P 1-34

Ultrasonograpic characteristics of Adhesive capsulitis according to Clinical staging

Jin Tae Hwang[1*], Kun Woo Kim[1], Jae Hyeong Choi[1], Jin Woo Suh[1], Kyung Jae Yoon[1], Yong Taek Lee[1], Jong Geol Do[1†]

Kangbuk Samsung Medical Center, Department of Rehabilitation Medicine[1]

Introduction
Adhesive capsulitis, or "frozen shoulder" is characterized by progressive pain and limited range of motion in glenohumeral joint, which is clinically divided into four stages. Since the clinical features resemble other shoulder pathologies, ultrasonography (US) could provide an adjunct clue to diagnosis. Recently, specific US parameters including thickening and hypervascularity of rotator interval (RI) and thickening of axillary recess (AR), are used to aid for proper diagnosis. The aim of this study was to estimate US features of adhesive capsulitis according to clinical staging.

Methods and Materials
We retrospectively enrolled 33 patients with unilateral adhesive capsulitis from November 2017 to May 2019. Diagnosis of adhesive capsulitis was made according to three criteria; (i) unilateral shoulder pain, (ii) shoulder stiffness, (iii) limitation of passive and active range of motion with capsular pattern. Clinical staging was determined by duration of symptom (stage 1 : 0-3 months, stage 2 : 3-9 months, stage 3 : 9-15 months, and stage 4 : 15-24 months). Thirteen patients were in stage 1 and 20 patients were in stage 2. There was no patient whose symptom duration is more than 9 months. Passive range of motion (PROM), numeric rating scale for pain (NRS) and shoulder pain and disability index (SPADI) were used to clinical assessment. Effusion of bicipital groove, thickness and vascularity of RI, and thickness of AR were evaluated by US. The ROC analysis was conducted for cut-off value for thickness of AR and RI. Subsequently, we analyzed the difference of US parameters according to the clinical staging.

Results
The mean thickness of RI and AR were significantly higher in the affected shoulder than the unaffected shoulder ($p<0.05$). The effusion of bicipital groove was significantly observed ($p< 0.001$), while there was no significant increased vascularity of RI (p-value = 0.151). The ROC analysis the best diagnostic performance using US parameters. The sensitivity, the specificity and the value of the AUC were 75.8%, 72.7%, and 0.81 for the thickened AR (>3.5mm), and 66.7%, 63.6%, and 0.66 for the thickened RI (>2.0mm). In

comparison with clinical stage 1 and 2, effusion of long head of biceps tendon sheath was frequently observed in stage 2 group (p<0.05).

Conclusion

In this study, thickness of AR and RI, and effusion of LHBT were significantly increased in adhesive capsulitis shoulder. In comparison with clinical stage, effusion of long head of biceps tendon sheath was frequently observed in stage 2. The ROC analysis revealed that thickened AR (>3.5mm) of the affected shoulder was best at distinguishing adhesive capsulitis patients from the unaffected shoulder.

Table 1. Characteristics of subjects

Characteristics	All patients (n=33)	Stage 1 group (n=13)	Stage 2 group (n=20)	p-value
Age (year)	56.5±8.2	58.4±8.6	55.2±8.0	0.284[a]
Sex : male/female	13/20	6/7	7/13	0.522[b]
Duration of symptoms (week)	15.5±9.0	8.0±3.5	20.4±8.1	<0.001[a]
Location : right/left	13/20	4/9	9/11	0.414[b]
Hypertension : yes/no	8/25	4/9	4/16	0.481[b]
Diabetes : yes/no	10/23	5/8	5/15	0.900[b]
Thyroid disease : yes/no	2/31	1/12	1/19	0.311[b]
Heart disease : yes/no	4/29	2/11	2/18	0.239[b]

Values are presented as mean±standard deviation.
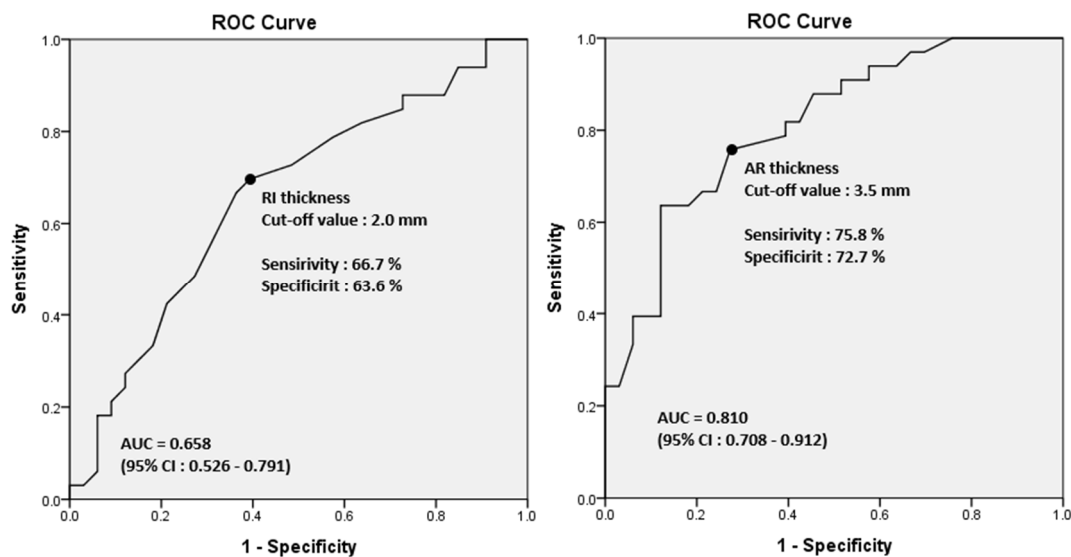a) Independent t-test, b) Chi-sqaure test

Figure 1 . ROC curve of RI and AR thickness

Table 2. Ultrasound parameters according to clinical stage(n=33)

Characteristics	Stage 1 (n=13)	Stage 2 (n=20)	p-value
Thickness of RI interval (mm)	2.0±0.6	2.3±0.9	0.309[a]
Thickness of axillary recess (mm)	4.5±1.8	4.7±1.4	0.706[a]
Difference of RI interval (mm)	0.4±0.4	0.4±0.5	0.987[a]
Difference of axillary recess (mm)	1.4±1.3	1.8±1.2	0.404[a]
Effusion of LHBT sheath : yes/no	3/10	12/8	0.037[b]
Hypervascularity of LHBT at RI : yes/no	0/13	2/18	0.239[b]

RI = rotator interval; LHBT = long head of biceps tendon;
a) Independent t-test, b) Chi-sqaure test