

# Comparison of combined intra-articular and sub-acromial injection with intra-articular injection in adhesive capsulitis

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## Abstract

**Background:** The pain and limitation of shoulder function can disrupt daily activities of patients for months to years. Adhesive capsulitis is considered a self-limiting disease but the duration remains uncertain. The brunt of the disease is focussed on the inflamed joint capsule. On this basis, use of corticosteroid injection is justified. However, injection method is not conclusive.

**Objectives:** To compare clinical benefits of intra-articular injection alone versus combined intra-articular and sub-acromial injections in management of adhesive capsulitis.

**Methods:** Fifty-nine patients with diagnostic criteria for adhesive capsulitis were included in the comparative prospective study from March 2019 to September 2020 after ethical clearance. Patients were divided into two groups; patients who underwent intra-articular (IA) injection alone (Group 1) and those who received both intra-articular and sub-acromial (IA+SA) injection (Group 2). The injections were landmark guided. Patients were followed up at three, six, and 12 weeks. Pain was recorded using visual analogue scale (VAS) and subjective function using Constant-Murley score.

**Results:** Twenty-eight patients were included in Group 1 (IA) and 31 in Group 2 (IA+SA). Thirty-six patients were female (18 each in Group 1 and Group 2) and 23 patients were male (Group 1 = 13; Group 2 = 10). In the twelfth week, VAS score was reduced in both the groups. On comparing the mean value of Constant-Murley score between the two groups there is significant difference in value recorded at the sixth and twelfth week.

**Conclusion:** The IA+SA injection provides significant reduction in pain and better function in the short term over the IA injection.

**Key words:** Adhesive capsulitis; Corticosteroid; Injection.

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## INTRODUCTION

Adhesive capsulitis is characterised by painful, gradual loss of both active and passive glenohumeral motion resulting from progressive fibrosis and ultimate contracture of glenohumeral joint capsule.<sup>1</sup> Although considered self-limiting, pain and limitation can persist for more than seven years.<sup>2,3</sup> It is seen commonly in women and diabetic patients.<sup>4</sup>

Underlying cause remains uncertain and pathology is based on concept of synovial inflammation, joint capsule being main pathology, hence intra-articular steroid injection can be justified for treatment.<sup>5</sup> Joint injection should be planned after other therapeutic interventions like non-steroidal anti-inflammatory drugs, physical therapy, and activity modification have been tried. Corticosteroids participate in numerous physiological pathways, including inflammation and carbohydrate

metabolism. They reduce pain and inflammation by inhibiting inflammation and prostaglandin production. Intra-articular steroid injection is considered an accepted treatment, however, not enough evidence exists to draw conclusions regarding which injection method: intra-articular (IA) versus sub-acromial injection (SA) is superior.<sup>6</sup>

Since adhesive capsulitis can occur with accompanying tendinitis and bursitis,<sup>7</sup> combination of IA and SA injections would address both capsulitis and sub-acromial pathology relieving patient's pain and improving their quality of life. Thus, objective was to compare clinical benefits of intra-articular injection alone versus combined intra-articular and sub-acromial injections in management of adhesive capsulitis.

## METHODOLOGY

A comparative prospective study was performed on adult patients with adhesive capsulitis from March 2019 to September 2020 for a period of one and half years in Kathmandu Medical College Teaching Hospital. Ethical clearance was taken from the hospital ethical committee and written informed consent was taken from all patients (Ref. 2005201916). Fifty-nine patients were included in the study by convenience sampling. The diagnostic criteria for adhesive capsulitis, commonly used in previous studies was selected for the study.<sup>8-10</sup> According to this criterion, a patient was diagnosed as having adhesive capsulitis when the patient's range of motion was decreased >30 degrees on two planes based on normal range of motion (forward flexion 180 degrees, extension 50 degrees, abduction 180 degrees, external rotation 90 degrees, internal rotation 90 degrees).<sup>11</sup>

Plain radiographs were obtained (true antero-posterior and lateral Y scapular view). Patients were excluded if they had secondary adhesive capsulitis and previous corticosteroid injections on the affected shoulder. Magnetic resonance imaging (MRI) was not routinely ordered, but patients who had symptoms and signs of rotator cuff tear were excluded. Patients not improving with physiotherapy and analgesics after four weeks were included in the study.

The patients were divided into two groups; patients who underwent an intra-articular (IA) injection alone were kept in Group 1 and those who received both intra-articular and sub-acromial (IA+SA) injection were categorised as Group 2. The patients were divided into two groups on the basis of odd and even hospital numbers. The odd numbers were placed in Group 1 and even in Group 2.

With the patient in a sitting position the injections were administered taking strict aseptic precautions. A solution of corticosteroid and local anaesthetic composed of 2 ml (80 mg) Methylprednisolone acetate and 4 ml of 2% Xylocaine was prepared. In the IA+SA group (Group 2), half of the mixture was injected into the IA, and the other half was injected into the SA space. The IA injection was administered using the posterior approach. The coracoid process, posterior, and lateral margins of the acromion were palpated. The site of the injection was 2 cm below and medial to the posterolateral point of the acromion. The needle was directed towards the coracoid process and advanced until the capsule was penetrated. In Group 2, the SA injection was administered using the lateral approach. The spine of scapula was palpated and followed laterally where it forms the acromion process. The lateral edge of acromion was palpated and the needle was placed about 2 cm inferior in the undersurface and advanced with slight superior angulation just parallel to the acromion into the subacromial space. Following the injection, oral analgesics in the form of non-steroidal anti-inflammatory drugs, combination of tramadol, paracetamol or codeine phosphate and paracetamol were prescribed to reduce the pain of the post injection flare for three days.

The patients were followed up at three, six and twelve weeks. Pain was recorded using visual analogue scale (VAS) and subjective function using the Constant-Murley score. The range of motion was assessed with a goniometer. The physiotherapy sessions began after one week in both groups.

The collected data was charted on Microsoft Excel 2013. Statistical package for the social sciences (SPSS) Statistics for Windows, version 12.0 (SPSS Inc., Chicago, Ill., USA) was used for the analysis of data. Patient characteristics were recorded on the first visit to the hospital. Quantitative data were expressed in terms of mean and standard deviation. The outcome between two groups was compared using an "independent sample t-test". The outcome between two groups was measured by comparing the mean value of Constant-Murley score of shoulder and VAS score.

## RESULTS

Fifty-nine patients were included in the study, among them 28 patients were included in Group 1 (IA) and 31 in Group 2 (IA+SA). Thirty-six patients were female (18 each in Group 1 and Group 2) and 23 patients were male (Group 1 = 13; Group 2 = 10). The mean time from which symptoms began was 20.21 days in Group 1 and 20.68

days in Group 2. The mean  $\pm$  SD age of Group 1 was  $51.21 \pm 7.1$  years and Group 2 was  $54.65 \pm 7.9$  years. The demographic variables of both the groups are shown in Table 1.

The baseline mean VAS score in Group 1 (IA only) was  $8.79 \pm 0.63$  whereas it was  $8.90 \pm 0.65$  in Group 2 (IA+SA). Similarly, baseline Constant-Murley score was  $29.82 \pm 2.91$  in Group 1 and  $28.06 \pm 2.25$  in Group 2. There was a significant reduction in VAS score in Group 1 by 6.65 and 6.77 in Group 2 when analysed on the third week of follow up ( $p < 0.05$ ). The VAS score was further reduced in both groups, the mean VAS score was  $2.04 \pm 1.03$  in Group 1 and  $1.81 \pm 0.91$  in Group 2 on the sixth week follow-up from baseline ( $p < 0.05$ ). On final follow up, which was set at twelfth week, VAS score increased in both the groups with mean value of  $3.18 \pm 1.36$  in Group 1 and  $2.06 \pm 1.06$  in Group 2 however it was still significantly lower than baseline value ( $p < 0.05$ ).

When VAS score was compared between the two groups there was not a significant difference from baseline to sixth week whereas on final follow up VAS score in Group 1 is 3.18 as compared to 2.06 in Group 2 ( $p < 0.05$ ).

The mean Constant-Murley scores at baseline were comparable between the two groups with mean values of  $29.82 \pm 2.9$  in Group 1 and  $28.06 \pm 2.25$  in Group 2. There was a significant increase in mean Constant-Murley score in both groups on the third week of follow-up with mean value of  $66.36 \pm 3.5$  in Group 1 and  $67.29 \pm 3.8$  in Group 2 respectively ( $p < 0.05$ ).

On comparing the mean values of Constant-Murley score between the two groups there is significant difference in value recorded at the sixth and twelfth week. The Constant-Murley score is  $66 \pm 3.5$  in Group 1 and  $69.61 \pm 2$  in Group 2 at sixth week ( $p < 0.05$ ) whereas it is  $69.14 \pm 2.2$  in Group 1 and  $72.35 \pm 1.7$  in Group 2 at twelfth week ( $p < 0.05$ ). Correlation between duration of symptoms with both VAS score and Constant-Murley score at 12th week was analysed using Pearson correlation coefficient. There was a positive correlation between duration of symptoms and VAS score ( $r = +0.587$ ) which meant that with increasing duration of symptoms there was higher VAS score. When correlation between duration of symptoms and Constant-Murley score was analysed negative correlation was found ( $r = -0.192$ ) and lower Constant-Murley score at twelfth week follow-up (Figure 1, 2).

**Table 1: Demographic variables of both age groups**

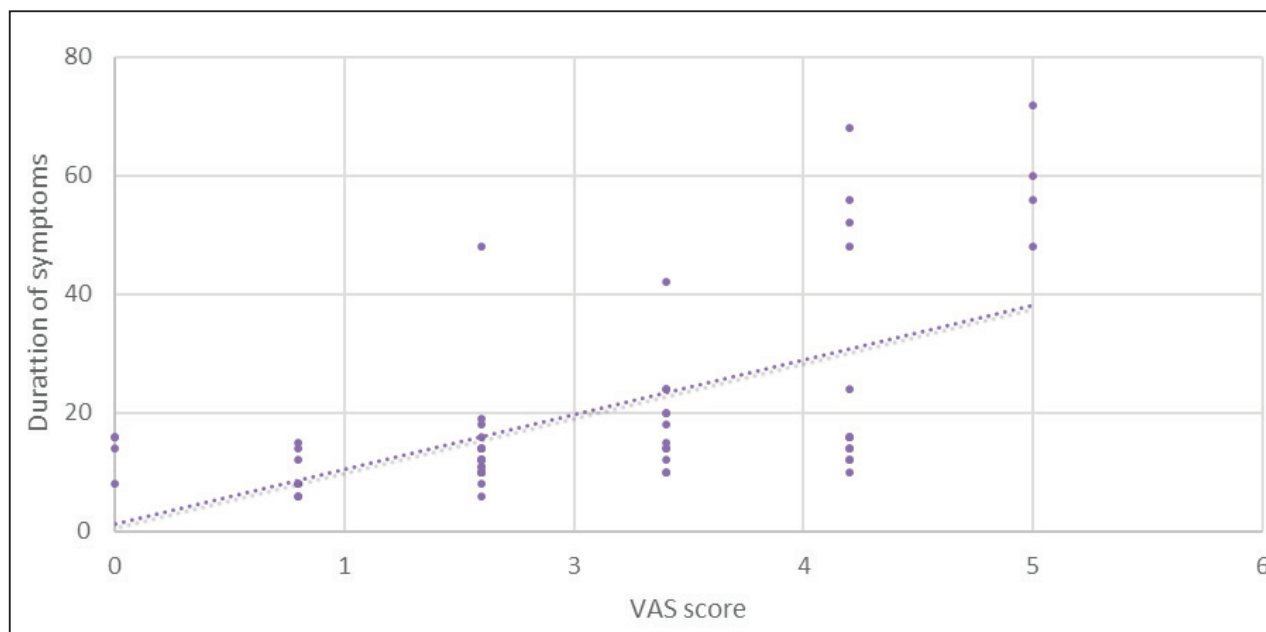
Type of injection	Number of patients	Minimum	Maximum	Mean $\pm$ SD	
Group 1 (IA)	Age (years)	28	38	63	$51.21 \pm 7.1$
	Sex	M13 F18			
	Side	L16 R15			
	Duration of symptoms (months)	28	6	72	$20.21 \pm 18.1$
Group 2 (IA+SA)	Age (years)	31	39	68	$54.65 \pm 7.9$
	Sex	M10 F18			
	Side	L18 R10			
	Duration of symptoms (months)	31	6	68	$20.68 \pm 15.5$

**Table 2: VAS score chart after injections**

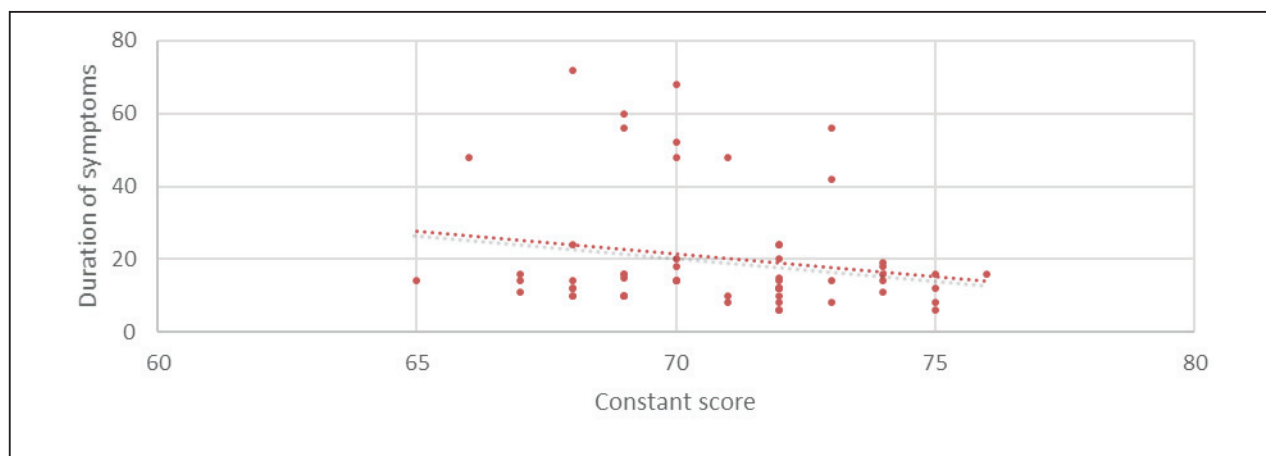
VAS	Group 1 (IA)	Group 2 (IA+SA)	p-value
Pre-injection	8.78	8.90	0.485
Three weeks	2.21	2.12	0.962
Six weeks	2.03	1.83	0.369
Twelve weeks	3.17	2.16	0.01

**Table 3: Constant-Murley score chart**

Constant-Murley score	Group 1 (IA)	Group 2 (IA+SA)	p-value
Pre-injection	29.82	28.16	0.012
Three weeks	66.21	67.29	0.333
Six weeks	65.89	69.61	0.001
Twelve weeks	69.10	72.41	0.001



**Figure 1: VAS score and duration of symptoms**



**Figure 2: Constant-Murley score and duration of symptoms**

**DISCUSSION**

Corticosteroid injection is considered to be a well-known and accepted treatment for adhesive capsulitis. Based on the concept of synovial inflammation for the pathology of adhesive capsulitis, the joint capsule can be the main pathology.<sup>5</sup> Many studies compare IA and SA injections

and there is not enough evidence to draw conclusions as to which injection method is superior.<sup>11</sup> Although corticosteroid injection is a commonly used therapy for adhesive capsulitis, there are only a few studies that compare the efficacy of IA and IA+SA injections.

The pathology of adhesive capsulitis affects not only the synovium of the joint, but also the rotator cuff, rotator interval and the coraco-humeral ligament. Injection into the SA space can reach up to the latter structures involved in adhesive capsulitis. There is limited literature available on use of SA injections in adhesive capsulitis.<sup>6</sup>

Andrieu et al found that the SA space is almost invariably involved in adhesive capsulitis and suggested an adjuvant SA corticosteroid injection in patients who do not respond to an IA injection. Rotator interval and coraco-humeral ligaments are the chief structures now believed to be involved in adhesive capsulitis<sup>12,13</sup> and often there is accompanying tendinitis or bursitis.<sup>7</sup> Both these structures are essentially extra-articular.<sup>6</sup>

Shin et al.<sup>14</sup> studied four groups with injections in SA, IA, IA+SA and no injections. They found significant short-term benefit of corticosteroid injections over only physiotherapy but there were no differences in functional outcomes between patients receiving only IA or SA injections or a combination of the two. Similar findings were shared by Oh et al.<sup>5</sup> and Rizk et al.<sup>15</sup> This study showed a significant increase in functional outcome at the third week in both groups. In comparison of the two groups at twelve weeks, the results were better in the IA+SA group.

Oh et al.<sup>5</sup> compared 37 patients receiving IA injections with 34 patients receiving SA corticosteroid injections for adhesive capsulitis. There was a significant reduction in pain scores in both the groups, though the patients receiving IA injections had lower pain scores at three weeks following injections. There was no difference in pain scores at six and twelve weeks. In our study, there was a significant reduction in VAS score in the third week in both groups, which further reduced at the sixth week and increased slightly at twelfth week.

Any beneficial effect of steroid injections is likely due to its anti-inflammatory effect. Accuracy of the injection is of utmost importance as inaccurate placement of steroid may result in a partial response. Henkus et al. reported that 62.5 to 76% of SA injections were accurately placed when given blind, the intended target being the subacromial bursa. Injections isolated to the subacromial bursa resulted in significantly decreased pain and improved functional scores, whereas injection of other

structures resulted in increased pain scores.<sup>16</sup> Eustace et al.<sup>17</sup> reported 29% (four out of 14) of SA and 42% (10 out of 24) of IA injections were accurately placed when given blind. There was also a positive correlation between clinical outcome and accurately placed injections. Our study was performed using landmark based injections so better results seen in the IA+SA group could be due to the accuracy of one of the injections if not both.

Ahn et al.<sup>11</sup> studied whether early presentation and early injection were of benefit and was related to the stage of the disease, as in the first and second stage, synovitis or inflammation is dominant, and the injection had better results and in the later stages when fibrosis was dominant, the role of injection was reduced. Symptoms of pain presenting within three months (the first and second stage) recovered better as they were in the early stage of inflammation.<sup>1</sup> While later in the disease, fibrosis develops and the role of steroid injection becomes limited. In our study, we found that there was a positive correlation between duration of symptoms and VAS score after injection at 12 weeks which indicates that shorter the duration of symptoms better the pain relief.

On the basis of the results obtained from our study, corticosteroid injections resulted in early pain relief. However, the pain relief was not consistent as the effects were not sustained at twelve weeks. These data suggest that corticosteroid injections are helpful for pain relief in only the short term. The comparison between the groups at the final assessment shows that the IA+SA group fared significantly better in terms of pain and function. Such an outcome suggests structures beyond the glenohumeral joint capsule may also have a role in the functional limitation in Adhesive capsulitis. This indicates that although the glenohumeral joint is a major site in pathogenesis, the SA space may be a contributing site.

## CONCLUSION

Corticosteroid injection to treat adhesive capsulitis; provides significant pain relief especially in the early stages when pain is the predominant presentation. The combination of the IA+SA injection provides better pain control and functional outcome.

**Conflict of interest:** None

**Source(s) of support:** None

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