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: 2004 7 2006 6  
35

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가 가 (8, 9).  
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(1).

가 가 (acromio -  
humeral distance)

2004 7 1 2006 6 30

(1 - 7).

26

61  
35

1  
2  
3

2007 5 21

2007 8 1

76

35  
24

가

11

53.5

33

2

12 7 29.2 70 T1 (TR/TE=566/14 msec)  
T2 (TR/TE=3300/98 msec)  
T1 (TR/TE=566/14 msec)  
T2 (TR/TE=3300/104 msec)  
(TR/TE=3200/34 msec)  
T2  
(TR/TE=3400/103 msec)  
(FOV) 14 cm, 256 × 224,  
4 mm 1 mm

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(true shoulder AP view), 30 (caudal 30 degree tilting view), (supraspinatus outlet view), (axillary lateral view)

1.5T Signa Twin Speed (General electric Medical Systems, Milwaukee, U.S.A.) 1.5T Magnetom Vision (Simens, Erlangen, Germany)

(supine, neutral position)

21 gadolinium (20 mL 0.1 mL Gd - system, PACS) DTPA ) 15 - 20 mL

T1 (TR/TE=850/9 msec)  
T2 (TR/TE=3100/107 msec)  
T1  
(TR/TE=850/10 msec) T2  
(TR/TE=3300/104 msec)  
T2 (TR/TE=3300/104 msec)  
14

가

grade 0, 가

grade 1, grade 2 (Fig. 1).

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(picture archiving and communicating



Fig. 1. Gradings of degenerative changes in acromion and greater tuberosity.  
A. grade 0, B. grade 1, C. grade 2.

(Fig. 2A - 2B, 3A, - 3B, 4A - 4B).

6

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24

, 24

1 cm (small size), 1  
 cm 3 cm (medium size), 3 cm  
 (large size)

SPSS

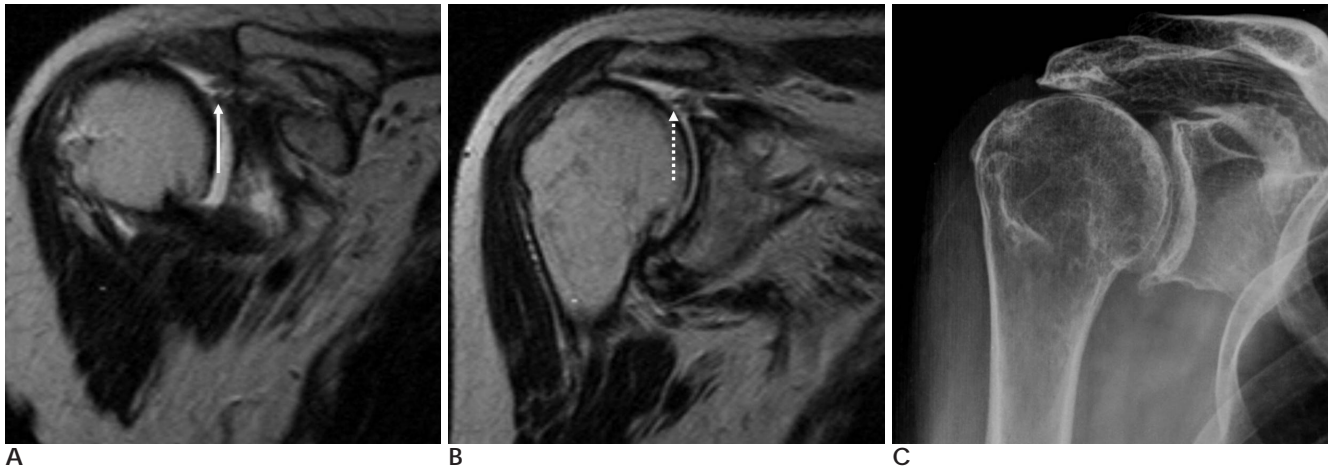
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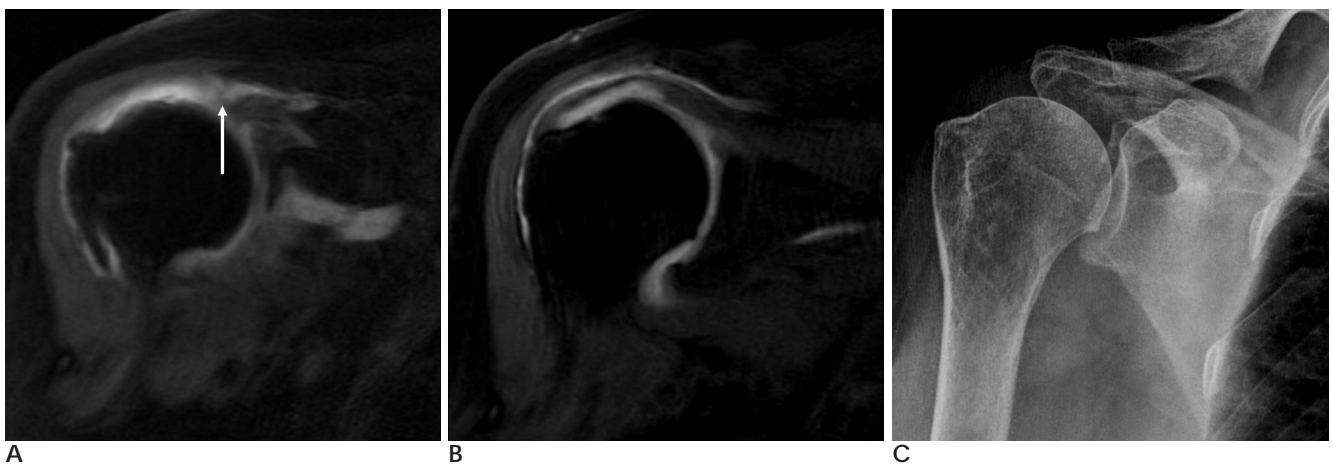


**Fig. 2.** 55-year-woman with complete and large size tear of supraspinatus tendon.

**A, B.** T2-weighted coronal MR images show complete tear in anterior to posterior portion of supraspinatus tendon.

**C.** Simple radiograph shows severe degenerative changes of shoulder joint (acromion = grade 2, greater tuberosity = grade 2) and marked decrease of acromiohumeral distance (acromiohumeral distance = 3.5 mm).

Note - arrow = anterior portion of torn supraspinatus tendon; dotted arrow = posterior portion of torn supraspinatus tendon with medial retraction.



**Fig. 3.** 76-year-old woman with incomplete and medium size tear of supraspinatus tendon.

**A, B.** T2-weighted fat saturated coronal MR arthrographs show torn anterior portion of supraspinatus tendon and intact posterior portion of supraspinatus tendon.

**C.** There is not evidence of severe degenerative change in shoulder joint on simple radiograph (acromion = grade 0; greater tuberosity = grade 1). The acromiohumeral distance was 8.8 mm.

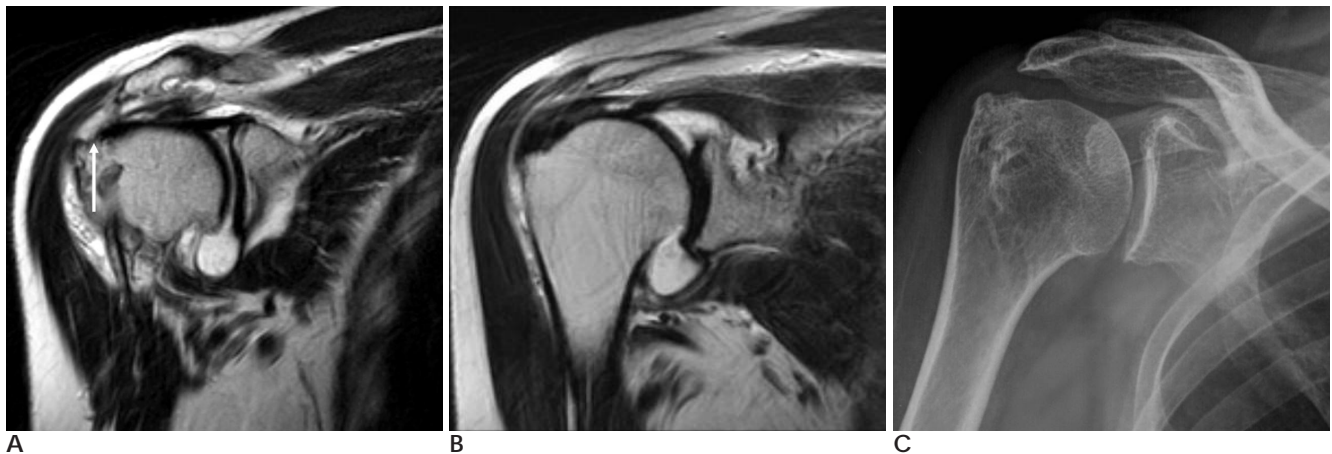
Note - arrow = anterior portion of torn supraspinatus tendon.

one - way ANOVA		( $p=0.001$ ),	가	-	가
(Table 2, Fig. 2 - 4)					
(Table 1, Fig. 2 - 4)	가	가	grade 2	가	
	grade가	( $p=0.959$ ).		가	
2	grade				
0, grade 1, grade 2가	grade 2가				
가	( $p=0.102$ ).				
		grade가			
		가	( $p=0.397$ ).		
가 9.3 mm ( , 6.4 - 11.3 mm;	, $\pm 1.4$				
mm)	가 7.2				
mm ( , 4.0 - 9.4 mm;	, $\pm 2.0$ mm)		( $n=13$ )	9.5 mm ( , 6.4 - 11.3 mm;	
-	가	, $\pm 1.4$ mm),	( $n=17$ )	8.0 mm (	

**Table 1.** Degenerative Changes of Acromion and Greater Tuberosity, and Mean Acromiohumeral Distance According to Degree of Tear

Simple Radiographic Findings	Incomplete Tear ( $n=22$ )		Complete Tear ( $n=13$ )	
	Acromion	Greater Tuberosity	Acromion	Greater Tuberosity
Degenerative Change				
Grade 0	2 (9%)	2 (9%)	0 (0%)	0 (0%)
Grade 1	11 (50%)	11 (50%)	3 (23%)	3 (23%)
Grade 2	9 (41%)	9 (41%)	10 (77%)	10 (77%)
Mean AHD (mm)	9.3 (range, 6.4 - 11.3; SD, $\pm 1.4$ )		7.2 (range, 4.0 - 9.4; SD $\pm 2.0$ )	

Note - AHD = acromiohumeral distance; SD = standard deviation



**Fig. 4.** 68-year-old woman with incomplete and medium size tear of supraspinatus tendon.  
**A, B.** T2-weighted coronal MR arthrographs show torn anterior portion of supraspinatus tendon and intact posterior portion of supraspinatus tendon.  
**C.** Simple radiograph shows severe degenerative changes of shoulder joint (acromion = grade 2; greater tuberosity = grade 2). The acromiohumeral distance was 7.2 mm.  
 Note - arrow = anterior portion of torn supraspinatus tendon.

, 4.0 - 10.8 mm; ,  $\pm 1.8$  mm),  
(n=5) 7.5 mm ( , 3.5 - 9.4 mm; , 1.9 mm)  
가 가

( $p= 0.041$ ).

- (acromio - humeral distance) ,

(1 - 7).

(Table 3)

가 grade2 (2, 10).  
( $p=0.510$ ). Saupe (3) 63  
- 가 7 mm (n=21) 19  
grade2가 (90%) , 14 (64%)  
, 9 (43%)  
( $p=0.778$ ). 가 -  
가 (n=8) 8.0 mm ( , 4.5 -  
10.3 mm; ,  $\pm 1.9$  mm) ,  
(n=17) 8.5 mm ( , 4.0 - 10.8 mm; ,  $\pm 1.6$   
mm) . (n=10) 9.0 mm ( , 3.5 -  
11.3 mm; , 2.4 mm) (Table 3). 61  
- 가 7 mm  
( $p=0.286$ ). (repair surgery) (flexion  
strength) (active movement) 가

**Table 2.** Degenerative Changes of Acromion and Greater Tuberosity, and Mean Acromiohumeral Distance According to Size of Tear

Simple Radiographic Findings	Small (n = 13)		Medium (n = 17)		Large (n = 5)	
	Acromion	Greater Tuberosity	Acromion	Greater Tuberosity	Acromion	Greater Tuberosity
Degenerative Changes						
Grade 0	1 (8%)	2 (15%)	1 (6%)	0 (0%)	0 (0%)	0 (0%)
Grade 1	6 (46%)	5 (39%)	6 (35%)	6 (35%)	2 (40%)	3 (60%)
Grade 2	6 (46%)	6 (46%)	10 (59%)	11 (65%)	3 (60%)	2 (40%)
Mean AHD (mm)	9.5 (range, 6.4 - 11.3; SD $\pm 1.4$ )		8.0 (range, 4.0 - 10.8; SD $\pm 1.8$ )		7.5 (range, 3.5 - 9.4; SD $\pm 1.9$ )	

Note - AHD = acromiohumeral distance; SD = standard deviation

**Table 3.** Degenerative Changes of Acromion and Greater Tuberosity, and Mean Acromiohumeral Distance According to Symptom Duration

Simple Radiographic Findings	Acute (n = 8)		Subacute (n = 17)		Chronic (n = 10)	
	Acromion	Greater Tuberosity	Acromion	Greater Tuberosity	Acromion	Greater Tuberosity
Degenerative Changes						
Grade 0	1 (13%)	1 (13%)	1 (6%)	1 (6%)	0 (0%)	0 (0%)
Grade 1	2 (25%)	2 (25%)	6 (35%)	7 (41%)	6 (60%)	5 (50%)
Grade 2	5 (62%)	5 (62%)	10 (59%)	9 (53%)	4 (40%)	5 (50%)
Mean AHD(mm)	8.0 (range, 4.5 - 10.3; SD $\pm 1.9$ )		8.5 (range, 4.0 - 10.8; SD $\pm 1.6$ )		9.0 (range, 3.5 - 11.3; SD $\pm 2.4$ )	

Note - AHD = acromiohumeral distance; SD = standard deviation

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(4, 5).

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. Bartolozzi (17)

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Bokor (18)

53

(13).

(NSAID)

(aging phenomenon)

3

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6

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(6, 7, 14, 15).

Cone (6)

(arthrography)

(bursography)

(specimen analysis)

가

, Hardy (14)

36

(selection bias)

(acromioclavicular joint)

가

Huang (7) 108

(golden

standard)

(cortical thickening)

(subcortical sclerosis)

가

가

, Neer (15)

가

48

(hemiarthroplasty)

1

가

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. Huang (7)

, Williams (16) 120

1. Moosikasuwan JB, Miller TT, and Burke BJ. Rotator cuff tears: clinical, radiographic, and US findings. *Radiographics* 2005;25: 1591-1607

2. Kotzen LM. Roentgen diagnosis of rotator cuff tear. Report of 48 surgically proven cases. *Am J Roentgenol Radium Ther Nucl Med* 1971;112:507-511
3. Saupe N, Pfirrmann CW, Schmid MR, Jost B, Werner CM, Zanetti M. Association between rotator cuff abnormalities and reduced acromiohumeral distance. *AJR Am J Roentgenol* 2006;187:376-382
4. Epstein RE, Schweitzer ME, Frieman BG, Fenlin JM Jr, Mitchell DG. Hooked acromion: prevalence on MR images of painful shoulders. *Radiology* 1993;187:479-481
5. : . 1999; 41:1183-1187
6. Cone RO 3rd, Resnick D, Danzig L. Shoulder impingement syndrome: radiographic evaluation. *Radiology* 1984;150:29-33
7. Huang LF, Rubin DA, Britton CA. Greater tuberosity changes as revealed by radiography: lack of clinical usefulness in patients with rotator cuff disease. *AJR Am J Roentgenol* 1999;172:1381-1388
8. Iannotti JP. Full thickness rotator cuff tears: factors affecting surgical outcome. *J Am Acad Orthop Surg* 1994;2:87-95
9. Iannotti JP, Bernot MP, Kuhlman JR, Kelley MJ, Williams GR. Postoperative assessment of shoulder function: a prospective study of full-thickness rotator cuff tears. *J Shoulder Elbow Surg* 1996;5: 449-457
10. van de Sande MA, Stoel BC, Rozing PM. Subacromial space measurement: a reliable method indicating fatty infiltration in patients with rheumatoid arthritis. *Clin Orthop Relat Res* 2006;451:73-79
11. Nove-Josserand L, Levigne C, Noel E, Walch G. The acromiohumeral interval. A study of the factors influencing its height. *Rev Chir Orthop Reparatrice Appar Mot* 1996;82:379-385
12. Ellman H, Hanks G, Bayer M. Repair of the rotator cuff. End-result study of factors influencing reconstruction. *J Bone Joint Surg Am* 1986;68:1136-1144
13. Donald Resnick. *Bone and joint imaging*. Philadelphia, Pennsylvania. Elsevier Saunders 2005;373-375
14. Hardy DC, Vogler JB, White RH. The shoulder impingement syndrome: prevalence of radiographic findings and correlation with response to therapy. *AJR Am J Roentgenol* 1986;147:557-561
15. Neer CS 2nd. Replacement arthroplasty for glenohumeral osteoarthritis. *J Bone Joint Surg Am* 1974 ;56:1-13
16. Williams M, Lambert RG, Jhangri GS, Grace M, Zelaso J, Wong B, et al. Humeral head cysts and rotator cuff tears: an MR arthrographic study. *Skeletal Radiol* 2006;35:909-914
17. Bartolozzi A, Andreychik D, Ahmad S. Determinants of outcome in the treatment of rotator cuff disease. *Clin Orthop Relat Res* 1994; 308:90-97
18. Bokor DJ, Hawkins RJ, Huckell GH, Angelo RL, Schickendantz MS. Results of nonoperative management of full-thickness tears of the rotator cuff. *Clin Orthop Relat Res* 1993;294:103-110

## Plain Radiographic Findings of a Supraspinatus Tear: Correlation with MR Findings<sup>1</sup>

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**Purpose:** To correlate the plain radiographic findings of a supraspinatus tear with the degree and extent of a supraspinatus tear on MR images.

**Materials and Methods:** We retrospectively reviewed the plain radiographs of 35 patients with a supraspinatus tendon tear confirmed by MRI and surgery from July 2004 to June 2006. On the plain radiographs, degenerative changes of acromion and the greater tuberosity and acromiohumeral distance were evaluated. Patients were divided into groups according to the degree and size of the supraspinatus tendon tear and the duration of symptoms. We compared the degenerative changes score and acromiohumeral distance among the groups.

**Results:** There was no statistically significant difference for the degenerative changes score for acromion and greater tuberosity among the groups classified by the degree and size of the supraspinatus tendon tear. However, the acromiohumeral distance was shorter as the extent of the tear was larger; this finding was statistically significant. There was no statistical correlation for the degenerative changes score and the acromiohumeral distance with the duration of symptoms.

**Conclusion:** On plain radiographs of the shoulder joint, a decreased acromiohumeral distance is useful to predict the degree and size of a supraspinatus tear, but degenerative changes are not useful to predict the degree and size of a supraspinatus tear and do not correlate with symptom duration.

**Index words :** Shoulder joint  
Rotator cuff  
Simple radiograph  
Magnetic resonance (MR)  
Acromion  
Rupture

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