms of injury presenting with shoulder pain. Several studies have shown an increase in prevalence of shoulder disease, with or without symptoms, in elderly subjects and in diabetics.<sup>12</sup>

Although Magnetic Resonance Imaging [MRI] nowadays is the reference standard for the diagnosis of a rotator cuff lesion, it is expensive, time-consuming and not always available. Also, there are patients that suffer from claustrophobia and do not sustain the examination, other have MRI contraindications, such as pacemakers or cochlea implants. Examination of the shoulder by ultrasound has been established as an additional diagnostic tool in the assessment. Ultrasound remains the preferred imaging modality as it is non invasive and has better soft tissue resolution for the non bony components of the shoulder and do not involve ionizing radiation. Ultrasound is however less expensive and more accessible than MRI, which is a very important factor to be considered in evaluation of patients especially in developing countries with limited resources.

This study demonstrated that shoulder lesions were more common in the diabetic subjects than the non-diabetics; this is shown by the significantly greater tendon thickness of SST. The SST thickness in diabetics and in the non diabetics were 6.5±0.8mm vs 5.9±0.6mm. (t58= -3.19, p<0.002). There was higher prevalence of the BT and SA effusion in the diabetic. More effusions in subacromial bursa were observed in diabetics (40.9% vs 15.8%, p<0.03). Odds ratio was 3.69 which suggested that diabetic patient has 3.7 times increased risk for development of SA effusion compared to non diabetic. Similarly, that there was significant correlation between diabetes and BT effusion since more effusion was found in diabetes compared to non diabetics in our study (64.7% vs 9.3%, p<0.00). Odds ratio was 17. These findings are in concordance with those of other studies done by Abate et al and Uchendu et al.<sup>11</sup>

In a study done by Abate et al tendon thickness was greater in diabetics than in non diabetics (supraspinatus tendon: 6.2 ± 0.09 mm vs 5.2± 0.7 mm, p < 0.001). Sonographic appearances of degenerative features in the rotator cuff and biceps were more frequently

observed in diabetics. Subjects with diabetes exhibited more tears in the supraspinatus tendon (minor tears: 15 (15.8%) vs 2 (3.1%),  $p < 0.03$ ; major tears: 15 (15.8%) vs 5 (7.8%),  $p > 0.05$ ). More effusions in subacromial bursa were observed in diabetics (23.9% vs 10.9%,  $p < 0.03$ ) as well as in biceps tendon (33.3% vs 10.9%,  $p < 0.001$ ). In both groups no difference was related to duration of diabetes(1). This was in concordance with our study except the findings of tear in the supraspinatus tendon. In our study, 40% of patients had partial thickness tear of SST compared to 17.8% in non diabetic patients, no significant correlation was found between DM and tear of the SST ( $p > 0.05$ ). No patients with full thickness tear of SST were found in our study.

No study was found to see the relationship between SAI and diabetes. The evaluation done in our study has shown that SAI are more common in diabetic patient. There was significant correlation between DM and SAI (53.3% vs 11.1%,  $p < 0.001$ ). The Odds ratio was be 9.1. However, in our study there was weak positive correlation between SST thickness and age of the patient without significant association. Since the selection criteria for the patients chosen was above 50 yrs. This could be the reason to have weak positive correlation since all our study groups were elderly patients.

The results of our study suggest that age - related rotator cuff tendon changes particularly SST are more common in diabetics. This conclusion is supported by the observation of a higher prevalence of tears and of degenerative phenomena in diabetics, as well as by the increased thickness of supraspinatus tendon, which is due to the abnormal storage of collagen layers in the tissue and therefore is itself an expression of degenerative changes.<sup>13</sup> This supports the studies which suggested diabetes as a major risk factor in rotator cuff disease.<sup>4</sup>

Rotator cuff disease is multi-factored and has been attributed to both intrinsic and extrinsic factors. Extrinsic factors contribute to compression of the rotator cuff tendons, impingement syndrome, while the intrinsic factors result in tendon degradation due to the natural process of ageing,<sup>14</sup> poor vascularity,<sup>15</sup> altered biology,<sup>16</sup> and inferior mechanical properties resulting in damage with tensile or shear loads.<sup>17</sup> An inherited predisposition for the development of rotator cuff disease has also been identified.<sup>18</sup>

Ageing and diabetes have a common biochemical mechanism of tendon degeneration secondary to nonenzymatic glycosylation of collagen with formation of advanced glycation end products (AGEs). The AGEs crosslink formation in the collagen fibres affects their

physical and chemical properties, reducing their solubility with a resultant tougher, stiffer, less elastic and a weaker matrix.<sup>19</sup>

Diabetics show excessive glycosylation and cross-linking of the collagens and, added to the microvascular complications, may explain the higher prevalence of the rotator cuff tendon degeneration. In our study the implicated tendon is SST and effusion in the subacromial bursa and biceps tendon effusion lesions. In addition, SAI was also found to be greater in diabetic groups.

Earlier detection of changes in shoulder joint in non symptomatic diabetic patients will help to prevent further changes. The best way to avoid tendon problems is to get diabetes under control. It will improve health and take pressure off tendons at the same time.

Some limitations of this study must be acknowledged. One of the limitations of the study was sample size. It is recommended that similar study to be conducted in large scale. This study was done in all dominant hand and no evaluation of the non dominant hand was done. Moreover, the examiner was not blind to whether or not the individuals had diabetes or not. The duration of DM was not taken into account in our study.

## CONCLUSIONS

There was increased supraspinatus tendon thickness, subacromial impingement, subacromial bursal effusion and biceps tendon effusion in diabetic patients that was aggravated by ageing. No significant correlation was found between tear and the diabetes. Real-time ultrasound provides a convenient and cost effective method of evaluating these shoulder lesions.

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