

## Acromiohumeral distance in subacromial impingement syndrome: A radiographic evaluation

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### ABSTRACT

**INTRODUCTION:** Subacromial impingement is one of the commonest causes of shoulder pain in Orthopaedic clinic. The etiology of subacromial impingement can be divided into intrinsic and extrinsic causes. There is still a controversy as whether the rotator cuff tendinitis is the result of impingement or vice versa. The knowledge about the dominant etiology would be beneficial for guiding the treatment. This study is intended to compare the acromiohumeral distance in plain radiograph (as one of the determinants of the extrinsic pathomechanism) in the shoulders with impingement and without impingement. It will help to determine whether the extrinsic or intrinsic mechanism is predominant factor of impingement in our population.

**METHODS:** The acromiohumeral distance in the shoulder with subacromial impingement syndrome (n=35) and in those without impingement (n=38) were measured in plain radiograph and compared to know whether the narrowing of the subacromial space actually leads to rotator cuff impingement.

**RESULTS:** The mean acromiohumeral distance in the patients with impingement was  $7.43 \pm 2.0$  mm and the group without impingement was  $8.10 \pm 2.13$ mm. The p value for mean difference was 0.172.

**CONCLUSION:** The mean acromiohumeral distance was lower in the patient with impingement than in patients without impingement. However this was not significant statistically.

**KEYWORDS:** Acromiohumeral distance, Radiograph, Subacromial impingement syndrome

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### INTRODUCTION

Subacromial impingement syndrome (SAIS) is one of the most common causes of shoulder pain and accounts for around 44 to 65 percent of all complaints of shoulder pain.<sup>1</sup> To and fro movement of internal and external rotation in abducted arm brings the rotator cuff in contact with the anterior edge of acromion where it might get compressed.<sup>2</sup> This results in a clinical syndrome called subacromial impingement syndrome (SAIS) characterized by pain, weakness and stiffness.<sup>3-5</sup> The etiology of the SAIS is multifactorial and can be classified as

intrinsic or extrinsic. Intrinsic mechanism leads to edema of rotator cuff tendon and secondarily impingement that can be treated by conservative means directed towards reducing the edema of the tendons. Extrinsic impingement occurs where the tendon is normal but the subacromial space is narrowed leading to tendon impingement, hence the treatment should be directed towards surgical approach to increase the space. There is still a controversy whether the rotator cuff tendinitis is the result of impingement or vice versa.<sup>2</sup> Knowing the predominant mechanism in the involved shoulder would be beneficial to

guide the treatment.<sup>6</sup>

Decreased subacromial space in X-ray, Magnetic Resonance Imaging (MRI), Computed Tomograph(CT) and ultrasonography(USG) has been shown to be associated with SAIS.<sup>7-11</sup> MRI, CT and USG can be used to evaluate state of the rotator cuff but these investigations are expensive and not available at most of the medical centres in Nepal. The purpose of this study is to measure and compare the acromiohumeral distance (AHD) in plain radiograph (as one of the determinants of the extrinsic pathomechanism) in the shoulders with and without impingement syndrome. It will help to determine whether the extrinsic or intrinsic mechanism is predominant factor of impingement in our population.

## METHODS

Patients presenting to Orthopaedic OPD of Kathmandu Medical College from Dec 2013 to May 2014 with shoulder pain were evaluated for subacromial impingement. Patients with positive Neer's and Hawkins Kennedy tests were subjected to impingement test. Impingement test with injection of 10ml of 1% lignocaine was done to diagnose subacromial impingement.<sup>2</sup> Patients having temporary relief of the symptoms after injection were taken as case of subacromial impingement. The patients presenting to OPD or emergency with non traumatic shoulder pain and no clinical features of impingement or cuff tear were taken as control. Patients with skeletal maturity and those who agreed to participate in the study after written informed consent were included in the study. Standard anteroposterior view and supraspinatus outlet view of the affected shoulder for cases and controls were taken.<sup>12</sup> The X ray was exposed from a fixed distance of 100 centimetres for all the radiographs according to our Hospital Protocol. The acromiohumeral distance was measured in the AP view from the inferior surface of the acromion as determined by the dense line to the superior most part of the head of humerus by two independent observers and the mean of the two readings were taken as the acromiohumeral distance for analysis (fig 1).



Fig:1. Standard AP view of shoulder showing technique of Acromiohumeral distance measurement

The observers were blinded for case and control. Supraspinatus outlet view was used to determine the acromial shape (fig 2).



Fig:2. Supraspinatus outlet view for evaluation of the type of acromion

Constant Murley<sup>13,14</sup> score was calculated for the cases of subacromial impingement syndrome to determine the severity. This is a score to evaluate the functional status of shoulder on the basis of four parameters namely pain, activities of daily living, range of motion and power. The score in each parameter is summed up to calculate the full score out of total of 100. The difference between two shoulders is calculated to grade the severity. Difference of less than 11 points is considered as excellent function, 11-20 as good, 20-30 as fair and more than 30 as poor.

SPSS version 17 was used to compare the mean acromiohumeral distance between cases and controls by independent samples t test. The mean acromiohumeral distance in cases

with different functional status of shoulder on the basis of Constant score was also compared by one way anova test to know whether acromiohumeral distance correlated with the severity of impingement. The research was approved by Institutional Ethical Review Committee KMCTH.

**RESULTS**

There were 35 patients with subacromial impingement syndrome and 38 controls in the study. The demographic data is shown in table I.

Table I: Demographics of study population

	Cases	Control
Total	35	38
Mean Age (Range)	49.54yrs (22-80)	42.95yrs (22-77)
Sex	M:12 (34.3%), F23 (65.7%)	M:19 (50%), F 19 (50%)
Side	R: 20 (57.1%), L: 15 (42.9%)	R 20 (52.6%), L 18(47.4%)
Dominant side involvement	26 (74.3%)	20 (52.60%)
Mean Height	156.77 cm	158.92 cm

The mean duration of pain among the cases was significantly more (181.86 days) than in the control group (79.53 days).

The incidence of different types of acromion in two groups is shown in table II and figure 3.

Table II: Morphology of acromion among cases and controls

Morphology of acromion				
Group	Type I (Flat)	Type II (Curved)	Type III (hooked)	Total
Case	16 (45.70%)	17 (48.60%)	2 (5.70%)	35
Control	25 (65.80%)	11 (28.90%)	2 (5.30%)	38
Total	41 (56.20%)	28 (38.40%)	4 (5.50%)	73

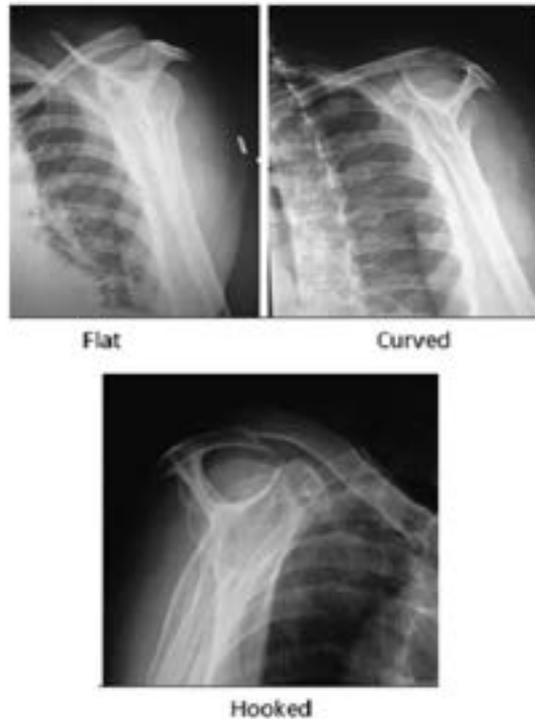


Fig 3. Different types of acromion as seen in supraspinatus outlet view

The most prevalent type of acromion was curved and flat among cases and controls respectively.

The mean acromiohumeral distance among the cases was 7.43 ± 2.0 mm and that among the controls was 8.10 ± 2.13mm. The difference in the mean AHD was not statistically significant as suggested by the p value of 0.172.

The mean acromiohumeral distance among the patients with shoulder impingement (cases) having excellent, good, fair and poor functional status of shoulder were 9.05 mm, 8.09 mm, 7.90 mm, and 6.52 mm respectively. Although the mean acromiohumeral distance measurements showed the decreasing trend with increasing severity of the shoulder function, the data did not achieve the statistical significance (p=0.062)

**DISCUSSION**

The acromiohumeral distance measurement is one of the tools in assessing the patients with the subacromial impingement syndrome. The relation of the reduced acromiohumeral distance in patients with subacromial impingement is suggested in various studies where the

measurements were made in the ultrasound or MRI. No study has detected the statistically significant difference in acromiohumeral distance in plain radiograph in patients with SAIS. However, the measurement of AHD in plain radiograph and MRI were shown to be reliable and correlated in some studies.<sup>9,15</sup> We tried to detect the difference between the acromiohumeral distance measured in X-ray in patients having subacromial impingement syndrome and the controls.

Our study shows that there is a tendency towards lower AHD in patients with subacromial impingement than in patient without impingement. However this finding wasn't statistically significant. Kim et al<sup>14</sup> also found reduced AHD in cases (9.98 +/- 1.29) compared to control (10.51 +/- 1.48) but failed to show the statistical significance  $p=0.13$ . Michener et al<sup>10</sup> measured the space in USG in 21 patients in each group and found smaller AHD in cases compared to control. This also didn't reach the statistical significance ( $p=0.316$ ). Similar study by Cholewinski et al<sup>7</sup> found statistical significant difference between cases and controls. The measurement was done in 57 cases and 72 controls and it was found that the median acromiohumeral distance in patients with impingement was significantly lower (19.4mm) than in control (22.7mm) with  $p<0.00$ . In this study, the distance was measured in ultrasound from the inferolateral edge of the acromion to the apex of the greater tuberosity. This difference in measurement technique might have shown an overall greater acromiohumeral distance in this study compared to our study. Most of the studies mentioned above revealed that AHD is lower in patients with impingement but only one study which had the largest sample size could show the significant association.

A review article by Seitz et al<sup>11</sup> in 2010 evaluated 5 articles which measured subacromial space in ultrasound between patients with and without rotator cuff diseases. In four out of five studies they detected the difference in the AHD in patients with and without the rotator cuff disease. Since the dominant hand is involved in most of

the recreational and professional activities, the conditions that arise from the repeated overuse commonly occurs in the dominant hand. This is reflected in our study (74.3% involvement in cases) as well as in few other studies.<sup>7,16,17</sup>

We observed that the mean AHD reduced with the worsening functional status of shoulder. However we could not detect the statistically significant difference. Similar relation of the AHD with shoulder function has been demonstrated in other studies also. Mayerhofer et al<sup>9</sup> found that the patients with an AHD  $< 7$  mm on MRI had significantly lower Constant Score ( $47.7 \pm 16.0$ ) than those with AHD  $> 7$  mm ( $66.2 \pm 16.0$ ). While measuring in plain radiographs he found that the scores were higher in cases with space  $>7$  mm but couldn't show the statistical significance.

## CONCLUSION

The acromiohumeral distance in patients with subacromial impingement syndrome is lower than in patients without impingement. The patients with worsening shoulder function tend to have lower mean AHD. However, we could not show the statistically significant association. From this study, we cannot recommend that the decrease in the acromiohumeral distance as a significant predictor of shoulder impingement. This study opens scope for further research with larger sample size to establish AHD as contributing factor for extrinsic impingement and an objective way of measuring the severity of shoulder impingement.

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