Original Article

Evaluation of the Coracohumeral Thickness in Patients with Shoulder Impingement Syndrome and Related Factors

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Abstract

Background: Subacromial space narrowing often leads to shoulder impingement syndrome (SIS), a debilitating upper extremity disorder. Given the scarcity of research on coracohumeral ligament (CHL) thickness and its clinico-radiological correlations in affected individuals, this study aimed to evaluate CHL thickness and identify its contributing factors in patients diagnosed with SIS.

Materials and Methods: All patients with SIS referred to Taleghani Hospital (Iran, Tehran) in 2025 were evaluated in a cross-sectional study. Patients underwent shoulder sonographic evaluations in terms of the CHL thickness, and its relationship with clinical and radiological parameters was assessed. The significance level was considered to be less than 0.05.

Results: The study population comprised 81 patients (mean age 49±14 years; 54.6% male). The mean CHL thickness was 1.62 ± 1.17 mm. Statistical analysis revealed that increased CHL thickness significantly correlated with reduced active range of motion in both seated and supine positions (r: -0.277, P: 0.018; and r: -0.244, P: 0.038, respectively). Similarly, significant negative correlations were found between CHL thickness and both pain intensity during stress (r: -0.279, P: 0.017) and scapular dyskinesia (r= -0.285, P: 0.014). CHL thickness showed a strong positive correlation with both proximal and distal coracoacromial ligament thickness (r: 0.412 and 0.553, respectively; both P-values: 0.00). No significant associations were observed with radiographic or MRI findings.

Conclusion: CHL thickness was associated with several clinical manifestations of SIS and may serve as a useful sonographic parameter during patient evaluation. Further controlled studies are needed to establish its diagnostic value.

Keywords: Coracohumeral ligament, Shoulder impingement syndrome, Sonography

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Introduction

Shoulder impingement syndrome (SIS) is a major cause of shoulder morbidity, accounting for approximately 40% to 64% of all shoulder-related clinical presentations[1]. Epidemiological data from the Netherlands indicate that rotator cuff tendinitis occurs at an annual rate of 3.2 to 4.2 per 1,000 individuals, whereas shoulder pain in general affects approximately 11.2 per 1,000 individuals. In the United Kingdom, nearly half of the population experiences shoulder discomfort during their lifetime, with subacromial impingement syndrome (SAIS) accounting for approximately 25% of these cases[2].

Commonly referred to as shoulder impingement in clinical practice, external impingement is a painful condition characterized by inflammation, irritation, and structural degeneration of the components within the subacromial space. Contemporary perspectives have shifted from considering SIS a single diagnosis to recognizing it as a multifactorial constellation of symptoms and anatomical variations[3]. Pathological compression, chronic degeneration, and mechanical attrition of the rotator cuff tendons are known to contribute to narrowing of the subacromial space. However, the causal relationship remains controversial, as it is unclear whether tendinous inflammation precedes impingement or whether narrowing of the subacromial space primarily drives tendon pathology[3,4].

Narrowing or obliteration of the subcoracoid space is a major cause of subcoracoid impingement. Previous studies have demonstrated that anterosuperior migration of the humeral head in rotator cuff-deficient shoulders, together with morphological variations of the coracoid process, lesser tuberosity, and bicipital groove, plays a significant role in this condition[5,6]. Ultrasonography enables quantification of the acromiohumeral distance (AHD) and coracohumeral distance (CHD), which represent the distances between the inferior aspect of the acromion and the humeral head, and between the posterolateral aspect of the coracoid process and the lesser tubercle, respectively. Although AHD and CHD have been associated with the clinical manifestations of SIS, further investigation is required[7-9]. In addition, alterations in the coracohumeral ligament (CHL) thickness have been reported in several shoulder disorders. However, specific evaluations of CHL thickness in patients with SIS remain limited[10,11]. Therefore, the present study aimed to assess CHL thickness in individuals with SIS and to identify its associated clinical and radiological manifestations.

Methods

Eligibility Criteria: This cross-sectional study was conducted on patients with shoulder impingement syndrome (SIS) who were admitted to the hospital in 2025. Patients were eligible for inclusion if they had a confirmed diagnosis of SIS. Conversely, individuals with concomitant shoulder pathologies (e.g., adhesive capsulitis), a history of corrective shoulder surgery, or non-compliance or unwillingness to provide informed consent were excluded from the study.

Clinical and Ultrasonographic Assessment: Eligible participants underwent a comprehensive evaluation that included demographic characteristics (age and sex), injury characteristics, pain profiles, affected musculoskeletal structures, and physical examination findings. Pain severity was assessed using a numerical rating scale (NRS) ranging from 0 to 10, based on the patient's subjective assessment of pain intensity. In addition, the presence of nocturnal pain and pain at rest was evaluated. Physical examinations were performed for each patient by an experienced orthopedic specialist. Scapular dyskinesia was assessed during physical examination and graded on a five-point ordinal scale ranging from 0 to 4 according to the severity of abnormal scapular motion. The obtained numerical scores were subsequently used for statistical correlation analyses with coracohumeral ligament thickness. Ultrasonography was used to measure coracohumeral ligament (CHL) thickness, enabling assessment of its prevalence and its potential associations with the aforementioned clinical parameters. Figure 1 demonstrates the normal appearance of the coracohumeral ligament on ultrasound imaging in an asymptomatic colleague.

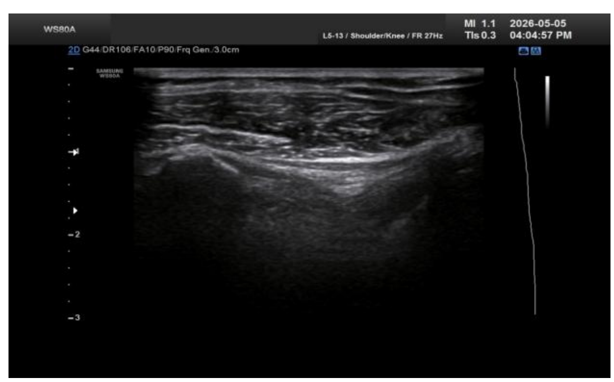

Figure 1. Demonstrates the normal appearance of the coracohumeral ligament on ultrasound imaging in an asymptomatic colleague.

Statistical Analysis: Data analysis was performed using IBM SPSS Statistics Version 26. Descriptive statistics, including means, standard deviations, and frequency distributions, were used to summarize the data. The associations between coracohumeral ligament (CHL) thickness and continuous clinical variables, specifically pain severity and range of motion (ROM), were assessed using Pearson or Spearman correlation coefficients, depending on data distribution normality. Statistical significance was defined as a p-value < 0.05.

Results

In this study, 81 patients with shoulder impingement syndrome (SIS) were evaluated. The mean age of the participants was 49 ± 14 years. Of the participants, 45 (54.6%) were male and 36 (44.4%) were female.
Clinical history and patient characteristics are presented in Table 1, whereas the findings of the physical examinations are summarized in Table 2.
Radiological findings, including sonographic, radiographic, and magnetic resonance imaging (MRI) findings, were evaluated in the patients, and the results are presented in Table 3.
Table 4 illustrates the associations between coracohumeral ligament (CHL) thickness and clinical history. Notably, pain elicited during stress testing demonstrated the strongest correlation with CHL thickness. Furthermore, a statistically significant association was observed between scapular dyskinesis and increased CHL thickness.
The correlations between coracohumeral ligament (CHL) thickness and several physical examination parameters, including range of motion (ROM), coracoacromial ligament (CAL) thickness, and physical examination findings, are summarized in Table 5. The findings demonstrated a statistically significant positive correlation between CHL and CAL thickness. Specifically, increased CHL thickness was associated with concomitant hypertrophy of the CAL in both its proximal and distal segments.
The associations between magnetic resonance imaging (MRI) findings and coracohumeral ligament (CHL) thickness were also evaluated. None of the MRI findings showed a significant association with CHL thickness (all p-values > 0.05).

Table 1. Results of the clinical history of patients with SIS.

Duration of Symptoms		Count	Column N %
Rest Pain	No	42	51.9
	Yes	39	48.1
Nocturnal pain	No	21	25.9
	Yes	60	74.1
NRS	2	1	1.2
	3	1	1.2
	4	7	8.6
	5	8	9.9
	6	24	29.6
	7	8	9.9
	8	13	16.0
	9	5	6.2
	10	14	17.3
Activity limitation	No	34	42.0
	Yes	47	58.0
Stress	No	77	95.1
	Yes	4	4.9

Discussion

Our findings demonstrated an inverse statistically significant correlation between coracohumeral ligament (CHL) thickness and active range of motion (ROM) in both sitting and supine positions, suggesting that ligamentous hypertrophy is associated with restricted joint mobility. Similarly, pain elicited during stress testing and the presence of scapular dyskinesis were significantly and negatively correlated with CHL thickness. Conversely, a strong positive association was observed between CHL thickness and the dimensions of the coracoacromial ligament (CAL) in both its proximal and distal segments. Notably, no significant statistical relationship was identified between CHL thickness and conventional shoulder imaging findings.
Shoulder impingement is characterized as a non-traumatic, unilateral condition presenting with peri-acromial pain during or following arm abduction. Historically, the syndrome has been attributed to mechanical entrapment of subacromial structures due to narrowing of the subacromial interval. However, this purely mechanical model has been questioned due to its limited ability to fully explain the underlying

Table 2. Results of physical examinations of patients with SIS.

		Count	Column N %	Mean	Standard deviation
Abduction	No	19	23.5	-	-
	Yes	62	76.5	-	-
External Rotation	No	57	70.4	-	-
	Yes	24	29.6	-	-
Forward Flexion	No	62	76.5	-	-
	Yes	19	23.5	-	-
Internal Rotation	No	47	58.0	-	-
	Yes	34	42.0	-	-
Active Sitting ROM		-	-	93.2	27.2
Passive Sitting ROM		-	-	98.8	21.1
ATA Test		-	-	100.4	28.0
Active Supine ROM		-	-	98.4	27.5
Passive Supine ROM		-	-	106.3	24.4
Modified ATA Test		-	-	103.6	34.8
Scapular Dyskinesia	0	18	22.2	-	-
	1	13	16.0	-	-
	2	33	40.7	-	-
	3	5	6.2	-	-
	4	12	14.8	-	-
Biceps Brachii Tendinitis	No	79	97.5	-	-
	Yes	2	2.5	-	-
Speed Test	No	59	72.8	-	-
	Yes	22	27.2	-	-
Shoulder Instability	No	75	92.6	-	-
	Yes	6	7.4	-	-
Painful Arc	No	5	6.2	-	-
	Yes	76	93.8	-	-
Jobe	No	42	51.9	-	-
	Yes	39	48.1	-	-
Resisted External Rotation	No	55	67.9	-	-
	Yes	25	30.9	-	-
	8	1	1.2	-	-
Neer	No	41	50.6	-	-
	Yes	40	49.4	-	-
Hawkins	No	36	44.4	-	-
	Yes	45	55.6	-	-
UpperTrapezius Muscle Trigger Points	No	54	66.7	-	-
	Yes	27	33.3	-	-
Rhomboid Muscle Trigger Points	No	78	96.3	-	-
	Yes	3	3.7	-	-
Deltoid Muscle Trigger oints	No	65	80.2	-	-
	Yes	16	19.8	-	-
InfraSpinatus Muscle Trigger Points	No	59	72.8	-	-
	Yes	22	27.2	-	-

pathology. Consequently, the term “subacromial pain syndrome” has emerged as a preferred diagnostic label,

Table 3. Results of sonographic, radiographic, and MRI findings in patients with SIS.

Variables		Count	Mean	Standard Deviation
SupraSpinatus Tendon	No	49	-	-
	Yes	32	-	-
Ac Joint Osteophyte	No	36	-	-
	Yes	45	-	-
Greater Tuberosity Cyst	No	56	-	-
	Yes	25	-	-
Subacromial Bursitis	No	33	-	-
	Yes	48	-	-
Subacromial Enthesophyte	No	74	-	-
	Yes	7	-	-
Subacromial Spur	No	78	-	-
	Yes	3	-	-
Biceps Brachii Tendinitis	No	79	-	-
	Yes	2	-	-
Upward Migration of Humeral Head	No	74	-	-
	Yes	7	-	-
Proximal Coracoacromial Ligament Thickness		-	0.69	0.70
Distal Coracoacromial Ligament Thickness		-	1.02	0.90
Thickening of the Coracohumeral Ligament		-	1.17	1.62
Subacromial Impingement in MRI	No	34	-	-
	Yes	47	-	-

encompassing a range of clinical and radiological entities, including supraspinatus tendinopathy, partial-thickness rotator cuff tears, calcific tendinitis, and subacromial bursitis[12,13].

Prior research has identified a moderate correlation between acromiohumeral distance (AHD) and coracohumeral distance (CHD) in both asymptomatic and symptomatic populations[14]. Specifically, Do et al. reported that pathological shoulders exhibited significant thickening of the supraspinatus tendon and subacromial bursa, along with reduced AHD and increased AHD% compared with contralateral healthy shoulders. Their findings demonstrated a linear positive correlation between supraspinatus tendon thickness and AHD metrics. Furthermore, receiver operating characteristic (ROC) analysis identified AHDAHD% as a superior diagnostic indicator (AUC: 0.877), suggesting that symptomatic subacromial impingement is closely associated with increased AHD% and tendinous hypertrophy. Threshold values of 65.6% for AHD% and 0.504 for AHDAHD% were proposed as robust diagnostic benchmarks for differential diagnosis[15]. In contrast to the findings of Do et al., our study demonstrated no significant association between coracohumeral ligament (CHL) thickness and either supraspinatus tendon or subacromial bursa dimensions. Notably, CHL thickness in our cohort was exclusively correlated with the proximal and distal segments of the coracoacromial ligament (CAL), with no significant associations observed with other tendinous structures. This discrepancy may be attributed to differences in sample size and demographic characteristics. These conflicting findings underscore the need for further investigation into the heterogeneous mechanisms of injury and the variable extent of soft-tissue involvement (tendons, ligaments, and bursae) across different patient populations, as the pathophysiological profile of shoulder impingement syndrome (SIS) may be population-specific.

Ting et al. explored the interrelationships between coracohumeral ligament (CHL) morphology, coracohumeral distance (CHD), and subscapularis (SSC) muscle characteristics in patients with subcoracoid impingement. Their findings indicated a moderate correlation between CHL thickness and CHD

Table 4. Results of the correlation between CHL thickness and clinical history findings in SIS patients.

Variabels		Thickening of the Coracohumeral Ligament
Rest Pain	Pearson Correlation	0.208
	P-value	0.07
	N	73
Abduction	Pearson Correlation	0.220
	P-value	0.061
	N	73
Stress	Pearson Correlation	0.279*
	P-value	0.017
	N	73
Scapular Dyskinesia	Pearson Correlation	0.285*
	P-value	0.014
	N	73

during both neutral position and internal rotation in subacromial cohorts. Notably, patients with subcoracoid impingement demonstrated significant CHL hypertrophy, increased subscapularis tendon thickness, and a higher SSC/CHD occupation ratio compared with healthy controls[16]. Similarly, our results demonstrated a significant inverse correlation between CHL thickness and active range of motion (ROM) in both sitting and supine positions, aligning with the findings of Ting et al. regarding the clinical impact of ligamentous alterations. Although our study did not directly measure subscapularis thickness, a significant association was observed between scapular dyskinesis and CHL thickness. Scapular dyskinesis is a well-established concomitant finding in various shoulder pathologies, including acromioclavicular instability, rotator cuff tears, glenoid labral lesions, and clavicular fractures, all of which share the common feature of impaired scapulohumeral rhythm[17]. Consequently, subscapularis involvement and scapular dyskinesis may serve as clinical markers of shoulder impingement syndrome, as evidenced by their significant correlation with the diagnostic features of the condition.

Regarding clinical symptoms and examinations, Wu et al. evaluated the correlation between coracohumeral ligament (CHL) thickness and shoulder range of motion (ROM) limitations, as well as disease duration in adhesive capsulitis, using ultrasonographic measurements. A total of 65 patients with a clinical diagnosis of adhesive capsulitis (AC) were included. A significant inverse correlation was observed between CHL thickness and shoulder ROM, including external rotation (ER) ($r=-0.335$, $P=0.006$) and internal rotation (IR) ($r=-0.409$, $P=0.001$). CHL thickness also correlated with disease duration ($r=-0.352$, $P=0.004$). After adjustment for age and disease duration, CHL thickness remained significantly associated with limitations in ER ($r=-0.293$, $P=0.02$) and IR ($r=-0.363$, $P=0.003$). Furthermore, the CHL was significantly thicker in patients with a disease duration exceeding 6 months[18].

In our study, a significant negative correlation was found between CHL thickness and active shoulder ROM in both sitting and supine positions, indicating that increased ligament thickness was associated with reduced active ROM. Pain during stress testing and scapular dyskinesis also showed significant negative correlations with CHL thickness. In a similar context, Oh et al. aimed to identify differences in dynamic coracohumeral distance (CHD) measured by ultrasound during various shoulder rotations and to examine its correlation with subscapularis tears. They reported no statistically significant differences in dynamic CHD across groups with different subscapularis tear statuses. However, based on the presence of dynamic subcoracoid stenosis, patients with this condition demonstrated significantly higher rates of partial subscapularis tears compared with those without stenosis[7]. A notable commonality across these studies is the use of ultrasonography for patient evaluation, highlighting its importance in assessing ligamentous thickness parameters. Indeed, ultrasonographic

Table 5. Results of the correlation between CHL thickness and physical examinations in patients with SIS.

Correlations		
		Thickening of the Coracohumeral Ligament
Active Sitting ROM	Pearson correlation	-0.277
	P-value	0.018
	N	73
Passive Sitting ROM	Pearson correlation	-0.191
	P-value	0.105
	N	73
ATA Test	Pearson correlation	-0.224
	P-value	0.057
	N	73
Active Supine ROM	Pearson correlation	-0.244
	P-value	0.038
	N	73
Passive Supine ROM	Pearson correlation	-0.200
	P-value	0.090
	N	73
Modified ATA Test	Pearson correlation	-0.110
	P-value	0.354
	N	73
Proximal Coracoacromial Ligament Thickness	Pearson correlation	0.412
	P-value	0.000
	N	73
Distal Coracoacromial Ligament Thickness	Pearson correlation	0.553
	P-value	0.000
	N	73

assessment of ligament thickness across various pathologies and populations may reveal meaningful correlations with clinical findings and physical examination results and may even provide predictive value for treatment outcomes; however, this potential warrant further investigation in future studies.

This study has several limitations. First, the absence of a healthy age-matched control group precluded direct comparison of coracohumeral ligament thickness between patients with shoulder impingement syndrome and the general population. Therefore, the observed values should be interpreted within the context of the studied patient cohort. Future controlled studies are required to establish normative sonographic values and diagnostic cutoff points for coracohumeral ligament thickness.

Second, although all ultrasonographic examinations were performed using a standardized imaging protocol by an experienced musculoskeletal radiologist, formal intra-observer and inter-observer reliability analyses were not conducted. The relatively wide variability observed in coracohumeral ligament thickness measurements may partly reflect patient heterogeneity as well as measurement variability. Future studies should evaluate the reproducibility of these measurements using reliability indices such as intraclass correlation coefficients.

Conclusion

It is concluded that coracohumeral ligament thickness was associated with several clinical manifestations of shoulder impingement syndrome, including reduced active range of motion, pain during stress testing, and scapular dyskinesia. In addition, CHL thickness demonstrated significant positive correlations with proximal and distal coracoacromial ligament thickness. These findings suggest that CHL thickness may represent a useful sonographic parameter during the clinical evaluation of patients with SIS. However, further controlled studies are necessary to determine its diagnostic value and establish normative cutoff values.

Ethics approval

The Ethics Committee of IUMS waived the requirement for ethical approval (IR.SBMU.MSP.REC.1405.041).

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Conflict of Interest

The authors declare no conflicts of interest related to this study.

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