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광범위 회전근 개 파열에서 방사선학적 소견과 임상 소견 간의 관계

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The Correlation Between Clinical Features and Radiographic Grades in Massive Rotator Cuff Tear Patients

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Purpose: The purpose of this study was to determine the correlation between the radiographic and clinical findings of massive rotator cuff tears.

Materials and Methods: Forty-five diagnosed cases (35 patients) of massive rotator cuff tears were investigated in this study. Grade of arthritis in the massive rotator cuff tears was classified based on plain radiographs using the method of Hamada et al.. And we clinically evaluated cases using the UCLA scoring system.

Results: No statistically significant correlation (r_s=0.220, p=0.151) was found between arthritis grades in massive rotator cuff tears and clinical features. Dominant arm involvement appeared to be related to a higher rate of surgical treatment and a lower UCLA score.

Conclusion: In massive rotator cuff tear patients, radiographic findings of arthritis may not always correspond to clinical features relevant in daily life. Therefore, we suggest that treatment strategies should be carefully considered when considering treatment modalities.

Key Words: Massive rotator cuff tear, Radiographic finding, Clinical feature

Introduction

Rotator cuff tear is one of the most common conditions affecting the shoulder[24]. However, the presence of a massive, irreparable rotator cuff tear is not incompatible with good overhead function[18]. These observations have made traditionally clinical decision making difficult in cases of symptomatic rotator cuff tears[24]. The treatment of massive rotator cuff tears

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remains a challenging dilemma and their shoulder function can be variable even in the presence of significant chronic rotator cuff deficiency.

Radiographically, the arthritic condition of the shoulder is characterized by humeral head elevation, a newly formed acromiohumeral articulation, loss of joint space at the glenohumeral joint, and adaptive changes on the acromion and humeral head. Patients with advanced disease may show a humeral head collapse, but not all patients with an irreparable rotator cuff tear subsequently develop painful symptomatic arthropathy[16].

Various treatment methods have been introduced to treat chronic massive rotator cuff tear with arthritis, however, it is difficult to obtain a satisfactory result using any of these treatment methods[5,7,12,13,17,19].

The patterns of radiographically detectable degenerative changes in patients with rotator cuff deficiency may vary, and in severe chronic rotator cuff tear patients, shoulder joint function may also vary[16]. Moreover, some patients show shoulder joint functions that do not correspond with radiographic findings, hence, treatment method selection has to be approached carefully. Some cases of massive rotator cuff tear show clinical symptoms that are not consistent with radiographic findings (Fig. 1). However, there are few reports on the correlation between the radiographic stages and its clinical features in massive rotator cuff tear in the literatures.

Therefore, the purpose of this study is to determine the correlation between the radiographic findings and the clinical features in massive rotator cuff tear patients.

Materials and methods

Forty-five cases in thirty-five patients diagnosed as having a massive rotator cuff tear affecting at least both the supraspinatus and infraspinatus tendons and with preoperative MRIs or ultrasonography were enrolled in this study. Massive rotator cuff tears were defined as those involving detachment of at least two entire tendons[10]. The patients presented at our outpatient clinic due to a shoulder problem between January 2003 and January 2005. The average patient age was sixty-one years (42~75), there were 16 men and 19 women, the right side was affected in 34 cases, and the left side in eleven. The dominant arm was involved in 33 cases and the non-dominant arm in twelve. We divided patient occupations into two groups according to physical intensity. There were 30 heavy laborers (23 farm workers and 7 construction workers) and 15 light laborers (9 housewives, 3 businessmen, 2 self-employed, and one unemployed).

Of the 45 cases suspected of having a massive rotator cuff tear, 28 cases were treated

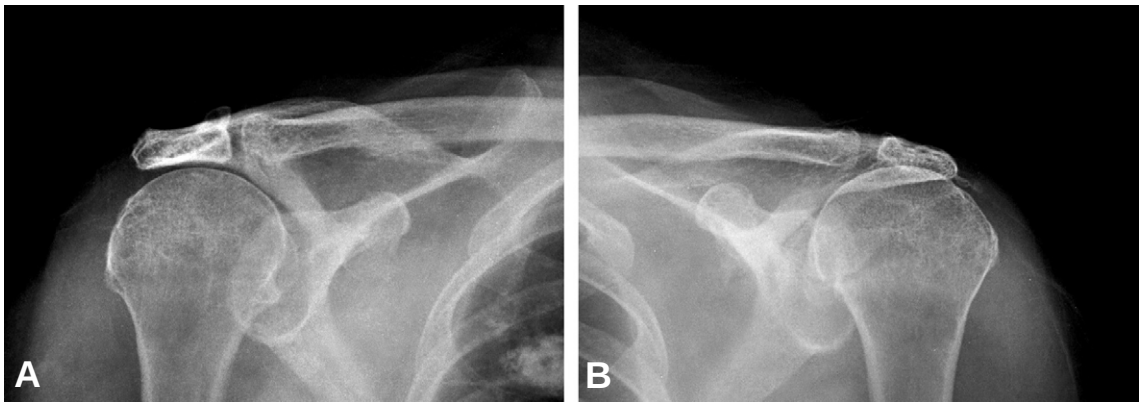

Fig. 1. 75 year old housewife who was treated nonoperatively. Her UCLA score of right shoulder was 32 points due to a slight shoulder pain and slight muscle weakness, and of the left shoulder was 34 points due to only slight muscle weakness. Anteroposterior radiographs show the radiographic findings of stage 3 **(A)** in the right side and stage 4 **(B)** in the left side according to the Hamada et al.[11] classification of arthritis in massive rotator cuff tears.

surgically due to severe pain and functional deficits to disturb active daily living of the affected shoulder joint after failure to conservative treatment. And, they showed findings of a massive rotator cuff tear intraoperatively, and the remaining 17 cases were treated non-operatively. Among the non-operatively treated cases, MRIs were obtained in five cases and ultrasonography in twelve.

Radiographic classification of massive rotator cuff tears

Plain radiographs obtained in the anteroposterior and axillary directions were analyzed for evidence of degenerative changes for all 45 affected shoulders. Grade of arthritis in the massive rotator cuff tears was classified based on plain radiographs using the method of Hamada et al.[11], which classifies massive rotator cuff tears into five grades based on radiographic findings of the acromiohumeral interval (AHI) narrowing, and degenerative changes of, the humeral head, tuberosities, acromion, and the acromioclavicular and glenohumeral joints. The classification of Hamada et al. was based mainly on the AHI, which is considered to be a sensitive indicator of the presence of a full-thickness cuff tear[11], an AHI of 6-7 mm has been reported to be the lower limit in normal shoulders by several authors[6,22].

Clinical evaluation

Functional assessments of shoulder were scored according to the UCLA shoulder scoring system[8]. We also evaluated the distributions of cases according to arthritis degree, the relationship between operation rate and the involvement of the dominant arm.

Statistical analysis

The differences between the results of the UCLA scores according to the degree of arthritis in massive rotator cuff tears, the need of operation, dominant arm involvement, gender, occupation, patients age, were compared using the Mann-Whitney or Kruskal-Wallis tests between groups.

Analyses of the correlations between UCLA scores and patient age and symptom duration were performed using Pearson's correlation test, and the correlation between UCLA scores and radiographic massive rotator cuff tear grades was determined using Spearman's correlation test. Statistical analyses were performed using SPSS version 11.0, and p-value of less than 0.05 was considered significant.

Results

Radiographical results

According to the classification of Hamada et al.[11], 9 cases (20%) had stage 1 disease, 23 (51%) stage 2, 7 (16%) stage 3, 5 (11%) stage 4, and one (2%) had stage 5. The majority of cases (51%) had Stage 2 disease (Table 1).

Clinical results

Of the 45 cases, the average UCLA score was 17.6±5.0 points in stage 1, 23.0±7.5 in stage

Table 1. Radiographic results

	Arthritis classification (Hamada et al.[11])					Total
Group	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	(cases)
Operation (case)	9	14	2	2	1	28
Non-operation (case)	0	9	5	3	0	17
Total (case) (%)	9	23	7	5	1	45
	(20)	(51)	(16)	(11)	(2)	(100)

2, 23.1±6.5 in stage 3, 22.6±9.5 in stage 4, and 9 in stage 5. The UCLA score of Stage 3 was the highest and that of Stage 5 was the lowest (Table 2). No statistically significant correlation was found between UCLA scores and radiographic grades of massive rotator cuff tears (r_s=0.220, p=0.151) (Fig. 2).

The average preoperative UCLA score was 18.8±6.0 points in the operation group and 26.3±7.4 points in the non-operation group (p=0.001). There was statistically significant differences of the average preoperative UCLA scores in categories of the pain (p=0.002), the function (p=0.008), and the satisfaction of the patient (p=0.002) (Table 3).

The average UCLA score was 19.6±6.1 points

Table 2. Clinical results

Category	Arthritis classification (Hamada et al.[11])				
	Stage 1 (Mean±SD)	Stage 2 (Mean±SD)	Stage 3 (Mean±SD)	Stage 4 (Mean±SD)	Stage 5 (Mean±SD)
Pain	5.3±1.4	5.4±2.7	6.3±2.1	6.8±2.3	2
Function	4.7±1.4	6.7±2.5	6.3±2.4	6.4±2.6	2
Active forward flexion	3.0±1.4	4.3±1.2	4.3±1.1	3.8±1.6	2
Muscle strength	4.0±0.5	3.7±0.5	3.4±0.5	3.6±0.9	3
Satisfaction	0.6±1.7	3.0±2.5	2.9±2.7	0.6±1.7	0
Total score	17.6±5.0	23.0±7.5	23.1±6.5	22.6±9.5	9
Number of case	9	23	7	5	1

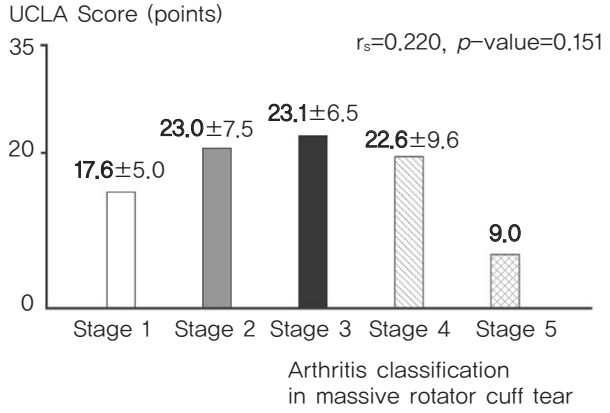

Fig. 2. The correlation between the UCLA scores and the grades of radiographic findings in massive rotator cuff tears has no statistically significances.

Table 3. Clinical results (preoperative UCLA score) in the operation and non-operation groups

	Group		p value
	Operation (Mean±SD)	Non-operation (Mean±SD)	
Pain	4.7±1.8	7.1±2.5	0.002
Function	5.3±2.0	7.4±2.5	0.008
Active forward flexion	3.7±1.4	4.2±1.3	0.168
Muscle strength	3.6±0.7	3.8±0.9	0.494
Satisfaction	1.4±2.3	3.8±2.2	0.002
Total	18.8±6.0	26.3±7.4	0.001

Table 4. UCLA scores tabulated by gender, occupation, patients age

		Number of cases	UCLA score (Mean±SD)	p value
Occupation	Light laborer	15	22.2±6.8	0.706
	Heavy laborer	30	21.3±7.8	
Gender	Male	20	21.4±8.6	0.672
	Female	25	21.8±6.5	
Age	< 50 years	5	15.6±4.4	0.105
	50-59 years	11	20.8±7.0	
	≥ 60 years	29	22.9±7.6	

in those with dominant arm involvement and 27.1±8.3 points in those with non-dominant arm involvement (p=0.003). In those with dominant arm involvement, 72.7% (24/33 cases) were treated surgically, whereas only 33.3% (4/12 cases) of those with non-dominant arm involvement were treated surgically.

In addition, UCLA scores were examined with respect to gender, occupation, and patient age and no statistically significant differences were detected (Table 4). Moreover, no statistically significant correlations were observed between UCLA scores and patient age (r=0.289, p=0.054) or symptom duration (r=0.060, p=0.712).

Discussion

Full-thickness tears of the rotator cuff tendons are a common and frequent cause of shoulder dysfunction[21]. The radiographic findings of rotator cuff tears have been reported continuously since Codman first reported it in 1934. In particular, many authors have mentioned the importance of AHI in connection with the radiographic findings of rotator cuff tears[6,22]. Walch et al.[21] judged reparability based on AHI values (<7 mm contraindicated repair) and referred to several reports on the topic[8,22].

In the 45 cases of the present study, AHI was less than 7 mm in 36 cases and greater than 6 mm in 9 cases, the latter of which could be classified as stage 1. In the present study, all stage 1 cases were treated surgically.

Hamada et al.[11] evaluated 22 cases of massive rotator cuff tear diagnosed using a special arthrographic technique, and established a classification system for arthritis in patients with massive rotator cuff tears by comparing and analyzing simple plain radiographic findings. In addition, they believed that a massive rotator cuff tear would progress to cuff tear arthropathy in a process involving several pathomechanisms and corresponding radiographic changes.

Neer et al.[15] explained that cuff tear arthropathy is the final stage of massive rotator cuff tear, and mentioned the nutritional and mechanical factors induced by the rotator cuff tear together with clinical, radiographic and pathological findings. Although they mentioned the clinical symptoms following a massive rotator cuff tear, they confined these symptoms to cuff tear arthropathy and did not mention any correlations between clinical and the radiographic findings.

Walch et al.[21] mentioned that the development of true cuff tear arthropathy, as described by Neer et al.[15], is not inevitable in patients with massive rotator cuff tears, and that in fact it occurs in only 4% of these patients.

In the present study, five cases in stage 4 and one case showing osteonecrosis of the humeral head in stage 5 (which was treated by hemiarthroplasty) showed glenohumeral arthritic changes.

A reviewing of the literature on arthroplasty for cuff-tear arthropathy revealed that severe pain, shoulder function impairment, and range of motion limitation later became problems, and that shoulder function scores before surgery were low in most cases. Various methods of arthroplasty were performed and reported results are as variable[1,2,3,9,14,20,23]. However, in these reports, it was rarely mentioned that patients sometimes had shoulder functions that were incompatible with radiographic findings of cuff tear arthropathy. It was also difficult to find mention of a correlation between radiographic stage and clinical features in massive rotator cuff tear.

According to the present study, the UCLA score of stage 3 was highest at 23.1 points, stage 1 was 17.6 points, and stage 5 was lowest at 9 points. However, we found no correlation between UCLA scores and arthritis stage (r_s=0.220, p=0.151), which suggests that the grade of radiographic findings of arthritis in massive rotator cuff tears may not always correspond to shoulder joint function in daily life. It may be that pathomechanical steps corresponding with radiographic changes may be present, as described by Hamada et al.[11], but that clinical findings may not correspond with

the progression of radiographical changes. Clinically, it would be interesting to investigate the major causes and factors of the inconsistencies between the radiographic and clinical findings in cases of massive rotator cuff tear.

We presume that the one of reasons why the patients with more severe radiological arthritic grade (stage 3) could show better clinical features than those of lower grades (Stage 1 and 2) is the possibility of functional rotator cuff tear pattern with captured (acromiohumeral) fulcrum kinematics defined by Burkhart[4]. There was enough sparing of posterior cuff and intact subscapularis that the lift off test was negative. However, the coronal plane force couple was not balanced enough to keep the humeral head centered in the glenoid, and the humerus subluxed superiorly to establish an acromiohumeral fulcrum. The deltoid was strong enough to allow elevation of the shoulder about this acromiohumeral fulcrum[4].

The major weakness of this study is that it is retrospective in nature and this study is not a community-based study, but hospital-based study with respect to study population. In addition, the other limitation is that various surgical modalities were considered simply as the single group which treated by surgical treatment. Another limitation of this study is scoring system. We evaluated the functional assessment of shoulder by the UCLA shoulder scoring system alone. UCLA scoring system includes the criterias about the subjective symptom (pain and satisfaction).

In conclusion, in massive rotator cuff tear patients, radiographic findings of arthritis may not always correspond to clinical features relevant in daily life. Therefore, we suggest that treatment strategies should be carefully considered during the decision-making process in the treatment of massive rotator cuff tear patients.

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초 록

목적: 본 연구의 목적은 광범위 회전근 개 파열에서 방사선학적 소견과 임상 소견 간의 관계를 알아보고자 하였다.

대상 및 방법: 광범위 회전근 개 파열로 진단된 45예 (35명)를 대상으로 하였다. Hamada의 분류법을 사용하여 광범위 회전근 개 파열 환자의 방사선학적 소견을 분석하고, 임상적 평가는 UCLA 점수를 이용하였으며, 서로 간의 결과를 비교하였다.

결과: 광범위 회전근 개 파열에서 관절염 등급과 임상 소견 사이에 유의한 연관성은 확인되지 않았다(r_s=0.220, p=0.151). 우세수 측 침범이 더 높은 수술적 치료의 비율과 더 낮은 UCLA 점수와 관련이 있었다.

결론: 광범위 회전근 개 파열 환자에서 관절염의 방사선학적 소견이 일상 생활에 영향을 미치는 임상적 소견과 항상 관련이 있는 것은 아닌 것으로 사료된다. 따라서, 광범위 회전근 개 파열 환자의 치료 방법의 결정에 있어서는 신중한 고려가 필요할 것으로 사료된다.

색인 단어: 광범위 회전근 개 파열, 방사선학적 소견, 임상 소견