Acromiohumeral Center Edge Angle for Predicting Degenerative Rotator Cuff Tear in Aging Patients: A Retrospective Study

Nithi Pakmanee, MD, Siravich Suvithayasiri, MD, Tanadul Jarrusrojwuttikul, MD, Sasikarn Wanitchakorn, MD, Sittan Aimprasittichai, MD

Department of Orthopedic Surgery,
Chulabhorn Hospital, Chulabhorn Royal Academy
Bangkok, Thailand

Disclosures:

• The authors involved do not have affiliations with any companies and did not receive any benefits for any products used in this study.

Background

- Degenerative rotator cuff tears (DRCT) are the most common causes of shoulder pain in aging shoulders[1].

- The etiology of DRCT remains unclear and controversial.

- Numerous radiographic measurements attempting to describe acromion morphology have been described previously.

- Singleton et al.[2] proposed a new radiographic parameter: the acromiohumeral center edge angle (ACEA) which was shown to be more accurate and reproducible than previously proposed values.

- However, this study only included patients with traumatic rotator cuff tears.

- Thus, the reliability of ACEA in degenerative rotator cuff tears still needs to be further explored.

Objective

Aim
- To validate and study the relationship between the acromiohumeral center edge angle (ACEA) and degenerative rotator cuff tears.
- To compare the predictive value of ACEA to more widely studied parameters, including acromion index (AI), lateral acromion angle (LAA), and critical shoulder angle (CSA).

Hypothesis
- We believe that ACEA is a valid and reliable method for predicting degenerative rotator cuff tears. Patients with higher ACEA are more likely to experience degenerative rotator cuff tears.

Material and Methods

- A retrospective cross-sectional study at Chulabhorn Hospital, Bangkok, Thailand between May 2021 and December 2021.

- Inclusion criteria:
  - Patient who had the Magnetic Resonance Imaging (MRI) of the shoulder at Chulabhorn Hospital from January 2005 to July 2021.

- Exclusion criteria:
  - Previous shoulder surgery, history of traumatic event, fracture, tumor, osteoarthritis, infection and the patients without a standard true anteroposterior shoulder radiograph.

Material and Methods

- **204 shoulder radiographs** obtained from patients aged ≥ 40 years.

- The study population was divided into two groups based on rotator cuff status as identified by magnetic resonance imaging (MRI).

- We compared various radiologic parameters in 108 patients with degenerative rotator cuff tears to 96 patients with intact rotator cuff tears.

- Two independent authors measured **the ACEA, AI, LAA,** and **CSA** values on a standardized anteroposterior shoulder radiograph. (Fig 1)
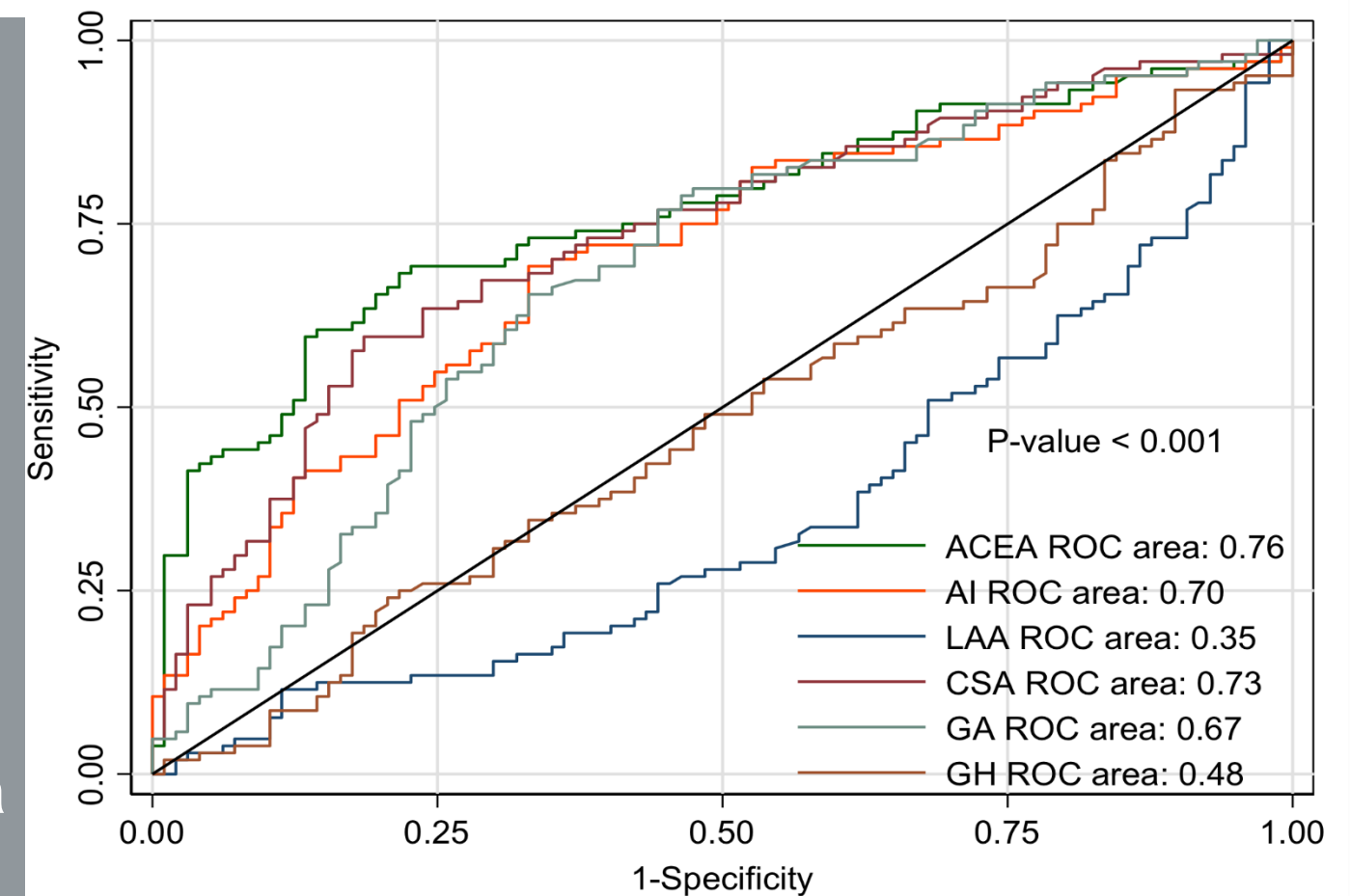
Figure 1.
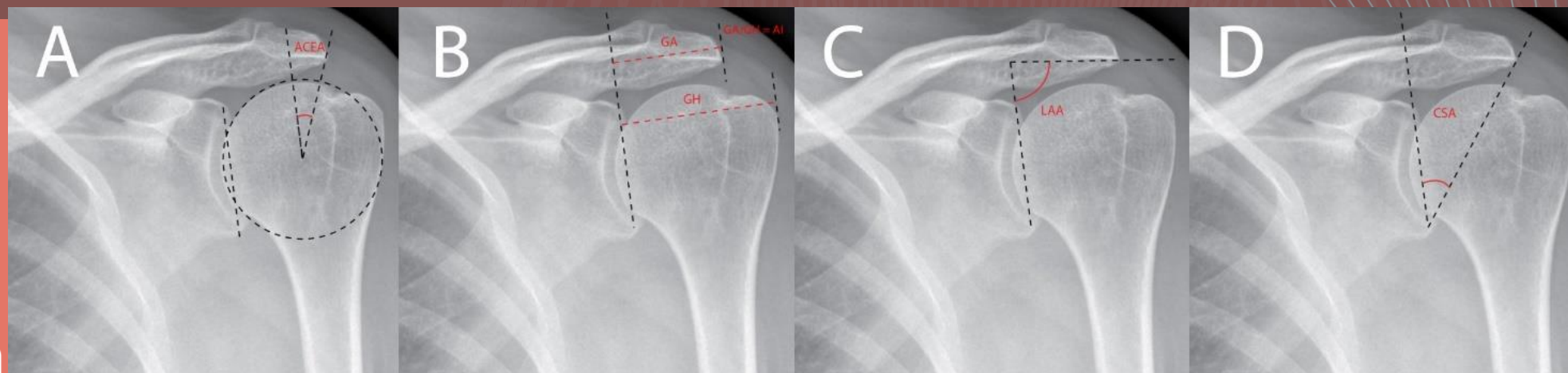
Results

Variable	Rotator cuff Intact	Rotator cuff tear	P-value
N	98	105	
Mean ± SD	55.38 (11.94)	63.57 (10.50)	*<0.001*
Sex N (%)			*0.546*
-Male	37 (37.76)	44 (41.90)	
-Female	61 (62.24)	61 (58.10)	
Medical Conditions			
-Diabetes Mellitus (DM) - Yes - No	 14 (14.29) 84 (85.71)	 20 (19.05) 85 (80.95)	 *0.364*
- Dyslipidemia - Yes - No	 27 (27.55) 71 (72.45)	 37 (35.24) 68 (64.76)	 *0.239*
- Inflammatory Joint Disorder - Yes - No	 1 (1.03) 96 (98.97)	 3 (2.86) 102 (97.14)	 *0.622*

Figure 1. Demographic data

- The mean age in the DRCT group was slightly higher than the control group (63.57 vs. 55.28; p<0.001).

- No statistically significant differences in gender and medical conditions were found between two group.

7

Results

- The mean ACEA was **significantly higher in the DRCT group** than in the intact group (33.11° vs. 24.56°, p<0.001).

- The ACEA has excellent reliability (intraclass correlation coefficient, 0.99).

- The cutoff value was determined to be **> 29.88°** (sensitivity, 0.69; specificity, 0.78).

- ACEA had the best predictive value (Area under curve: 0.76) and reliability compared with AI, LAA, and CSA.

Figure 2. Reciever operative characteristics (ROC) curve for the acromiohumeral centre edge angle (ACEA) *in green*, acromion angle (AI) *in red*, lateral acromion angle (LAA) *in blue*, critical shoulder angle (CSA) *in purple*, glenoacromial distance (GA) *in grey*, glenohumeral distance (GH) *in brown*.

Discussion

- Our study found **statistically significant** difference in the **average ACEA between the DCRT group and intact group (33.11° vs. 24.56°, p<0.001).**

- This indicated that a greater humeral head coverage could lead to degenerative rotator cuff tears.

- The average ACEA in our study was **higher** than reported by Singleton[2] in both groups (24.56° vs.16.6° in control group, 31.11° vs. 23.89° in DRCT group) which could be due to the difference in etiology or the racial differences.

- We included and studied in the patients with DRCT which the disease had gradually progressed without traumatic triggering. According to the theory of impingement, it was reasonable to assume that the average ACEA in shoulders with DRCT was larger than in the traumatic shoulders.

Discussion

- The reliability of ACEA is excellent (ICC = 0.99) which was consistent with previous Singleton et al.[2] and Vijittrakarnrung et al.[3] (0.93 and 0.96 respectively).

- An ROC analysis indicated a **cut off value of 29.88°** (sensitivity: 0.69, specificity:0.78) which is much higher than the cut-of value of 18° by Vijittrakarnrung et al.[3] (sensitivity 0.85, specificity 0.50).

- The mean age of the control groups was much higher (55.28 years) than by Singleton et al and Vijittrakarnrung et.[3] (35 and. 35.81 years, respectively. Having a younger control group limits the amount of aging-related acromion changes, which leads to the reduction of ACEA value of the control group and thus lowers the cut off value.

Conclusion

- The **ACEA** is an excellent, reliable, and superior predictor of degenerative rotator cuff tears compared to the popular AI, LAA, and CSA.

- Patients with **ACEA value** that are **> 29.88°** are more likely to be diagnosed with degenerative rotator cuff tears.

References

1. Keener JD, Patterson BM, Orvets N, Chamberlain AM. Degenerative Rotator Cuff Tears: Refining Surgical Indications Based on Natural History Data. *J Am Acad Orthop Surg*. 2019;27(5):156-65.
2. Singleton N, Agius L, Andrews S. The acromiohumeral centre edge angle: A new radiographic measurement and its association with rotator cuff pathology. *J Orthop Surg (Hong Kong)*. 2017;25(3):2309499017727.
3. Vijittrakarnrung C, Fuangfa P, Jaovisidha S, Kijkunasathian C. Correlation between full-thickness degenerative supraspinatus tear and radiographic parameters including the acromiohumeral centre edge angle and the greater tuberosity angle. *BMC Musculoskelet Disord*. 2021;22(1):607.

ISAKOS CONGRESS 2023

Boston Massachusetts June 18–June 21