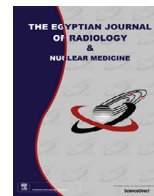




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## Original Article

## Greater tuberosity sclerosis: Does it correlate with tear size?

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## ABSTRACT

**Introduction:** Radiographic findings of the shoulder joint have been reported in patients with rotator cuff tear, greater tuberosity changes are among the most reported.

The aim of this work is to assess the greater tuberosity sclerosis as a radiographic sign of rotator cuff tear and its relation to the tear size.

**Patients and methods:** This study was conducted from July 2009 until May 2013 in a retrospective fashion and included 425 patients, 250 females (58.8%) and 175 males (41.2%).

**Results:** Sclerosis was detected in 398 cases out of 425 patients (93.6%). Of those, 360 (90%) were found to have a tear of the rotator cuff documented on M.R.I. Also greater tuberosity sclerosis being more prominent with large-sized tears. One hundred (23.5%) patients had been operated arthroscopically and a tear documented intraoperatively (Table 2).

**Conclusion:** Greater tuberosity sclerosis has both high sensitivity and positive predictive value for rotator cuff tear. Also greater tuberosity sclerosis is found more with large-sized rotator cuff tears.

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## 1. Introduction

Radiographic findings of the shoulder joint have been reported in patients with rotator cuff tear, greater tuberosity changes [1] are among the most reported. The radiographic signs of rotator cuff tear may include secondary degenerative changes as sclerosis, subchondral cysts, osteolysis, and notching or pitting of the greater tuberosity. In chronic rotator cuff disease, with or without tear, there may be sclerosis of the greater tuberosity and cyst formation along with subacromial spurring.

Approximately 40% of asymptomatic patients over 50 years old have full-thickness rotator cuff [1], and the prevalence of partial- and full-thickness tears in symptomatic patients over 60 years old is greater than 60% [2]. Findings in rotator cuff tear include subacromial sclerosis “eyebrow sign”, sclerosis and cyst formation of the greater tuberosity and narrowing of the acromio-humeral distance (AHD) (<7 mm). No formal study has been carried out to investigate the relation of sclerosis of the greater tuberosity to cuff tear, or whether this may signify partial or complete tear. The current study was carried out to study the relation between sclerosis

of the greater tuberosity and rotator cuff tear and significance of this radiographic sign.

For diagnosing lesions of the rotator cuff of the shoulder, magnetic resonance imaging is widely used [3]. MRI can provide high resolution imaging of the shoulder structures, and can delineate lesions in the symptomatic portions of the shoulder joint. Regarding the intrasubstance pathology of the rotator cuff muscles; MRI can provide information that is difficult to diagnose using shoulder arthroscopy [4].

MRI is used to diagnose shoulder pain; as it is a non-invasive and well tolerated test by the patients [5].

The aim of this work is to assess the greater tuberosity sclerosis as a radiographic sign of rotator cuff tear and its relation to the tear size.

## 2. Patients and methods

This study was conducted from July 2009 until May 2013 in a retrospective fashion and included 425 patients, 250 females (58.8%) and 175 males (41.2%). Dominant side was affected in 342 patients (80%). Average age in males was 46 years (24–68 years) and 54.5 years in females (44–65 years).

Inclusion criteria were:

- (a) shoulder pain for 6 months or more with difficulty to move the shoulder,

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- (b) painful limited abduction and forward flexion on examination,
- (c) no improvement on physical therapy or local injection and no prior surgery.

All patients underwent antero-posterior radiographs of the shoulder. Patients not responding to 6 weeks of medical treatment underwent magnetic resonance imaging.

The exclusion criteria were:

- (a) glenohumeral or acromioclavicular arthritis,
- (b) shoulder instability,
- (c) history of previous surgery or shoulder joint fracture and,
- (d) severe neurological deficit.

### 3. Imaging technique

Standardized patient position was utilized during MR shoulder scanning; supine position with the arm abducted by the side of the patient in neutral position.

MRI of the shoulder was performed for all patients with 1.5 T superconducting unit (Magnetom Espree, Syngo, MR B15, Siemens, Erlangen, Germany) using a phased-array multi-coil. No specific preparation was asked from the patients prior to examination. No contrast agents were used. Shoulder MR scan was performed for all patients as follows; GRE sequence in axial plane, PD fat-sat sequence in axial, coronal and sagittal planes, T2 fat-sat sequence in coronal plane and T1 sequence in coronal plane. The following parameters were used; Gradient echo-weighted imaging with parameters TR of 600 ms, TE of 22 ms, slice thickness 4 mm and field of view of 180 mm; PD-weighted fat-sat imaging with parameters TR of 2200 ms, TE of 42 ms, slice thickness of 4 mm and field of view of 180 mm; T2-weighted fat-sat imaging with parameters TR of 4000 ms, TE of 83 ms, slice thickness of 4 mm, and field of view of 180 mm; T1-weighted imaging with parameters TR of 500 ms, TE of 18 ms, slice thickness 4 mm and field of view of 180 mm.

Greater tuberosity sclerosis was defined as cortical thickening and subchondral sclerosis, extending from the articular cartilage of humeral head to the lateral humeral cortex on an AP shoulder radiograph.

One hundred patients (23.5%) agreed to undergo surgical shoulder arthroscopy, confirming presence of partial or complete rotator cuff tear and determining the size of the tear. These were repaired back to bone using 2 or 3 anchors.

Statistical analysis:

For the interrater analysis for reliability Kappa value was used. A  $p$  value of  $<0.05$  was assigned as significant value for *chi square* test.

Statistical calculations were conducted using PASW Statistics 18 software (IBM SPSS, Chicago, IL, USA).

### 4. Results

Radiographs were examined for greater tuberosity sclerosis by the first two authors independently and M.R.I. scans were examined by the three authors independently for cuff tear and Kappa value was calculated (Table 1).

Sclerosis was detected in 398 cases out of 425 patients (93.6%). Of those, 360 were found to have a tear of the rotator cuff documented on M.R.I. One hundred patients had been operated arthroscopically and a tear documented intraoperatively (Table 2) (Chart 1).

Significance found associating greater tuberosity sclerosis with rotator cuff tear is summarized in Table 3 (Chart 2).

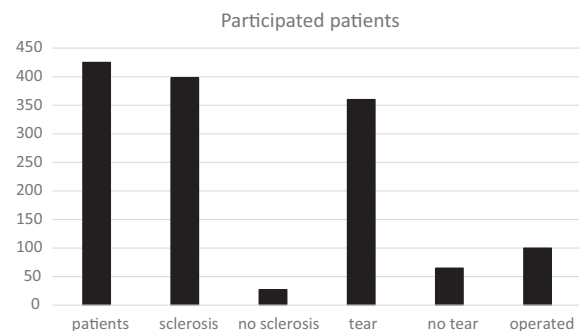
**Table 1**  
Interrater reliability.

Examination	Authors	Kappa value
Radiographs Shoulder MRI	First two authors	0.57
	First two authors	0.59
	Second two authors	0.60
	First and last authors	0.58

**Table 2**

Numbers of participated patients, patients with and without greater tuberosity sclerosis, patients with and without rotator cuff tears, and operated upon patients.

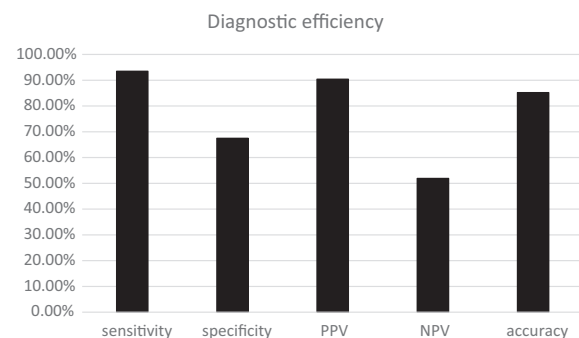
Total number of patients	425 (100%)
Number of patients with greater tuberosity sclerosis	398 (93.6%)
Number of patients with no greater tuberosity sclerosis	27 (6.4%)
Number of patients with rotator cuff tear	360 (90%)
Number of patients with no rotator cuff tear	65 (15.3%)
Number of patients operated upon	100 (23.5%)



**Chart 1.**

**Table 3**  
Diagnostic efficiency of greater tuberosity sclerosis for rotator cuff tear.

Sensitivity	93.5%
Specificity	67.5%
PPV	90.4%
NPV	51.9%
Accuracy	85.2%



**Chart 2.**

However, no relation was found between sclerosis of the greater tuberosity and the site of the tear ( $p$  0.49). (Table 4).

While being more prominent with large-sized tears ( $p$   $< 0.05$ ); tears were categorized as small  $\leq 1-3$  cm tears and large  $> 3$  cm tears (Table 5).

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