



# Association Between Glenoacromial Spacing and the Risk for Shoulder Instability

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# Disclosures

- My coauthors and I have nothing to report



# Objective

- Utilize an existing cohort of cadets with prospectively collected MRI's, strength measurements and 4 year surveillance to evaluate for correlation of rotator cuff and deltoid strength to radiographic parameters, and is there any correlation with a risk for instability?



# Hot Topic/Background

- CSA - angle made between the plane of the glenoid and the lateral most aspect of the acromion
- CSA has been a controversial and hot topic

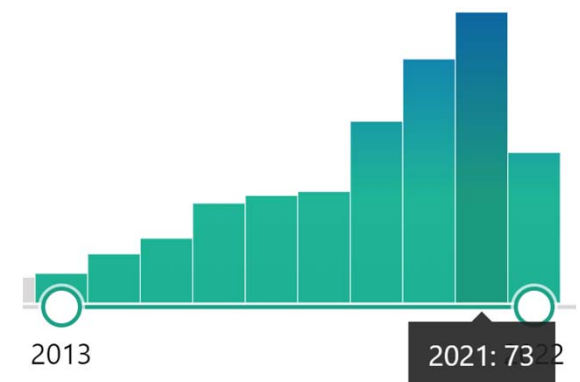


Editorial Commentary: #Fakeradiographicangle-Critical Shoulder Angle, Like Acromioplasty, May Not Be **Critical**.

Meislin R.

Arthroscopy. 2019 Nov;35(11):3144-3145. doi: 10.1016/j.arthro.2019.08.025.

PMID: 31699268



# Background

- Biomechanics studies showing higher supraspinatus strength required to keep shoulder located for higher CSA's
- Higher CSA = higher shear forces at the joint
- **Our goal – Can we find evidence of this in vivo?**

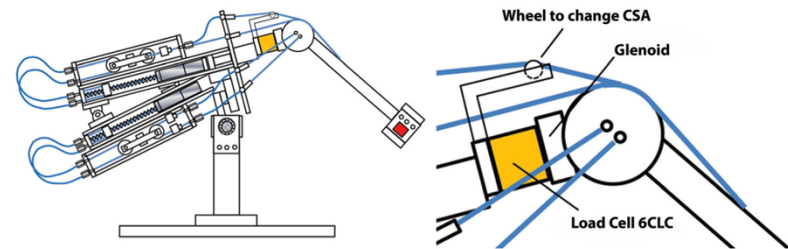
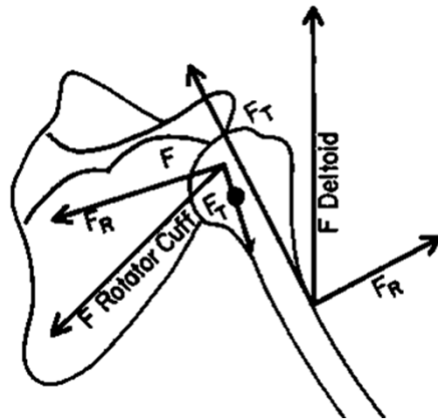
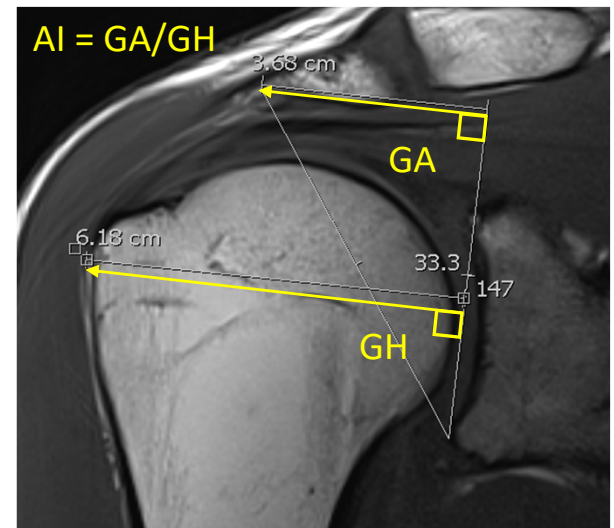
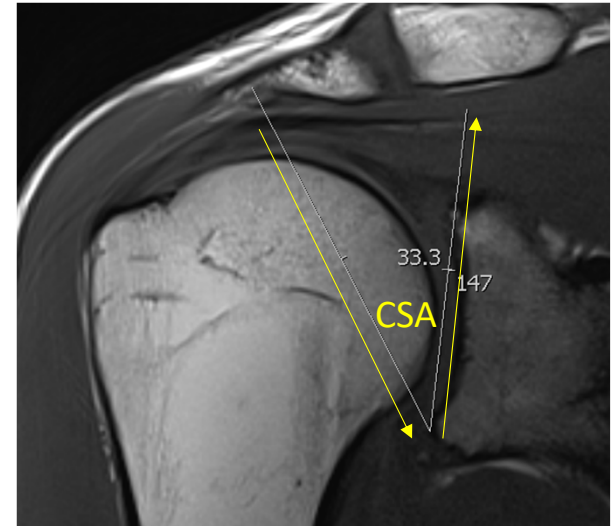


Figure 1. Left: shoulder simulator; right: device to change CSA.



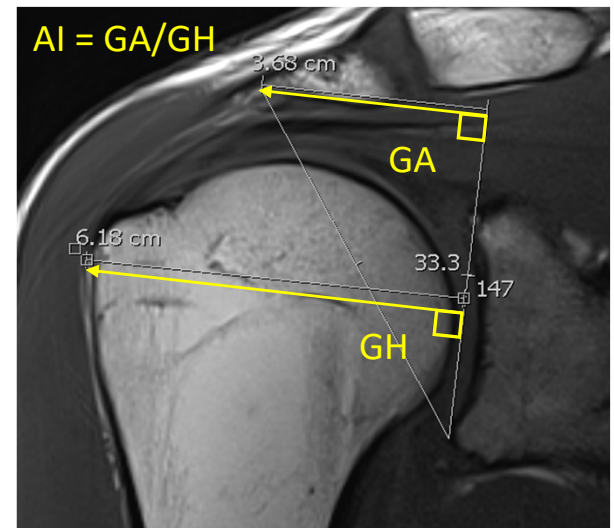
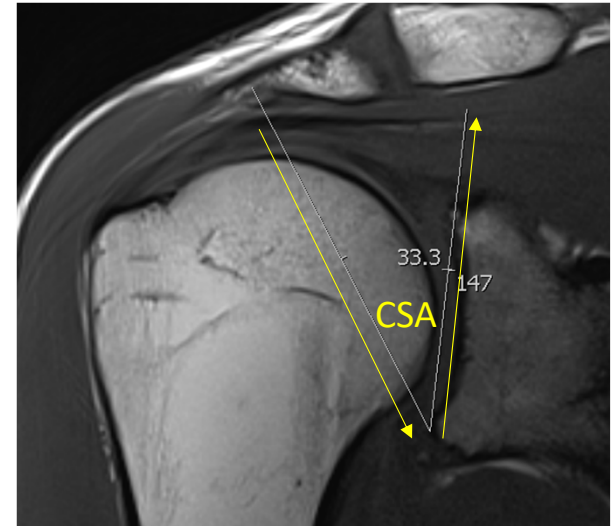
# Methods

- 320 MRIs; 36 cadets w/ instability; 125 controls
  - All subjects had bilateral MRI's
  - Controls randomly selected after stratifying the existing cohort by strength and dividing it into quartiles
- Baseline Bilateral Shoulder MRIs
- Baseline Rotator Cuff Strength Data
- Multivariate linear regression models controlling for
  - Sex, height, weight, limb dominance



# Methods

- CSA – Critical Shoulder Angle
- AI – Acromial Index
- GA – Glenoacromial Distance
- GH – Glenohumeral Distance



# Results

- Positive relationship detected between shoulder morphology and the likelihood of sustaining a shoulder instability injury

- CSA: OR = 1.29, 95% CI: 0.97, 1.72

- GA: OR = 14.63, 95% CI: 1.03, 206.98

- Positive relationship was detected between morphology and strength

- GH and ER strength at 45° abduction (Coefficient = 0.35, 95% CI: 0.04, 0.67)

- GA and ER strength at 45° abduction (Coefficient = 4.42, 95% CI: 1.16, 7.28)

- GA and IR strength at both 0° abduction (Coefficient = 4.29, 95% CI: 0.01, 8.56) and 45° abduction (Coefficient = 4.48, 95% CI: 0.81, 8.14).





You can see how the glenoacromial distance had a much larger affect on strength compared to the glenohumeral distance

### Association of Shoulder Morphology and Strength

Morphology	Strength (N)								
	ER 45°			IR 0°			IR 45°		
	Coef	Sig	95% CI	Coef	Sig	95% CI	Coef	Sig	95% CI
GH (cm)	0.352	<b>0.030</b>	0.035 , 0.669	0.010	0.966	-0.463 , 0.484	0.183	0.375	-0.223 , 0.590
GA (cm)	4.422	<b>0.003</b>	1.564 , 7.280	4.285	<b>0.049</b>	0.010 , 8.561	4.476	<b>0.017</b>	0.813 , 8.140

Bold value denotes significant result. Abbreviations: glenohumeral distance (GH), glenoacromial distance (GA), centimeter (cm), newton (N), external rotation (ER), internal rotation (IR), coefficient (coef), significance (sig), confidence interval (CI)



## Association of Shoulder Morphology and Instability Risk

### Shoulder Instability Risk

Morphology	OR	Sig	95% CI
CSA (degrees)	1.294	0.076	0.973 , 1.720
GA (cm)	14.631	<b>0.047</b>	1.034 , 206.978
GH (cm)	0.310	0.381	0.022 , 4.244

Bold value denotes significant result. Abbreviations: glenoacromial distance (GAD), glenohumeral distance (GHD), centimeter (cm), odds ratio (OR), significance (sig), confidence interval (CI)

This table depicts the relation between CSA, glenoacromial, and glenohumeral distances and the likelihood for shoulder instability.

The relation between glenoacromial distance and instability was significant. It's odds ratio would suggest that for every 1 cm increase in the glenoacromial distance, there is a 14 times increase in the likelihood of instability.

The CSA was not necessarily significant, but trended that way, and would suggest the consequences of every degree increase in CSA would result in a 30% increased likelihood of instability.



# Discussion/Conclusion

- Shoulders, like instability, are complex. These were crude measurements made in a single plane of a complex 3D structure, despite that...
- Glenoacromial distance linked to both ER and IR **strength** and **instability**
- Theory: Increased deltoid moment arm increases strength and shear, resulting in instability either directly or through an attritional or fatigue state



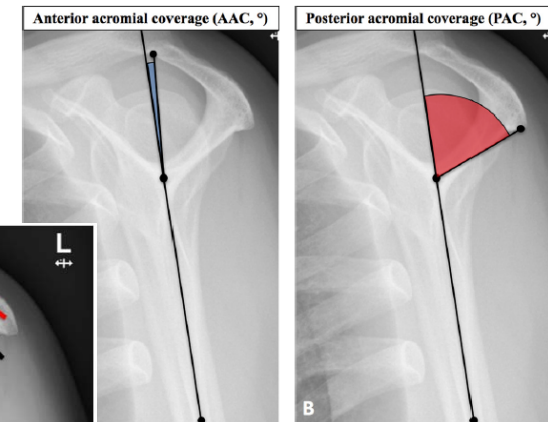
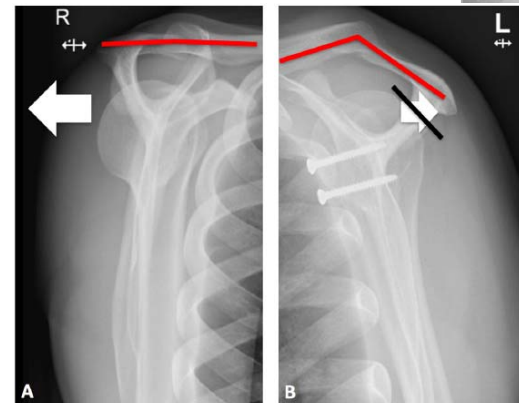
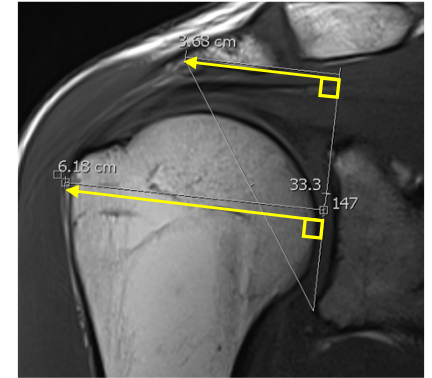
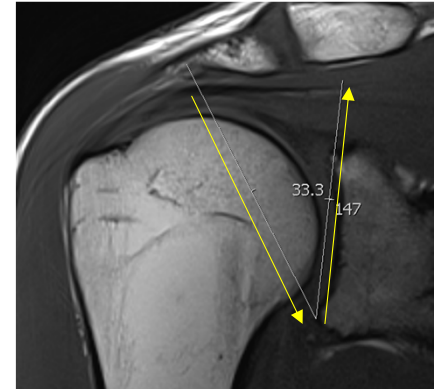
# Discussion/Conclusion

- No other significant relationships were detected
  - Unable to replicate biomechanics studies showing correlation to supra/deltoid strength ratio



# Next Steps

- We demonstrated a laterally positioned acromion is related to strength and instability risk but deltoid and cuff do not work purely in the coronal plane
- Moving forward, incorporate sagittal measurements



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