EFFICACY COMPARISON OF SUBACROMIAL AND POSTERIOR APPROACH GLENOHUMERAL JOINT INJECTIONS USING TRIAMCINOLONE ACETONIDE IN CASES OF PRIMARY ADHESIVE CAPSULITIS

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ABSTRACT

Objective: To compare the efficacy of subacromial and posterior approach glenohumeral joint injections using triamcinolone acetonide in cases of primary adhesive capsulitis.

Study Design: Quasi-experimental study.

Place and Duration of Study: Pain Clinics of Armed Forces Institute of Rehabilitation Medicine Rawalpindi and Combined Military Hospital Jhelum, from May to Nov 2014 and from Jan to Jul 2019 respectively.

Methodology: We included patients with primary adhesive capsulitis in stage 1 and 2. The pain, measured by Numeric Rating Scale and range of motion of the affected joint measured through goniometer before and four weeks after the injection were the study parameters. A 40-mg injection of triamcinolone acetonide was given blindly into the affected shoulder joint through subacromial injection in 45 patients (group A) and posterior glenohumeral injection in 43 patients (group B).

Results: Each group had a significant reduction in mean pain score after four weeks of treatment (p<0.001) and a significant increase in range of motion in flexion, abduction, internal, and external rotation after treatment (p<0.001). The mean reduction in pain score for group B was significantly greater than the mean pain reduction for group A (p<0.001). The mean increase in flexion and internal rotation was significantly greater in group B, compared to group A (p=0.003 and p<0.001, respectively).

Conclusions: The posterior glenohumeral injection of triamcinolone acetonide when compared with subacromial injection, was significantly more effective in reducing pain, and improving range of motion especially in flexion and internal rotation in patients with primary adhesive capsulitis.

Keywords: Adhesive capsulitis, Intraarticular injections, Joint range of motion, Shoulder pain, Triamcinolone acetonide.

INTRODUCTION

Adhesive capsulitis (AC), originally named "frozen shoulder" by Codman is a debilitating condition of the shoulder that grossly impacts quality of life of the patient. It induces gradually increasing pain and restriction in both active and passive range of motion (ROM) of the glenohumeral joint, eventually culminating in constrained upper limb function and difficulty activities of daily living[1]. AC is one of the most common musculoskeletal problems seen in the orthopedic clinics[1,2]. AC is associated with stroke, diabetes mellitus, cerebrovascular accident, coronary artery disease, hypothyroidism, and autoimmune disease[3]. It has four stages[3,4]. Stage 1 is characterized by pain with shoulder movements but no considerable restriction in glenohumeral joint ROM when examined under anesthesia. The stage 2 (freezing stage), is characterized by pain with shoulder motion and developing glenohumeral joint ROM restriction in flexion, abduction, and internal and external rotation. In stage 3 (frozen stage), there is a significant reduction in pain but glenohumeral joint ROM is still restricted. In stage 4 (thawing stage), the ROM progressively improves[3,4].

AC can be divided into primary and secondary types[3,4]. Secondary AC is preceded by some

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Received: 26 Dec 2019; revised received: 14 Feb 2020; accepted: 20 Jul 2020

contributing event such as trauma or surgery to the affected extremity[3,4]. AC is treated by a spectrum of therapeutic options including physical modalities, therapeutic exercises, medications, manipulation under anesthesia, local injection of steroids and sodium hyaluronate, and hydraulic distension[1-4]. The accuracy of the technique used for injection procedures reflects in the outcome in terms of improvement in pain and function. The blind technique, which determines the injection site through palpation of anatomical landmarks without ultrasound or fluoroscopic guidance is the most commonly used technique.

There are two types of injections that can be used to treat AC; the subacromial injection and the glenohumeral joint injection through anterior or posterior approach[5]. Posterior approach is generally easier than anterior approach, especially in muscular and obese patients and there are fewer chances of vascular or neurologic injury[5]. In subacromial injection, the lateral aspect of the shoulder is palpated for the point of maximal tenderness, usually 1 to 2 cm inferior and 1 to 2 cm anterior to the angle of the acromion and the needle is inserted below the acromion near the point of maximal tenderness[6]. In posterior approach glenohumeral joint injection, the posterolateral corner of the scapular spine and the tip of coracoid process are palpated[7]. The needle is inserted just below the scapular spine insertion site and directed towards the tip of coracoid process until it reaches the articular surfaces[7]. There is always a debate among clinicians about the better approach for injection to reduce pain in AC with lesser side effects. Though, some studies have found no difference in efficacy, it is still unsettled.

The objective of this study was to compare the effectiveness of posterior approach glenohumeral joint injection and subacromial injection using corticosteroids in improving clinical outcome for patients with primary AC. Mean pain score measured through Numeric Rating Scale (NRS)[8] and improvement in ROM of the affected shoulder joint measured through goniometer were selected as the study parameters.

METHODOLOGY

This was a quasi-experimental study carried out at the pain clinics of Armed Forces Institute of Rehabilitation Medicine Rawalpindi (AFIRM) and Combined Military Hospital (CMH) Jhelum from May to November 2014 and from January to July 2019 respectively. Approvals from the hospital ethics review committees of both institutes were taken. A sample size of 32 with 16 in each intervention group was calculated through an online sample size calculator (Clin Calc LLC)[9] while taking anticipated mean and standard deviation of group-1 as 1.8 ± 0.3[10] respectively, anticipated mean of group-2 as 1.5[10], with level of significance as 5% and power of the test as 80%.

After verbal informed consent, the individuals of age 18–80 years belonging to both genders diagnosed with AC were selected through consecutive sampling following the ethical guidelines given by the declaration of Helsinki.

We included AC patients in stage 1 or 2 as intraarticular steroid injections may be beneficial during painful phase but not advocated during adhesive phase[11]. The pain was measured through NRS before injection and then at four weeks after the injection. The ROM of the affected joint was measured through goniometer before injection and then at four weeks after the injection.

One hundred and fifteen patients were enrolled as per the inclusion criteria. Twenty-seven patients, with history of shoulder trauma, shoulder surgery, bleeding disorders, uncontrolled hypertension or diabetes mellitus, and hypersensitivity to steroids, as well as, with skin infections around shoulder joint, were excluded (fig-1).

A total of 88 patients were finally selected for the study. Sixty-seven were tested in AFIRM while 21 were tested in CMH Jhelum. Forty-five patients were randomly allocated to group A while 43 were allocated to group B through simple randomization using lottery method. A written proforma was filled for each patient that contained patient identification number,

intervention group, age, side of shoulder involved, and the measurements of pain based on NRS as well as measurement of ROM in flexion, abduction, internal, and external rotation.

A 1ml (40 mg) of triamcinolone acetonide (Lonacort, Zafa Pharmaceutical Laboratories Limited, Karachi, Pakistan) with 2 ml solution of 2% W/V lignocaine (Xylocaine, Barrett Hodgson Pakistan Limited, Karachi, Pakistan) via 5ml sterilized 23-guage 1-inch disposable syringe was injected into the affected shoulder of each patient. The blind technique for shoulder injection i.e. without ultrasound or fluoroscopic guidance was used in both groups. For patients in group A, the subacromial injection was given, while for patients in group B, the posterior approach glenohumeral injection was administered using guidelines described earlier[5,7]. Two operators with three years' experience in independent shoulder injections performed the injection procedures in both groups. All inductees were shifted on a combination of paracetamol (650 mg and orphenadrine citrate (50 mg) (Nuberol Forte, Searle Pakistan Limited, Karachi, Pakistan) twice daily orally and local application of piroxicam gel 0.5% w/w (Pcam, Merck Private Limited, Karachi, Pakistan) four times a day. After the injection, a comprehensive rehabilitation plan comprising of therapeutic exercises was explained to all patients in both groups that were to be performed at home.

Two other investigators took the pain and ROM measurements before and after four weeks of intervention through goniometer. These investigators were blinded for the participants' allocation.

The Statistical Package for Social Sciences v 20.0 (IBM Corp., Armonk, NY, USA) was used for all analyses. All values were measured for the groups before start of intervention, and after four weeks of intervention. For variables of age, pain, ROM, means and standard deviations were calculated. The reduction in pain score and the improvement in ROM between groups A and B were analyzed using independent sample or paired sample t-tests where appropriate. The *p*-value ≤0.05 was considered statistically significant.

RESULTS

Out of 88 patients, 70 (79.5%) were males and 18 (20.5%) were females. The mean age of the sample was 42.5 ± 8.6 years. From group B, one patient later refused to receive shoulder injection and therefore excluded. The distribution of gender and the side of involvement in each group as well as the mean age is described in table-I. Two patients from group A and three patients from group B failed to follow-up.

The mean pain score on NRS and the mean ROM in flexion, abduction, internal rotation, and external rotation before and after treatment are given in table-II. Each group had a significant reduction in mean pain score according to NRS after four weeks of treatment (p<0.001) and a significant increase in ROM in flexion, abduction, internal, and external rotation after treatment (p<0.001) (table-II).

The mean reduction in pain for group B was found significantly greater than the mean pain reduction for group A (p<0.001) (table-III). The mean increase in flexion and internal rotation was found to be significantly greater in group B, in comparison with group A (p=0.003 and

Table-I: Demographics of the study population.

Variables	Gender		Side of the shoulder joint involved		Age (Years)
	Male n† (%)	Female n (%)	Right side n (%)	Left side n (%)	Mean ± SD*
Whole sample	70 (79.5)	18 (20.5)	63 (71.6)	25 (28.4)	42 ± 9
Group A	38 (84.4)	7 (15.6)	32 (71.1)	13 (28.9)	44 ± 10
Group B	32 (74.4)	11 (25.6)	31 (72.1)	12 (27.9)	41 ± 7

†n: Frequency, *SD: Standard Deviation

p<0.001, respectively) (table-III). The difference in improvement of abduction and external rotation was, however, not significant (*p*=0.084 and *p*=0.536, respectively).

and ROM up to twelve weeks. The injections were generally safe and produced infrequent and minor side effects. Sun and colleagues[13] included eight randomized controlled trials with 416

Table-II: Pre and post intervention mean values and their comparison for pain and range of motion in flexion, abduction, internal rotation, and external rotation for each group.

Variables	Group A (Subacromial injection) n†=30		*p*-value	Group B (Posterior glenohumeral Injection) n=29		*p*-value
	Pre-Treatment	Four Weeks Post Treatment		Pre-Treatment	Four Weeks Post Treatment	
	Mean ± SD*	Mean ± SD		Mean ± SD	Mean ± SD	
Pain measured on Numeric Rating Scale	6.8 ± 1.2	4.8 ± 1.3	<0.001	7.1 ± 1.6	3.6 ± 1.9	<0.001
Flexion	162.7 ± 7.4	169.9 ± 5.9	<0.001	165.1 ± 3.6	176.7 ± 3.8	<0.001
Abduction	162.4 ± 6.1	170 ± 5.3	<0.001	163.7 ± 4	174 ± 4.2	<0.001
Internal Rotation	60.7 ± 6.6	66.9 ± 5.3	<0.001	63.9 ± 3.6	77.3 ± 5.9	<0.001
External Rotation	60.1 ± 5.4	67.7 ± 5.4	<0.001	63.5 ± 2.2	72.3 ± 4.5	<0.001

†n: Frequency, *SD: Standard Deviation, ‡NRS: Numeric rating scale

Table-III: The mean reduction in pain and the mean improvement in range of motion in flexion, abduction, internal and external rotation.

Variables	Group A (Subacromial) n†=30 Mean ± SD*	Group B (Posterior glenohumeral) n=29 Mean ± SD	*p*-value
Mean reduction in pain measured on numeric rating scale	2.05 ± 1.1	3.34 ± 1.9	<0.001
Mean increase in flexion	7.3 ± 6.2	11.05 ± 4.9	0.003
Mean increase in abduction	7.6 ± 5.4	9.9 ± 6.6	0.084
Mean increase in internal rotation	6.2±3.9	12.7 ± 6.9	<0.001
Mean increase in external rotation	7.7 ± 5.4	8.4 ± 5.2	0.536

†n: Frequency, *SD: Standard Deviation

DISCUSSION

In our study, the pain and the joint ROM significantly improved after either route selected for injections. The therapeutic role of cortico-steroid injections and their safety profile has been a topic of debate for the past many years[11-14]. Recent meta-analyses, however, have supported use of corticosteroid injections in treatment of AC especially in the early stages when pain is the predominant presentation. Koh[12] pooled data from ten randomized trials and found that corticosteroid injections were superior to placebo and physiotherapy in improving shoulder pain

patients and concluded that intraarticular steroid injection relieved pain, improved functional performance, and increased ROM in passive external rotation, abduction, and flexion. The beneficial effects were significant up to sixteen weeks post-intervention. The complications were reported in 3.9% of patients in three trials and included nausea, dizziness, facial flushing, and chest or shoulder pain. Song *et al*[14] in another meta-analysis, reviewed and combined data from 25 studies and discovered that 92% of all studies documented a greater improvement in either pain scores or ROM after corticosteroid injections

in the first six weeks when compared to control or comparison group. However, long-term outcomes were similar to other treatments including placebo.

The corticosteroid injections are, though a proved therapeutic option in managing AC, the appropriate route and mode of administration is yet to be affixed. With the aim of choosing a better route from subacromial and posterior glenohumeral approaches, we found that the group receiving posterior glenohumeral injections showed significantly greater improvement in terms of pain relief and ROM in flexion and internal rotation following treatment. However, the results were not promising in abduction and external rotation. There are few other studies, that have compared the clinical effects of different approaches for shoulder corticosteroid injections but none has depicted preference of one technique over the other. Oh and colleagues[15] had found that the glenohumeral or the subacromial approaches did not produce statistically significant difference in the outcome pain score at 6 or 12 weeks or ROM at serial follow-up. Shin and Lee[16] randomly allocated 191 patients with AC to 1 of 4 groups and each group received corticosteroid injection through a different technique. Group I received subacromial injection. Group II received intra-articular injection while group III was given intra-articular injection combined with subacromial injection. The group IV was given oral medication only. Reduction in pain and patient satisfaction were assessed with a visual analog scale and functional outcomes were evaluated with the American Shoulder and Elbow Surgeons Score at 24 weeks after treatment. No significant difference in pain scores was observed among the 4 groups at 24-week follow-up visits (p=0.670) and no significant differences in shoulder motion or functional outcomes were found among the 4 groups (p=0.117). Rizk *et al*[17] reported a randomized trial comparing 4 groups: intra-articular methylprednisolone and lidocaine injection, intrabursal methylprednisolone and lidocaine injection, intra-articular lidocaine injection, and intrabursal lidocaine injection. There was no significant difference in outcomes between intrabursal injections and intra-articular injections. A recent meta-analysis regarding comparison of glenohumeral versus subacromial corticosteroid injection for the treatment of AC found no significant difference in the primary outcomes with an exception of visual analog scale score at 2-3 weeks and ROM in internal rotation at 8-12 weeks that did not last beyond the 2-3-weeks' time period. Sub-acromial injection had the additional advantage of avoiding adverse reactions from the corticosteroid, especially a fluctuation of serum blood glucose levels[18]. One possible explanation as to why our results differ from the previous studies might be the ease of performing posterior glenohumeral injection compared to subacromial injection through blind technique, owing to ambiguity of landmarks in the later especially in a muscular or obese individual. The needle may fail to be positioned between head of the humerus and the acromion in a subacromial injection technique.

Using blind technique is also a limitation of the study, as the blind technique has an accuracy rate of 33 to 47%[19]. The current literature favors using ultrasound guidance for injecting corticosteroids in the shoulder joint that offers the advantage of being accurately placed[19,20]. Better clinical outcomes are also found with ultrasound guided technique[11,19-21]. However, ultrasound guided injections require expertise, and lose their benefit in the absence of sufficient knowledge and experience.

The present study is also limited by a relatively small sample size. Therefore, the findings should be treated with necessary caution. Future studies should be focused on multiple center trials and meta-analysis of randomized trials reported in the literature.

CONCLUSION

The posterior glenohumeral injection of triamcinolone acetonide when compared with subacromial injection, was significantly more effective in reducing pain, and improving ROM

especially in flexion and internal rotation in patients with primary AC.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Cho CH, Bae KC, Kim DH. Treatment strategy for frozen shoulder. Clin Orthop Surg 2019; 11(3): 249-57.
2. Franz A, Klose M, Beitzel K. Konservative Therapie der "frozen shoulder" Conservative treatment of frozen shoulder. Unfallchirurg 2019; 122(12): 934-40.
3. Le HV, Lee SJ, Nazarian A, Rodriguez EK. Adhesive capsulitis of the shoulder: review of pathophysiology and current clinical treatments. Shoulder Elbow 2017; 9(2): 75-84.
4. Yuan X, Zhang Z, Li J. Pathophysiology of adhesive capsulitis of shoulder and the physiological effects of hyaluronan. Eur J Inflamm 2017; 15(3): 239-43.
5. Kalb RL. Evaluation and treatment of shoulder pain. Hosp Pract 1998; 33(1): 119-22.
6. Walsh NE, Eckmann M. Injection procedures. In: Frontera WR, Gans BM, Walsh NE, Robinson LR (eds): DeLisa's Physical medicine and rehabilitation: Principles and practice. (5th ed). Philadelphia: Lippincott Williams & Wilkins, 2010, 1815-73.
7. Stitik TP, Kim JH, Mehnert MJ, Dorri MH, Ibarbia J, Why DJV, et al. The shoulder. In: Stitik TP (ed): Injection procedures. Osteoarthritis and related conditions. New York: Springer Science + Business Media, 2011; 133-211.
8. Pathak A, Sharma S, Jensen MP. The utility and validity of pain intensity rating scales for use in developing countries. Pain Rep 2018; 3(5): e672-80.
9. Kane SP. ClinCalc.com [Internet]. [Accessed 2019 July 9]. Available from: https://clincalc.com/stats/samplesize.aspx
10. Lee HJ, Lim KB, Kim DY, Lee KT. Randomized controlled trial for efficacy of intra-articular injection for adhesive capsulitis: Ultrasonography guided versus blind technique. Arch Phys Med Rehab 2009; 90(12): 1997-2002.
11. Ahn JH, Lee DH, Kang H, Lee MY, Kang DR, Yoon SH. Early intra-articular corticosteroid injection improves pain and function in adhesive capsulitis of the shoulder: 1-Year retrospective longitudinal study. Phy Med Rehab 2018; 10(1): 19-27.
12. Koh KH. Corticosteroid injection for adhesive capsulitis in primary care: a systematic review of randomised clinical trials. Singapore Med J 2016; 57(12): 646-57.
13. Sun Y, Zhang P, Liu S, Li H, Jiang J, Chen S, Chen J. Intra-articular steroid injection for frozen shoulder: A systematic review and meta-analysis of randomized controlled trials with trial sequential analysis. Am J Sports Med 2017; 45(9): 2171-79.
14. Song A, Higgins LD, Newman J, Jain NB. Glenohumeral corticosteroid injections in adhesive capsulitis: a systematic search and review. Phy Med Rehab 2014; 6(12): 1143–56.
15. Oh JH, Oh CH, Choi JA, Kim SH, Kim JH, Yoon JP. Comparison of glenohumeral and subacromial steroid injection in primary frozen shoulder: A prospective, randomized short-term comparison study. J Shoulder Elbow Surg 2011; 20(7): 1034-40.
16. Shin SJ, Lee SY. Efficacies of corticosteroid injection at different sites of the shoulder for the treatment of adhesive capsulitis. J Shoulder Elbow Surg 2013; 22(4): 521-27.
17. Rizk TE, Pinals RS, Talaiver AS. Corticosteroid injections in adhesive capsulitis: investigation of their value and site. Arch Phys Med Rehabil 1991; 72(1): 20–22.
18. Shang X, Zhang Z, Pan X, Li J, Li Q. Intra-articular versus subacromial corticosteroid injection for the treatment of adhesive capsulitis: A meta-analysis and systematic review. Biomed Res Int 2019; 2019: 1274790.
19. Yi TI, Kim ST, Kim DH, Kim JS, Park JS, Lee JH. Comparison of blind technique and ultrasonography guided technique of intraarticular injection of the shoulder. J Korean Acad Rehabil Med 2006; 30(1): 45-50.
20. Daniels EW, Cole D, Jacobs B, Phillips SF. Existing evidence on ultrasound-guided injections in sports medicine. Orthop J Sports Med 2018; 6(2): 2325967118756576.
21. Raeissadat SA, Rayegani SM, Langroudi TF, Khoiniha M. Comparing the accuracy and efficacy of ultrasound-guided versus blind injections of steroid in the glenohumeral joint in patients with shoulder adhesive capsulitis. Clin Rheumatol 2017; 36(4): 933-40.