JOINTS (Journal Orthopaedi and Traumatology Surabaya)
October 2024; 13(2): 69-74, DOI: 10.20473/joints.v13i2.2024.69-74
Received: 04 February 2024 / Revised: 29 October 2024
Accepted: 29 October 2024 / Published: 31 October 2024

Original Article

Correlation Between Shoulder Pain Severity, Acromion Morphology, and Acromiohumeral Distance Using MRI: A Study at Haji Adam Malik Hospital Medan in 2022

Husnul Fuad Albar[1], Geon Rendy[1], Iman Dwi Winanto[1]

[1]Department of Orthopaedics and Traumatology, Faculty of Medicine, Universitas Sumatera Utara, Haji Adam Malik General Hospital, Medan, Indonesia

Correspondence should be addressed to Geon Rendy, Department of Orthopaedics and Traumatology, Faculty of Medicine, Universitas Sumatera Utara, Haji Adam Malik General Hospital, Jl. Dr. Mansyur No. 5, Padang Bulan, Medan Baru, Medan 20155, Indonesia. e-mail: geonrendy.gr@gmail.com

ABSTRACT

Background: Studies have shown that rotator cuff tears (RCTs) are the most common cause of shoulder pain and restricted movement. The acromion is a posterior shoulder landmark. Specific acromion morphologies may predispose individuals to rotator cuff tears. Furthermore, studies have found a correlation between supraspinatus tendon tears and acromiohumeral distance. This study examines how shoulder pain assessed with American Shoulder and Elbow Surgeons (ASES) score relates to acromion morphology and acromiohumeral distance on MRI at Haji Adam Malik Hospital in 2022.
Methods: This descriptive analytical study employed a cross-sectional approach. A total of 38 patients with a confirmed diagnosis of shoulder pain underwent shoulder MRI examinations and were assessed using the ASES score. Statistical analysis included assessing data normality and performing Spearman correlation analysis. Data were processed and analyzed using SPSS version 25.0.
Results: In this study of 38 patients, most participants were women with an average age of 54.66 years. The most common acromion type was type 1 (flat), and the most frequent acromiohumeral distance category was normal. There was no correlation between acromion type and ASES scores, but a moderate correlation was found between the scores and acromiohumeral distance (p=0.016). A positive correlation was observed between type III acromion and ASES score.
Conclusion: Shoulder pain based on ASES score has a moderate correlation with acromiohumeral distance and acromion type III variation has a positive correlation although there is no significant correlation was found between shoulder pain and acromion type.

Keywords: Acromiohumeral distance; Acromion type; ASES score; Health outcomes; Shoulder pain

INTRODUCTION

Epidemiological studies have shown that rotator cuff tears (RCTs) are a leading cause of shoulder pain and limited movement. Supraspinatus tears are the most common type of rotator cuff injury, with a prevalence of 61.9% in men and 38.1% in women. Supraspinatus tears are particularly common in individuals over 60 years of age; 70% of people over 80 have a supraspinatus tear.[1–3]

The acromion, a bony projection on the posterior shoulder, is formed by the posterolateral extension of the scapular spine, superior to the glenoid. It articulates with the clavicle and serves as the origin of the deltoid and trapezius muscles. Variations in acromial morphology can contribute to pathological conditions such as impingement syndrome and RCTs.[4,5] The most common method for classifying acromion types is based on morphological variations identified through imaging: flat (type I), curved (type II), hooked (type III), and convex (type IV).[6,7]

The specific etiology of rotator cuff tears remains unclear, but it is thought to be multifactorial, involving a combination of intrinsic and extrinsic factors. Intrinsic factors include degenerative changes, hypovascularity, and microstructural abnormalities of collagen fibers. Extrinsic factors include subacromial impingement, tensile overload, and repetitive use.[8] In 1983, Neer stated that 95% of rotator cuff tears are caused by mechanical impingement, which can be successfully treated with anterior acromioplasty.[9] One study observed the relationship between Neer's classification and supraspinatus tears, finding that Neer type 3 is associated with a higher incidence of supraspinatus tears/tendinitis, followed by Neer type 2.[10] Other studies have also found a lower lateral acromial angle (LAA) in patients with rotator cuff disease.[11,12]

Recent studies have shown that specific acromion morphology is a predisposing factor for RCTs. Previous studies have linked a lower LAA to RCTs. Additionally, patients with lateral acromial extension have a higher incidence of RCTs.[12] Balke et al. also reported differences in acromion morphology between patients with degenerative supraspinatus tears and those with traumatic tears.[13]

Aside from acromion morphology, studies have found a correlation between the severity of supraspinatus tendon tears and acromiohumeral distance. Xu et al. reported that a narrow acromiohumeral distance is positively correlated with the severity of supraspinatus tendon tears.[14] Razmjou et al. also reported that acromiohumeral distances of less than 6 mm have a strong correlation with advanced rotator cuff pathology.[15]

In patients with shoulder or elbow disorders, outcome assessment can be done using scores from the American Shoulder and Elbow Surgeons (ASES). The ASES assessment system is a popular and commonly used tool for evaluating shoulder and elbow disorders, particularly in assessing pain and function. This questionnaire was first created in 1994 in the United States and was developed to serve as a standard method for shoulder evaluation. The ASES score assessment has been adapted into various languages and is considered to provide a comprehensive shoulder evaluation compared to other scoring systems. This score has a maximum value of 100 and can be used in various shoulder pathologies. The assessment evaluates two aspects: pain and physical activity limitations that affect patients' quality of life.[16]

Acromion morphology plays an important role in rotator cuff tears, while acromiohumeral distance can influence tear severity. This study aims to examine the relationship between shoulder pain assessed with ASES score, acromion morphology, and acromiohumeral distance using MRI at Haji Adam Malik Hospital in 2022.

MATERIAL AND METHODS

This analytical descriptive study with a cross-sectional approach included patients with shoulder pain who were diagnosed at the Orthopedic and Traumatology Polyclinic of Haji Adam Malik Hospital in 2022. Inclusion criteria were: age over 45 years, shoulder pain, and undergoing MRI examination. Patients with a history of trauma to the shoulder, clavicle, or proximal humerus were excluded. Consecutive sampling was used for efficient subject recruitment. Based on the sample size calculation for correlation analysis, a minimum of 19 subjects was required. Acromion type and acromiohumeral distance were determined from MRI results. ASES scores were analyzed using the Spearman correlation test. All statistical analyses were performed using SPSS version 25.0 (IBM Corporation, Armonk, NY, USA).

RESULTS

The demographic data showed that most participants were women, and the most common acromion type was type 1. A study by Guo et al. reported that the most common acromion types are type 1 (flat) and type 2 (curved), each accounting for more than

Table 1. Participant characteristics

Characteristics	n (%)
Total	38 (100%)
Gender	
Man	11 (28,9%)
Woman	27 (71,1%)
Age	
Average (years old)	54,66 ±5,09
Acromion type	
I	13 (34,2%)
II	9 (23,7%)
III	7 (18,4%)
IV	9 (23,7%)
Acromiohumeral distance	
Narrow	11 (28,9%)
Normal	24 (63,2%)
Wide	3 (7,9%)
ASES score	
Average	81,13 ± 12,38

Table 2. Acromiohumeral distance and ASES score correlation test

			ASES Score	Distance Acromiohumeral
Spearman's rho	**ASES Score**	**Correlation Coefficient**	1.000	.387*
		Sig. (2-tailed)	.	.016
		N	38	38
	Acromiohumeral Distance	**Correlation Coefficient**	.387*	1.000
		Sig. (2-tailed)	.016	.
		N	38	38

*Correlation is significant at the 0.05 level (2-tailed).

40% of cases (Table 1).

There is a moderate correlation between shoulder pain (based on the ASES score) and acromiohumeral distance (based on MRI examination) at Haji Adam Malik Hospital (Table 2). Studies have shown a correlation between the severity of supraspinatus tendon tears and acromiohumeral distance. A narrow acromiohumeral distance may contribute to shoulder pain due to compression of the supraspinatus tendon between the humerus and the acromion. This compression can also lead to bursal tears from friction and abrasion.

There was no correlation between shoulder pain (based on the ASES score) and acromion type (based on MRI examination) at Haji Adam Malik Hospital (Tables 3 and 4). This finding is consistent with previous research by Ayangolu and Kaya, who studied clinical outcomes in patients undergoing arthroscopy, subacromial decompression, and acromioplasty. They found no association between acromion type and ASES scores assessed before or after surgery (p = 0.447).

DISCUSSION

The demographic data of this study showed that most participants were women, and the most common acromion type was type 1. This is consistent with research by Guo et al.,[17] which reported that the most common acromion types are type 1 (flat) and

Table 3. Acromion Type and ASES Score Correlation Test

			Acromion Type	ASES Score
Spearman's rho	Acromion Type	Correlation Coefficient	1.000	-.181
		Sig. (2-tailed)	.	.277
		N	38	38
	ASES Score	Correlation Coefficient	-.181	1.000
		Sig. (2-tailed)	.277	.
		N	38	38

Table 4. Stratified Acromion Type and ASES Score Correlation Test

Acromion type	r	p
Type I	-0.231	p > 0.05
Type II	-0.153	
Type III	0.675	
Type IV	-0.204	

type 2 (curved), each accounting for over 40% of cases. However, Koca et al.[18] found that type 2 was the most frequent, comprising 62% of their sample. An analysis by Yadav and Zhu[19] of published literature indicated that type 2 is the most commonly reported acromion type, followed by type 1.

Bigliani et al.[20] described three acromion types based on shape, noting that acromial slope can be associated with impingement and pain.[10] The upward or downward slope of the acromion can reduce the space available for the supraspinatus tendon, potentially causing damage. A study by Ban[10] on acromial morphology using MRI found that rotator cuff tears have a higher prevalence in patients with hooked (type 3) acromions ($p < 0.001$), which are also associated with impingement.

This study found no significant correlation between acromion type and ASES scores. This finding aligns with research by Ayangolu and Kaya,[21] who found no association between acromion type and ASES scores before or after arthroscopic subacromial decompression and acromioplasty ($p = 0.447$). In contrast, Bahtiyar et al.[22] found that type 3 acromions are associated with shoulder pain, likely due to a greater tendency for rotator cuff injury. However, that study used a different pain assessment tool and a larger sample size (n = 240). This suggests that further research with larger sample sizes may be needed to fully elucidate the relationship between acromion type and shoulder pain.

The results of this study yielded a correlation coefficient of r = 0.181. Based on this finding, a recalculation of the required sample size for further research regarding acromion type was performed as follows:

$$n = \left[\frac{1{,}96 + 0{,}84}{0{,}5 \ln (1 + 0{,}181 / 1 - 0{,}181)}\right]^2 + 3$$

n = 238,85

n= 239

A limitation of this study is the reliance on MRI for evaluating acromion morphology and acromiohumeral distance. X-ray examination, a more accessible and affordable imaging modality, could be included in future studies as an independent variable. This would allow for the evaluation of acromion morphology and its relationship to ASES score in diverse healthcare settings. Nonetheless, MRI remains the gold standard for comprehensive assessment of acromial morphology.

CONCLUSION

This study found no correlation between shoulder pain (based on the ASES score) and acromion type, but a moderate correlation was found

between shoulder pain and acromiohumeral distance. All measurements were based on MRI examinations conducted at Haji Adam Malik Hospital Medan.

ACKNOWLEDGMENTS

We would like to thank all of the staff and participants who took part in this research. We also thank the editors for their kind support and feedback, which greatly contributed to the improvement of this paper.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Jeong JJ, Park SE, Ji JH, Lee HH, Jung SH, Choi BS. Trans-tendon suture bridge rotator cuff repair with tenotomized pathologic biceps tendon augmentation in high-grade PASTA lesions. Arch Orthop Trauma Surg 2020;140(1):67–76.
2. Jeong J, Shin DC, Kim TH, Kim K. Prevalence of asymptomatic rotator cuff tear and their related factors in the Korean population. J Shoulder Elb Surg 2017;26(1):30–5.
3. Redondo-Alonso L, Chamorro-Moriana G, Jiménez-Rejano JJ, López-Tarrida P, Rid-ao-Fernández C. Relationship between chronic pathologies of the supraspinatus tendon and the long head of the biceps tendon: systematic review. BMC Musculoskelet Disord 2014;15:377.
4. Almokhtar AA, Qanat AS, Mulla A, Alqurashi Z, Aljeraisi A, Hegazw AH. Relationship between acromial anatomy and rotator cuff tears in Saudi Arabia population. Cureus 2020;12(5):e8304.
5. Mansur DI, Khanal K, Haque M, Sharma K. Morphometry of acromion process of human scapulae and its clinical importance amongst Nepalese population. Kathmandu Univ Med J 2012;10(38):33–6.
6. McLean A, Taylor F. Classifications in brief: Bigliani Classification of acromial morphology. Clin Orthop Relat Res 2019;477(8):1958-1961.
7. Mohamed RE, Abo-Sheisha DM. Assessment of acromial morphology in association with rotator cuff tear using magnetic resonance imaging. Egypgt J Radiol Nucl Med 2014;45(1):169-80.
8. Kajita Y, Harada Y, Takahashi R, Sagami R, Iwahori Y. A comprehensive analysis of the acromial morphology and etiological factors of partial rotator cuff tears. JSES International 2024;1-5.
9. Familiari F, Gonzalez-Zapata A, Ianno B, Galasso O, Gasparini G, McFarland E. Is acromioplaty necessary in the setting of full-thickness rotator cuff tears? A systematic review. J Orthopaed Traumatol 2015;16(3):167-74.
10. Ban DAA. Correlation of Supraspinatus Tears and Tendinosis with Acromion Morphology and Acromioclavicular Arthritis Based on Conventional MRI and CT. J Med Sci Clin Res 2019;7(6):106-15.
11. Hong G, Kong X, Zhang L, Zheng Y, Fan N, Zang L. Changes in the lateral acromion angle in rotator cuff tear patients with acromioplasty. Orthop Surg 2024;16(2):471-80.
12. Rashmeet K, Anshul D, Simmi G, Kapil B, Radhe G, Paramdeep S. Correlation of acromial morphology in association with rotator cuff tear : a retrospective study. Polish Journal of Radiology 2019;84:e459-e463.
13. Balke M, Liem D, Greshake O, Hoeher J, Bouillon B, Banerjee M. Differences in acromial morphology of shoulders in patients with degenerative and traumatic supraspinatus tendon tears. Knee Surg Sport Traumatol Arthrosc 2016;24(7):2200–5.
14. Xu M, Li Z, Zhou Y, Ji B, Tian S, Chen G. Correlation between acromiohumeral distance and the severity of supraspinatus tendon tear by ultrasound imaging in a Chinese population. BMC Musculoskelet Disord 2020;21(1):1–6.
15. Razmjou H, Palinkas V, Christakis M, Kennedy D, Robarts S. Diagnostic value of acromiohumeral distance in rotator cuff pathology: Implications for advanced-practice physiotherapists. Physiother Canada 2020;72(1):52–62.
16. Wylie JD, Beckmann JT, Granger E, Tashjian RZ. Functional outcomes assessment in shoulder surgery. World J Orthop 2014;5(5):623–33.
17. Guo X, Ou M, Yi G, Qin B, Wang G, Fu S, et al. Correction between the morphology of acromion and acromial angle in Chinese population: A study on 292 scapulas. Biomed Res Int 2018;2018:1–6.
18. Koca R, Fazliogullari Z, Aydin BK, Durmaz MS, Karabulut AK, Dogan NU. Acromion types and morphometric evaluation of painful shoulders. Folia Morphol 2022;81(4):991–7.
19. Yadav SK, Zhu WH. A systematic review: Of acromion types and its effect on degenerative rotator cuff tear. Int J Orthop Sci 2017;3(1g):453–8.
20. Maalouly J, Tawk A, Aouad D, Abdallah A, Darwiche M, Abboud G, et al. Association of acromial morphological parameters and rotator cuff tears, and evaluation of the influence of age and

gender on the parameters and impact on cuff tears: A study on a Middle Eastern population. Asia Pac J Sports Med Arthrosc Rehabil Technol 2020;20:17-23.
21. Kaya Ye, Ayanoğlu T. Short-Term Results of patients undergoing arthroscopic subacromial decompression and acromioplasty. J DU Health Sci Inst 2021;11(3):353-7.
22. Bahtiyar B, Açikgöz AK, Bozkir MG. Evaluation of acromion morphology and subacromial distance in patients with shoulder pain. J Surg Med 2022;6(5):567–72.