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Does Single Blind Anterior Glenohumeral Steroid Injection Performed by Short Experienced Clinicians Could Provide Clinical Efficacy in Patients with Frozen Shoulder?

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Background: The purpose of this study was to evaluate the effect of single blinded anterior intra-articular corticosteroid injection to the glenohumeral joint performed by short experienced clinicians in frozen state adhesive capsulitis patients.
Methods: From March to June of 2013, among the patients who visited the shoulder outpatient clinic due to shoulder pain for 5-6 months and those patient diagnosed as frozen state adhesive capsulitis was selected. The diagnosis were based on base, first the global limitation of range of motion, defined as forward elevation <100, external rotation at side <10, internal rotation less than buttock, and abduction <70. Second, the patients had additional radiologic evaluations showing no major pathologies for such stiffness. Clinical outcome, were performed with pain visual analog scale (PVAS) and functional visual analog scale (FVAS), American Shoulder and Elbow Surgeons Shoulder score (ASES), preinjection and postinjection after 2−4 weeks. Finally 82-patients were enrolled. Mean age of the patients was 55.1 years and mean follow-up duration was 25.17 days.
Results: The mean preinjection PVAS was 6.91 and postinjection was 3.11, there was 3.8 decreases from preinjection status ($p < 0.001$). The mean FVAS score showed 4.26 at preinjection and 6.63 afterwards ($p < 0.001$). The ASES score showed 27.89 increases after injection ($p < 0.001$). There were 64-patients (78.04%) who reported more than 3 points of decrease of PVAS, who could be judged as effective treatment.
Conclusions: Single anterior glenohumeral steroid injection by short experienced clinicians to the patients with frozen state adhesive capsulitis has shown relatively high efficacy in clinical result evaluated by means of PVAS.
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Key Words: Shoulder; Adhesive capsulitis; Glucocorticoid; Intra-articular injections

Introduction

Frozen shoulder (adhesive capsulitis), as a commonly known disease entity and pain source of shoulder joint, has been known to have 2−5% of prevalence in normal population.[1)] Since significant portion of populations are affected by this disease entity, there are much interest in proper treatment modalities. Several treatment modalities are commonly accepted; oral non-steroidal anti-inflammatory drugs, oral corticosteroids, various physical therapies, manipulation under anesthesia, hydrodilation with saline injection, and intra-articular injection of steroid mixtures.[2)]

The intra-articular injection of steroid mixtures has several different aspects to consider. First the amount of triamcinolone and lidocaine combination can be different from one surgeon to another. Second, the locations of the injection site in the shoulder have been in much debate. There are subacromial and glenohumeral injection methods and the injection entry methods (antero/posterolateral and anterior or posterior, respectively) and also blinded or radiologic assisted (such as, ultrasonography) injection. Several previous studies report their successful outcome

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and acceptable accuracy by measuring the clinical outcome or anatomical evaluations. However, they could not conclude or convince some specific superiority from one method to another.[2-6] We were in question whether a single blinded anterior glenohumeral steroid injection will have some effect on the subjective patient's symptoms.

The purpose of this study was to evaluate the effect of single blinded anterior intra-articular corticosteroid injection to the glenohumeral joint performed by short experienced clinicians in frozen state adhesive capsulitis patients. We assumed that the patients who reported more than 3 points decrease in pain visual analog scale (PVAS) is considered to have satisfactory injection treatment result based on our previous study. Our hypothesis was single blind anterior glenohumeral injection could have considerable clinical efficacy even the procedure had been performed by short experienced clinician.

Methods

Patient Demographics

Under retrospective study design, from March to June of 2013, among the patients who visited the shoulder outpatient clinic due to shoulder pain for more than 5 to 6 months and those patients who were diagnosed as frozen state adhesive capsulitis was selected. The diagnosis of frozen state adhesive capsulitis, defined as Griesser et al.,[2] was based on following modified criteria. First, the global limitation of range of motion (ROM), defined as forward elevation <100 degrees, external rotation at side <10 degrees, internal rotation less than buttock, and abduction <70 degrees. Second, the patients had additional radiologic evaluations (magnetic resonance imaging or ultrasonography) showing no major pathologies for stiffness such as rotator cuff tear or calcific tendinitis. Eighty-nine patients had the final diagnosis of frozen-state frozen shoulder and underwent glenohumeral steroid injection via anterior approach by standard blind method (Fig. 1). After the injection procedure, every patient was prescribed and ordered to take nonsteroidal anti-inframatory drugs during the whole follow-up period. The outcome was assessed via telephone survey and 7 patients refused the survey. Finally 82 patients were enrolled to the study.

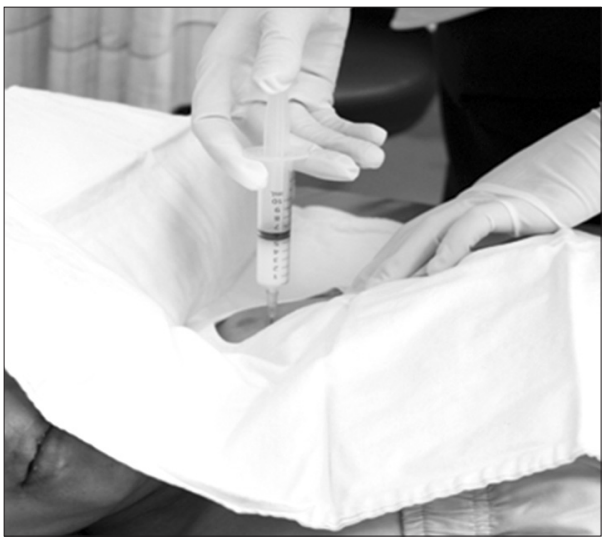

Fig. 1. Glenohumeral steroid injection via anterior approach by standard blind method.

Injection Procedure

The injection procedure was done by three examiners who were the fellows in the shoulder division of orthopedic surgery. The blind injection method was chosen since the blind procedure is considered as more preferable method for short experienced clinicians, who are not fully equipped with ultrasonogram. The standard anterior approach was performed as followed:[6]

1. The patients were placed in supine position with their arm abducted about 10 degrees.
2. The anterior joint line, the margins of the acromion and the bony contour of coracoid process were palpated.
3. The injected solution was a mixture of 1 ml triamcinolone (Tamceton injection 40 mg™; Hanall Biopharma, Seoul, Korea) and 4 ml 2% lidocaine (Lidocaine HCl Hydrate 20 mg™; Huons, Seongnam, Korea), after the mixture the needle was changed to a new sterile one.
4. The needle was entered from the anterolateral edge of palpated coracoid process after draping with povidone iodine and alcohol cotton balls, 22 gauge 10 ml sized syringe was used.
5. By the guidance of opposite hand placed on the shoulder, palpating the landmarks, the needle was advanced toward the posterior joint line, attempting to match the anteversion of the glenoid surface (Fig. 1).
6. After confirming by regurgitation, the mixture was injected slow manner and if the resistance felt too strong, the needle was slightly adjusted the direction and the depth and injection was performed.

Clinical Outcomes

The pain subsidence and the functional outcome were evaluated by means of PVAS, functional visual analog scale (FVAS), American Shoulder and Elbow Surgeons Shoulder score (ASES).[7] Each variable was checked before the injection by single examiner (experienced shoulder therapeutic specialists). Additionally, pain just after the injection was also checked by means of PVAS to evaluate the correlation of injection pain and score variables. Around 4 weeks after the injection procedure, the same examiner performed telephone survey to the patients and rechecked the variables.

Statistics

Statistical analysis was performed using PASW Statistics ver. 18.0 software (IBM Co., Armonk, NY, USA) and $p < 0.05$ was considered statistically significant. Clinical outcome variables were analyzed between preinjection and postinjection data to figure out whether the data has significant changes using Wilcoxon's signed-ranks test in PVAS and FVAS, paired t-test in ASES score. Additionally, Pearson correlation test was used for correlation analysis between injection pain and the other score variables.

Results

The mean age of the study group was 55.1 years (range, 32−83 years, standard deviation [SD] = 8.38). The average follow-up duration was 25.17 days (range, 14−38 days, SD = 8.35). There were 23 male and 59 female patients. Seventeen patients had diabetes as an underlying disease, 12 patients had thyroid diseases and 1 patient had both diseases. The baseline demographics are summarized in Table 1.

The mean preinjection PVAS was 6.91 and postinjection was 3.11, there was 3.8 decreases from preinjection status ($p < 0.001$). The mean FVAS score showed 4.26 at preinjection and 6.63 afterwards ($p < 0.001$). The ASES score showed 27.89 increases after injection ($p < 0.001$). The score data was summarized in Table 2.

There were 64 patients (out of 82, 78.04%) who reported more than 3 points of decrease of PVAS, who could be judged as effective injection treatment. Among the 18 patients (21.95%) who reported less than 3 points decrease, there were 12 patients (14.63%) who reported some degree of pain relief (decrease of PVAS 1−2 points), 4 patients (4.87%) reported no difference prior to injection, and 2 patients (2.44%) even reported having more pain after injection. The proportion of patients in terms of effectiveness was demonstrated in Fig. 2.

Preinjection and postinjection PVAS showed positive correlation with injection pain and the other variables showed negative correlation but only preinjection PVAS and postinjection ASES had significant correlation with injection pain. The correlation data was described in Table 3. Besides injection pain, none of the patients reported significant side effect of injection procedures.

Table 1. Baseline Demographics

Variable	Value
Patient counts	82
Age (yr)	55.12 ± 8.38
	54 (32 – 83)
Sex	
Male	23
Female	59
Follow-up duration (d)	25.17 ± 8.35
Comorbid conditions	
None	54
Diabetes mellitus	17
Thyroid disease	12
Both	1

Values are presented as number, mean±standard deviation, or median (range).

Table 2. Clinical Result Data

	Preinjection	Postinjection	*p*-value
PVAS	6.91 ± 1.74	3.11 ± 2.02	<0.001
FVAS	4.26 ± 1.94	6.63 ± 1.81	<0.001
ASES	34.56 ± 15.43	62.45 ± 15.06	<0.001

Values are presented as mean±standard deviation.
PVAS: pain visual analog scale, FVAS: functional visual analog scale, ASES: American Shoulder and Elbow Surgeons Shoulder score.

Discussion

In this study, the efficacy of single anterior glenohumeral steroid injection by short experienced clinicians to the patients

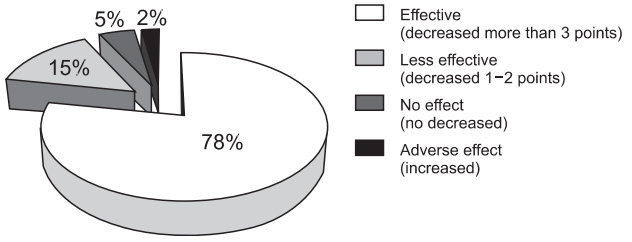

Fig. 2. The proportion of effectiveness.

Table 3. Correlation with Injection Pain

	Pearson correlation	*p*-value
prePVAS	0.236	0.033
preFVAS	-0.053	0.635
preASES	-0.213	0.054
postPVAS	0.161	0.147
postFVAS	-0.171	0.125
postASES	-0.224	0.043

prePVAS: pain visual analog scale before injection, preFVAS: functional visual analog scale before injection, preASES: American Shoulder and Elbow Surgeons Shoulder score before injection, postPVAS: pain visual analog scale after injection, postFVAS: functional visual analog scale after injection, postASES: American Shoulder and Elbow Surgeons Shoulder score after injection.

with frozen state adhesive capsulitis was evaluated. The results showed marked improvement in clinical outcome in 78 percent of the patients. Injection pain had weak positive correlation with preinjection PVAS and weak negative correlation with postinjection ASES; however, it did not show any statistical significance with other variables.

There are several approaches for shoulder joint injections and numerous reports deal with the injection accuracy of each approach. Kang et al.[8] reported overall 70% of accuracy of subacromial injection through anterolateral, lateral or posterior approach but no significant difference between those approaches. While Marder et al.[9] reported superior result of anterior and lateral approach than posterior approach which was 84/92% versus 56%. In terms of glenohumeral injection, Tobola et al.[10] reported the accuracy of anterior 64.7%, posterior 45.7%, and by supraclavicular approach 45.5%; however, these results did not showed any statistical significance. On the other hand, Kraeutler et al.[4] showed 93.3% success rate of blind anterior approach confirmed by arthroscope using coracoid process as a standard landmark which was performed by experienced shoulder arthroscopist. Although we do not have proof to state that successful pain relief of the patient is due to successful anterior glenohumeral injection, and we cannot strongly correlate this with glenohumeral injection accuracy, our 78% of symptom relief is somewhere between the 65% accuracy[10] and the 93%,[4] so we might carefully state that the accuracy of anterior blinded glenohumeral injection can be somewhere between these two numbers.

In the point of clinical result of steroid injection, there were several debates about the effectiveness of the treatment. McInerney et al.,[11] in there prospective randomized controlled study, showed the treatment with steroid (methylprednisolone) injection to subacromial space had no better result than control group. Withrington et al.[12] also had similar result in there prospective randomized control study. On the other hand, Blair et al.[13] noted substantial pain reduction, negative impingement sign and ROM increase at 33 weeks after the steroid injection in their prospective randomized control study. Even Adebajo et al.[1] reported superior therapeutic effect of corticosteroid injection than the oral diclofenac medication in their subset analysis of randomized control study. In our study, judging the effective treatment result by PVAS decrease more than 3 points, about 78% of patients turned out to be had satisfying result after the treatment.

Among the numerous studies about the effectiveness of steroid injection applied to shoulder joint, there are few study that mentioned the pain at which was originated by the injection procedure itself. Since, considering the pain originated by injection procedure could aggravate the joint pain, we evaluated the correlation between the pain score right after the injection procedure and clinical results. However, the result showed positive correlation with pre- and postinjection PVAS, negative correlation with the other variables. But there only preinjection PVAS and postinjection ASES score results were statistically significant. Moreover, the correlation coefficient was too small to consider as important factor related to outcomes. Conclusively, postinjection pain didn't show any significant effects on clinical result.

There are several limitations of this study. Since the study was designed as a case series study, the patient selection was not randomized and the control for other pain medications was not strict. The follow-up duration was short to demonstrate the long term effect of the injection procedure and patient numbers were relatively small. Although the study design was to report the efficacy of the procedure especially by short experienced clinicians, it could be better to compare the results with the results of experienced clinicians, but there was no control group, whose procedure was performed by experienced clinicians. Considering that the accuracy of injection procedure could alter the clinical result of the procedure, it could be a weakness that the accuracy was not confirmed by any reliable method and the procedure was performed by multiple clinicians. In clinical result assessment, ROM improvement was not evaluated despite of its' importance when estimating the therapeutic result of frozen shoulder treatment.

Conclusion

Single anterior steroid glenohumeral injection by short experienced clinicians to the patients with frozen state adhesive capsulitis has shown relatively high efficacy in clinical result evaluated by means of PVAS.

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