

PREVALENCE OF ASYMPTOMATIC ROTATOR CUFF TEARS IN INDIVIDUALS WITH CONTRA LATERAL SYMPTOMATIC ROTATOR CUFF TEAR DIAGNOSED BY ULTRASONOGRAPHY IN A HOSPITAL. ORIGINAL RESEARCH ARTICLE

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ABSTRACT

Shoulder disorders are the most common complaint in general population and have an unfavorable outcome in many patients. Shoulder pain is the third most common cause of musculoskeletal consultation in primary care. Degenerative rotator cuff tear is the characteristic cause of shoulder pain and most often involves the supraspinatus tendon (SSP tendon). These tears can cause the significant impact on patient's life, marking the functional impairment of shoulder joints. Plain radiography, ultrasonography, MRI, are the imaging modalities used for the assessment of rotator cuff-related pathologies. Ultrasonography of shoulder is accepted as the investigation of choice for rotator cuff abnormality mainly because it is non-invasive, cost effective, time consuming and well tolerated imaging modality that uses high frequency transducers to diagnose rotator cuff tears. This research deals with the study of prevalence of asymptomatic rotator cuff tears and their correlation with respect to age, sex, hand dominance and diabetes mellitus.

Key words –Rotator cuff tears, ultrasonography, Shoulder, Prevalence

INTRODUCTION

The mobility of a shoulder joint is allowed by the “large ball-small socket” bony arrangement and the voluminous glenohumeral joint capsule⁽¹⁾. The joint is composed of 4 articulations; Sternoclavicular joint, Acromioclavicular joint, Glenohumeral joint and Scapulothoracic joint that work together to allow smooth shoulder function⁽¹⁾. Supraspinatus, infraspinatus, teres minor originate separately from the posterior surface of scapula and the subscapularis from the anterior surface and they run laterally and fuse together with the articular capsule into a common insertion on greater and lesser tuberosities known as the ‘Footprint of the rotator cuff.’⁽²⁾. Rotator cuff muscles results in humeral head rotation at various positions of abduction thus stabilizing the joint. As a group they have a smaller cross sectional area as compared to other muscles around the shoulder. They lie close to the center of rotation and their lever arm is shorter. Due to this anatomy it provides stability to the dynamic fulcrum during glenohumeral abduction⁽³⁾. Humeral head rotation or steering during the shoulder motion is due to the concavity-compression and the asymmetric contraction because of contraction of rotator cuff muscles. Also force couples act across the glenohumeral joint and these force couples occur when resultant force of two opposing muscle groups produces a given momentum⁽³⁾.

Shoulder impingement is classified into three stages; Tendon inflammation, Fibrosis and Cuff tear⁽⁴⁾. Progression of these cuff tears might play a role in development of rotator cuff arthropathy⁽⁵⁾. Biochemical changes occurring at the time of tendon degeneration are nearly similar in ageing and in patients with diabetes mellitus⁽⁶⁾. It is known from earlier studies that non enzymatic glycosylation of the collagen fibers with formation of Advanced Glycation End Products (AGE) within the tendon occurring in diabetic patients is the main pathogenic mechanism^(7, 8, 9). These AGEs affect the proteins which affect the collagen cross links. This results in increased number of collagen cross links and this in turn results in reduced elasticity and increased chances of tear⁽¹⁰⁾.

The ability to evaluate the musculoskeletal system has increased dramatically due to the development of high frequency linear array real time transducers, coupled with significant technologic advances that have improved the image resolution. Use of ultrasonography is a good alternative for detection of rotator cuff tears and has a proven accuracy in rotator cuff assessment^(11, 12, 13, 14, 15). Teefey SA et al did a retrospective study to determine the diagnostic performance of high-resolution ultrasonography compared with arthroscopic examination for the detection and characterization of rotator cuff tears⁽¹⁶⁾. They included 98 patients who had undergone pre-operative ultrasonography and subsequent arthroscopy. The sonography findings of rotator cuff were compared with that of arthroscopic findings. They concluded that ultrasonography was a highly accurate diagnostic modality for detecting full thickness rotator cuff tears with sensitivity of 100 percent and overall accuracy of 96 percent. Sizes of tears in horizontal dimension were correctly diagnosed in 86% of the individuals with full thickness rotator cuff tears.

METHODOLOGY

Study was carried out at Deenanath Mangeshkar Hospital and Research Centre, Pune, Maharashtra. The 129 patients with age more than or equal to 40 years for both males and females, diagnosed for unilateral shoulder pain due to rotator cuff tear by ultrasonography and were subjective to contra lateral asymptomatic shoulder were considered ideal for the respective study. Patients having history of asymptomatic shoulder trauma or surgery or any neuromuscular disorders were excluded from the study.

Study Methodology:

All the required and relevant data of 129 patients was collected who presented with complaints of unilateral shoulder pain to the orthopedic /shoulder OPD in Deenanath Mangeshkar Hospital underwent ultrasonography of the symptomatic shoulder as well as the opposite asymptomatic shoulder in the same sitting as a part of routine protocol. In patients who were a known case of diabetes mellitus, their fasting and post prandial blood sugar levels and HbA1C values were noted. Blood sugar levels were not considered in patients who were non-diabetic. Diabetic individuals were divided into controlled and uncontrolled group according to their HbA1C values. Controlled group were having HbA1C values of < 7% and uncontrolled group having HbA1C values of $\geq 7\%$.

The ultrasonography of both the shoulders was done by single well trained musculoskeletal ultrasonologist with 15 years of experience. The patients were examined using a GE Wipro LOGIQ e with a 7-11 MHz linear multi-frequency probe manufactured in Bangalore. The rotator cuff was examined with arm in neutral and adduction-internal rotation in longitudinal and transverse planes and with modified Crass maneuver.

The major criteria for diagnosis of full thickness tear was; non visualization of the cuff, focal non visualization and focal anechoic lesion extending from the bursal surface up to the articular surface. Whereas minor criteria for same were; Fluid along the biceps tendon sheath and in the sub deltoid bursa and the joint is a very reliable sign of rotator cuff injury. It is suggestive of 95% probability of cuff tear. The tears were graded into small (0 -10 mm), medium (10-30 mm), large /massive (≥ 30 mm) depending upon the size of the tear/ amount of retraction that was observed at the time of sonography of asymptomatic shoulder.

Statistical method: Statistical analysis was carried out with the help of SPSS (version 20) for Windows package (SPSS Science, Chicago, IL, USA). The description of the data was done in form of % proportion for qualitative

(categorical) data. P-values of < 0.05 were considered to be significant. The associations between the prevalence of asymptomatic rotator cuff tears, age, gender, hand dominance and diabetes mellitus were tested with chi-square test. Also Odds ratio was used for calculating the risk of occurrence of asymptomatic rotator cuff tears with increasing age.

OBSERVATIONS AND RESULTS

The age wise **prevalence** of the asymptomatic rotator cuff tears was found out to be **36.4%** [(47/129) x100] as described in table 1. By using Chi square test, p value < 0.05 (0.036) there is significant association of asymptomatic rotator cuff tears with increasing age.

Age groups * Rotator Cuff Tear Cross tabulation					
			Rotator Cuff Tear		Total
			Yes	No	
Age groups	40 to 50 yr	N	1(7.7%)	12(92.3%)	13
	50 to 60 yr	N	9(25%)	27(75%)	36
	60 to 70 yr	N	22(47.8%)	24(52.2%)	46
	70 to 80 yr	N	11(42.3%)	15(57.7%)	26
	Above 80 yr	N	4(50%)	4(50%)	8
Total		N	47(36.4%)	82(63.6%)	129

Table 1: Age group specific prevalence's of asymptomatic rotator cuff tears.

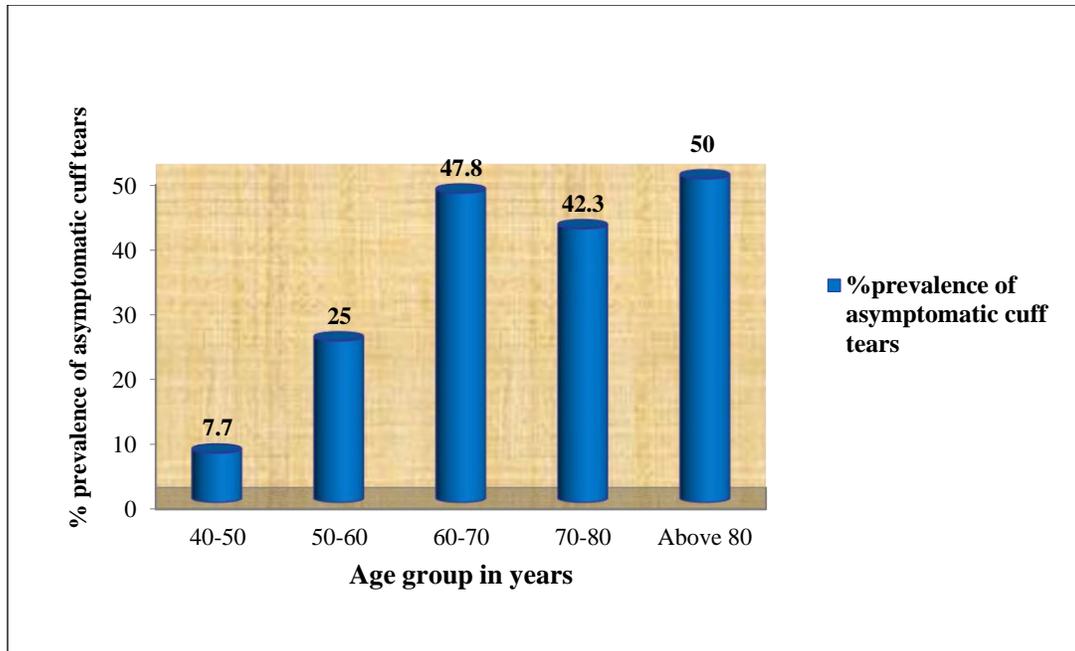


Figure 1: Bar diagram showing age wise prevalence's of asymptomatic cuff tears.

Risk of occurrence of asymptomatic rotator cuff tears is 11times more in 60-70yrs age group ($p=0.027$), 8.8 times more in 70-80yrs age group ($p=0.05$) and 12times more in ≥ 80 yrs age group ($p=0.048$) as compared to 40-50yrs as shown in table 2.

Age group	OR=Exp(B)	95% C.I for Exp (B)		Significance ($p<0.05$)
		Lower	Upper	
40-50yrs	1.0			
50-60yrs	4.000	0.454	35.209	0.212
60-70yrs	11.000	1.320	91.683	0.027
70-80yrs	8.800	0.991	78.107	0.05
≥ 80 yrs	12.000	1.019	141.336	0.048

(Age group of 40-50yrs is taken as a reference category.)

Table 2: Age related risk of occurrence of asymptomatic cuff tears.

The prevalence of cuff tears according to age group for males was 0% in 40-50yrs, 29.4% in 50-60yrs, 52.4% in 60-70yrs, 47.1% in 70-80yrs, 66.7% in ≥ 80 yrs. The prevalence of cuff tears according to age group for females was 14.3% in 40-50yrs, 21.1% in 50-60yrs, 44% in 60-70yrs, 33.3% in 70-80yrs, 0% in ≥ 80 yrs. (Table 3 and figure 2)

Age groups * Rotator Cuff Tear In Males and Females Cross tabulation				
Gender			Rotator Cuff Tear	
			Male	Female
Age groups	40 to 50 yr	N	0 (0%)	1 (14.3%)
	50 to 60 yr	N	5 (29.4%)	4 (21.1%)
	60 to 70 yr	N	11 (52.4%)	11 (44%)
	70 to 80 yr	N	8 (47.1%)	3 (33.3%)
	Above 80 yr	N	4 (66.7%)	0 (0%)
Total		N	28 (41.8%)	19 (30.6%)
$p > 0.05$				

The overall **Table 3: Gender wise distribution of asymptomatic cuff tears (n=No.of patients=47)** was more in males as compared to females. Using chi square test there was no significant difference in rotator cuff tears between males and females ($p > 0.05$) (Figure 2)

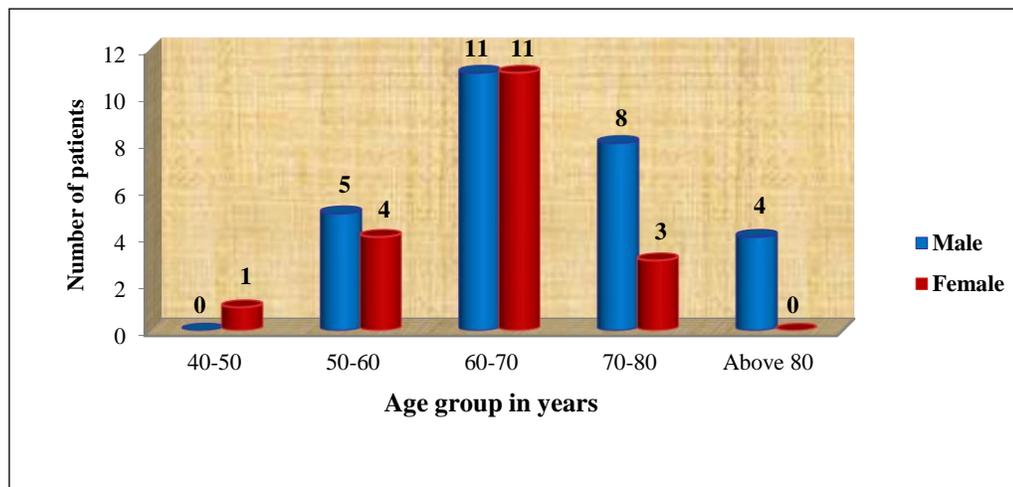


Figure2: Bar diagram showing gender wise distribution of asymptomatic cuff tears with respect to age group.

In our study, 89.1% (115/129) were right hand dominant, 9.3% (12/129) were left hand dominant and 1.6% (2/129) were ambidextrous. Of these 129 subjects, in 50 of them right shoulder was asymptomatic and in remaining 79 the left shoulder was asymptomatic. 46% (23/50) of the asymptomatic right shoulders were having cuff tears and 30.4% (24/79) of asymptomatic left shoulders were having cuff tears. Using chi square test there was no significant association between hand dominance and the side of asymptomatic cuff tear (p value > 0.05).

Dominance * Asymptomatic side * Rotator Cuff Tear Cross tabulation						
Rotator Cuff Tear				Asymptomatic side		Total
				Right	Left	
Yes	Dominance	Right	N	21 (91.3%)	23 (95.8%)	44 (93.6%)
		Left	N	2 (8.7%)	1 (4.2%)	3 (6.4%)
	Total		N	23	24	47
No	Dominance	Right	N	24 (88.9%)	49 (89.1%)	73 (89%)
		Left	N	3 (11.1%)	6 (10.9%)	9 (11%)
	Total		N	27	55	82
P value>0.05						

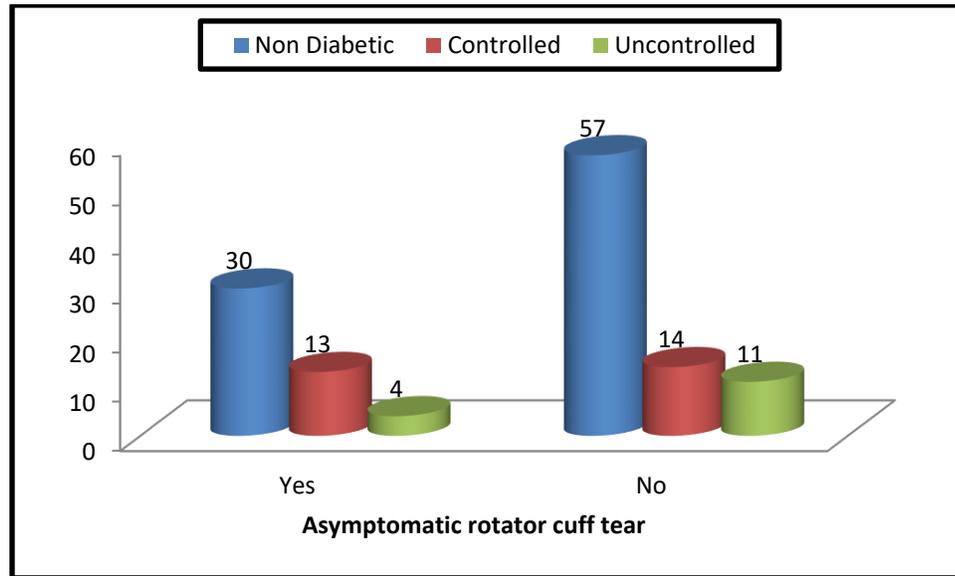
Table 4: Analysis of correlation of hand dominance with side of asymptomatic cuff tear

As shown in table 5, out of 129 individuals, 32.6% (42/129) were having diabetes mellitus. We had classified the individuals with diabetes mellitus into controlled and uncontrolled group using their HbA1C values. 64.2% (27/42) were included in controlled group while 35.8% (15/42) were included in the uncontrolled group. 48.1% individuals (13/27) of the controlled diabetic group were having asymptomatic rotator cuff tears. 26.7% individuals (4/15) of the uncontrolled diabetic group were having asymptomatic rotator cuff tears. 40.4% (17/42) of diabetics were having asymptomatic rotator cuff tears. The prevalence of asymptomatic rotator cuff tears in non diabetic individuals was 34.5% (30/87).

Diabetes Mellitus * Rotator Cuff Tear Cross tabulation					
			Rotator Cuff Tear		Total
			Yes	No	
Diabetes Mellitus	Non Diabetic	N	30	57	87
		Row%	34.5%	65.5%	100.0%
		Col %	63.8%	69.5%	67.4%
	Controlled	N	13	14	27
		Row%	48.1%	51.9%	100.0%
		Col %	27.7%	17.1%	20.9%
	Uncontrolled	N	4	11	15
		Row%	26.7%	73.3%	100.0%
		Col %	8.5%	13.4%	11.6%
	Total		N	47	82
Row%			36.4%	63.6%	100.0%
Col %			100.0%	100.0%	100.0%
p=0.31					

Table 5: Analysis of correlation of diabetes mellitus with asymptomatic rotator cuff tears.

Using chi square test there was no significant association between diabetes mellitus and asymptomatic cuff tears (p value >0.05)

**Figure 3: Graphical Distribution of asymptomatic rotator cuff tears in diabetics.**

DISCUSSION

The aim of the study was to examine the integrity of the asymptomatic rotator cuff in patients with a confirmed symptomatic rotator cuff tear on ultrasound in the opposite shoulder.

It has been shown in many studies that there is a high prevalence of asymptomatic rotator cuff tears in general population ^(17, 18, 19, 20).

Ultrasonography used for screening purpose is a good diagnostic modality as showed by various studies in literature ^(19, 21, 22, 23, 24, 25).

The patients belonging to age group of more than 60yrs account for 62.1% which suggest that the more number of patients belong to higher age groups and it correlates with the fact that rotator cuff tear is due to the tendon degeneration occurring due to aging. In our study we found out that there was a linear rise in the prevalence of asymptomatic rotator cuff tears with increasing age group. The patients which were included were ≥ 40 years of age. The prevalence's noted in each group in our study were 7.7% in 40-50yrs age group, 25% in 50-60yrs age group, 47.8% in 60-70yrs age group, 42.3% in 70-80yrs age group and 50% in >80yrs age group.

A significant rise in percentage of asymptomatic cuff tear is seen beyond 60 years of age group as compared to previous age groups. Lehman C et al concluded that the incidence of rotator cuff tears had a linear correlation with increasing age and that the prevalence was 6 percent in individuals less than 60 years of age and the prevalence increased to 30 percent in individuals more than 60 years of age ⁽²⁶⁾. Overall prevalence was found to be 17%.

Sher J et al. ⁽²⁰⁾ concluded that there was statistically significant correlation between asymptomatic rotator cuff tears and increasing age. Overall prevalence noted was 15%. They found 28% prevalence in >60yrs of age, 4% prevalence in 40-60yrs of age and 0% in less than 40yrs of age.

C Milgrom et al. ⁽²⁷⁾ studied 90 subjects and found that there was increase in prevalence of cuff tears after 50years and that this was significant statistically.

Tempelhof et al. ⁽²⁸⁾ concluded in their study regarding increasing prevalence of rotator cuff tears with age. Over all prevalence in their study was found to be 23%. In age group of 50-59yrs the prevalence was 13%, 60-69yrs it was 20%, 70-79yrs it was 31% and >80yrs it was 50%.

Yamaguchi et al. ⁽²⁹⁾ mentioned in their study that onset of rotator cuff tear and increasing age was highly correlated. By logistic regression analysis they showed a 50% likelihood of a bilateral rotator cuff tear after the age of sixty six years. Overall prevalence of contra lateral asymptomatic full thickness rotator cuff tear was found to be 35.5%.

Moosmayer and his co-workers ⁽³⁰⁾ concluded in their study that there was a linear correlation of prevalence of asymptomatic rotator cuff tears and age. They found a prevalence of 2.1% in 50-59years age group, 5.7% in 60-69years age group and 15% in 70-79years age group. These were the full thickness cuff tears and their overall prevalence was 7.6%.

G Girish et al. ⁽³¹⁾ conducted a study to find out the asymptomatic shoulder findings in 51 men to be investigated by ultrasonography. It was found that 10% of these men had full thickness supraspinatus tear and 4% had full thickness infraspinatus tear. These infraspinatus tears were associated with supraspinatus tear. They also concluded that there was linear correlation between age and rotator cuff tear.

In our study there were 67males and 62 females. All of them were having symptomatic rotator cuff tears. Males accounted for 51.9% of the study population and females accounted for 48.1%. It is seen that there is no significant difference within the population according to gender which suggests that the occurrence of rotator cuff tears is not gender dependant. E. Lawrence Keyes ⁽¹⁷⁾ in his study mentioned that gender did not influence the occurrence and distribution of rotator cuff tears/lesions. C Milgrom ⁽²⁷⁾ and his colleagues also concluded in their study on 90 individuals that there was no statistically significant gender difference which affected the prevalence of asymptomatic rotator cuff tears.

It can be seen from the results that the prevalence of asymptomatic cuff tear is slightly more in non dominant arm in both the groups. Using chi square test it is seen that the above difference found is not statistically significant ($p>0.05$). Hence it can be said that asymptomatic cuff tears can be present in either shoulders irrespective of the hand dominance. Thus it can be said that asymptomatic cuff tears can be present even in dominant arms. Milgrom C. et al. ⁽²⁷⁾ in their study showed that there was no significant correlation between hand dominance and prevalence of asymptomatic cuff tear.

From the results, it is observed that the prevalence of asymptomatic cuff tears is more in diabetics (40.4%) as compared to non diabetics (34.5%). Also prevalence was more in controlled diabetics probably due to more number as compared to the uncontrolled group. But using chi square test, it was found that although the prevalence is higher in diabetics it is not statistically significant. The p value obtained was 0.31(>0.05).

Michele Abate ⁽⁶⁾ and his colleagues in their study of sonographic evaluation of asymptomatic shoulders in diabetics concluded that age related degenerative changes within the tendon are common in diabetics. There is a statistically significant correlation ($p=0.03$) between occurrence of minor tears (partial thickness tears and small full thickness tears that is <1cm) and diabetes mellitus. There was no statistically significant correlation ($p=0.14$) between major tears (large full thickness tears and massive tears) and diabetes mellitus ⁽⁶⁾.

It can be seen that the asymptomatic rotator cuff tears occur more commonly as the age increases. This correlates with the fact that rotator cuff tears occur due to the tendon degeneration that occurs with aging ⁽³²⁾. The disturbing fact is that the vast majority if tears were significantly large to massive – 72.3% of the asymptomatic tears were of a

capricious (moderate to large) size and hence need to be watched. The repercussions of a massive, irreparable tear, is serious; and if these asymptomatic tears decompensate then the surgical options are less than ideal.

CONCLUSION

It is seen that the prevalence of asymptomatic rotator cuff tears is statistically significant correlation with increasing age. With increasing age there is a linear rise in the prevalence of asymptomatic rotator cuff tears. This high prevalence of asymptomatic rotator cuff tears can be regarded as a natural correlate of aging and that the bilateral rotator cuff tears are common. The appearance of asymptomatic rotator cuff tears had no significant correlation with gender, hand dominance, and diabetes mellitus. A vast majority of the asymptomatic tears are medium to large size. We accept that the group of patients that were selected had a prior symptomatic cuff tear and may not represent the true general population.

CONFLICT OF INTEREST

On behalf of all authors, corresponding author states no conflict of interest.

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