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Original Article

Acromiohumeral distance in patients with rotator cuff tears and shoulder impingement

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ABSTRACT

Objective: The aim of this study is to establish whether or not there is a relationship between acromiohumeral distance (AHD) and rotator cuff injury. Method: The study population consists of 50 patients (27 males, 23 females). AHD was measured using anteropsterior plain radiographs of the affected shoulder for each subject. It was compared with MRI findings of the same shoulder using the Chi-squared test. Results: From the Chi-squared test, it is found that Sig. = 0.370 which is < $\alpha/2=0.025$. This means the naught hypothesis (there is no relationship between AHD and Rotator cuff injury) should be accepted with refusal of the alternative hypothesis (there is a relationship between AHD and rotator cuff injury). Conclusion: A correlation between AHD and rotator cuff injury was not found. It was slightly larger in males compared to females.

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Introduction

Rotator cuff tears have a wide etiology, generally including traumatic and degenerative causes. The gold standard method for diagnosis is MRI, however MRI is not available in all centers. Because of this, radiography is an important tool for diagnosis. It helps in raising the possibility of rotator cuff tears by observing the superior migration / elevation of the humeral head and by measuring the acromohumeral distance on a plain anteroposterior (AP) shoulder radiograph. The normal subacromial space is 9-10mm According to a previous study done using 175 plain shoulder radiographs (88 males and 87 females); there was no left-right difference, it was also proven that a subacromial space less than 6mm is considered pathological in middle age, usually indicating a full-thickness cuff tear [2]. Wether the rotator cuff tears cause shortening of the acromiohumeral distance (AHD) or vice versa is still a matter of debate. The mechanism of upward displacement of the humeral head (which in turn narrows the AHD) is not clearly understood. Increased deltoid pull, lack of stabilization by the rotator cuff, and a tear in tendons acting as space holders have been considered.

Other studies were done to analyze factors affecting AHD, a large group of patients were operated on over a period of 10 years for full thickness tears of supraspinatus and infraspinatus +/- anterior cuff lesion. AP shoulder radiographs were done for all patients, only 84 of them had CT arthrograms to analyze fatty degeneration, there was a moderately significant association between AHD and duration of symptoms. It was discovered that the major depressor of the humeral head is the infraspinatus and rupture of the bicep tendon has no influence on AHD, although biceps dislocation can cause significant migration of humeral head superiorly. Therefore a narrow AHD should indicate a severe rotator cuff tear, dislocation of the bicep or muscle degeneration [3].

In 2006, a study was conducted where AHD was measured on plain radiographs and MRIs of 63 patients to evaluate the association of its reduction with rotator cuff disease. The AHD was related to the size of the rotator cuff tear and degree of fatty degeneration [1]. In other studies even morphological changes of the acromion which reduced the AHD led to shoulder impingement [6].

The aim of our study is to observe and analyze the correlation between acromiohumeral distance and rotator cuff tears at King Abdulaziz university hospital, Jeddah, Kingdom of Saudi Arabia.

Method:

The population of our study consists of 50 patients (see table 1), 27 males, 23 females, age ranges between 15-76 years with a mean age of 46.1. Seven age groups were formed from the population between 10 and 80 years, The largest amount of subjects were in the age group between 51y and 60y (see figure 1) .Imaging of the subjects consisted of anteroposterior X-ray and MRI of the affected shoulder. Data was collected retrospectively from the hospital's electronic database. The inclusion criteria was conventional anteroposterior radiograph of the shoulder, and an MRI of the same shoulder done in the same year at KAUH. There was no further exclusion criteria. The bioethics department approved of the collection of data with no need for a written consent to review the patients' medical files. Acromiohumeral distance (AHD) measurement: Images were reviewed using the hospital's database, Plain shoulder radiographs were displayed and 2 perpendicular lines were drawn, one was a tangent to the most inferior part of the acromion process, while the other was at the most superior subchondral part of the humeral head.

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The distance between these two lines was taken for every conventional radiograph in the sample (see table 2). AHD was divided into four groups. The MRI findings were recorded according to the reports written by the radiology consultants responsible for each case. They were divided into three groups: Group A represented those with the presence of a tendon or muscle tear, group B represented those with the presence of tendonopathy without a tear and group C represented those who neither had a tear nor any tendonopathy whatsoever (see table 3). The MRI findings were compared to AHD accordingly. Relationship between AHD and rotator cuff injury on MRI was tested using the Chi-square test. According to the Chi-square test, the naught hypothesis is: There is no relationship between the two variables, while the alternative hypothesis is: There is a relationship between the two variables.

Results and discussion:

After the Chi-square test was applied (see table 4) it was found that Sig. = 0.370 which is <α/2=0.025, which means the naught hypothesis is accepted and the alternative hypothesis is refused. Therefore, the results of this study suggest that there isn't a clear relationship between acromiohumeral distance (AHD) and the presence of a rotator cuff tear. The presence of a tear or tendinopathy did not correlate with shortening of AHD. Given the literature reviewed, the results of this study were quite surprising. 10 patients in group C (20% of the sample population) had an AHD less than 7mm contradicting the results of previous similar studies. The mean acromiohumeral distance is 4.5mm rounded to one decimal point. The AHD in males is slightly larger than that of females, the mean AHD in males is 5.0mm whereas it is 4.0mm in females. An arthrographic study showed that the average AHD in an intact shoulder was 10.5 mm, whereas it was only 8.2 mm if a tear of the rotator cuff tendons was present [7]. Another study showed complete supraspinatus tears in 90% of patients with an AHD <7mm (male and female) [6]. The mean values in this study were under the normal range of AHD which is 9-10mm according to a research carried out in Sweden [2]. A sample population of 50 may have created a deficiency in the study, perhaps a more accurate result would've been observed if the sample size was larger.

The plain x-ray samples that were used happened to have some images that were taken at a different angle than the standard AP shoulder radiograph, this may have increased the chance of error in measurement of AHD. Another negative point about the study is that the MRI findings were grouped into very wide categories, for example group A contained all MRI findings with the presence of a tear in the rotator cuff of the shoulder, while in other studies the AHD was not only compared with the mere presence of a rotator cuff tear, but also the degree of tear as well [6]. There was a wide range regarding the age of the patients in the sample population from King Abdulaziz university hospital, and according to research done in 1984; AHD is affected with aging in males [2]. The same study can be repeated with a larger sample taken from a wider variety of hospitals around the Kingdom and a more focused age group to enhance the accuracy of the research carried out. The results of this study give rise to a consideration that maybe there are factors other than rotator cuff tears that have an effect on changing AHD and they can be investigated further in future researches. In conclusion, a clear correlation between AHD and rotator cuff injury was not found. The AHD had no relationship with age. It was slightly larger in males compared to females.

Table 2. Distribution of subjects according to socioeconomic status (N=160)

Table 1 Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	27	54.0	54.0	54.0
Female	23	46.0	46.0	100.0
Total	50	100.0	100.0	

Figure 1 Age distribution

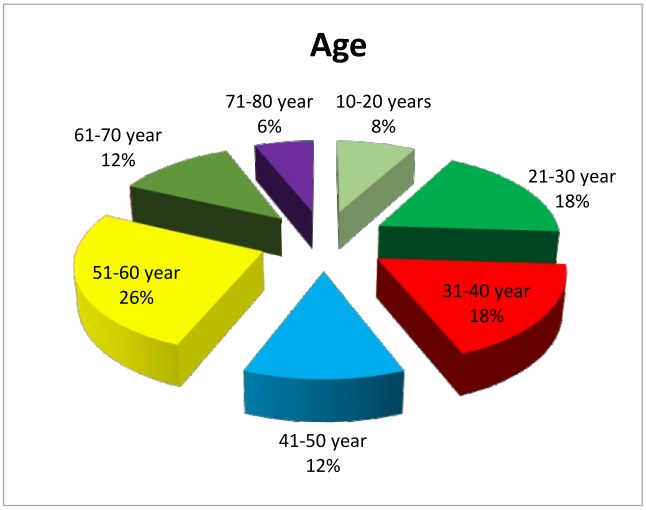


Table 2 Acromiohumeral distance

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 5 mm	27	54.0	54.0	54.0
5.1-10	17	34.0	34.0	88.0
10.1-15 mm	5	10.0	10.0	98.0
15.1and more	1	2.0	2.0	100.0
Total	50	100.0	100.0	

Table 3 MRI finding

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A(Tear)	22	44.0	44.0	44.0
	B(Tendono Pathy)	12	24.0	24.0	68.0
	C(Not tear neither tendono pathy)	16	32.0	32.0	100.0
	Total	50	100.0	100.0	

Table 4 : Chi-Square Test

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	75.363[a]	72	.370
Likelihood Ratio	85.335	72	.135
Linear-by-Linear Association	.160	1	.689
N of Valid Cases	50		

a. 111 cells (100.0%) have an expected count less than 5. The minimum expected count is 24.

Table 5: The MRI findings of males compared to females

		MRI			
		A	B	C	Total
Sex	Male	13	5	9	27
	Female	9	7	7	23
Total		22	12	16	50

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