Glenohumeral versus Subacromial Steroid Injections for Impingement Syndrome with Mild Stiffness: A Randomized Controlled Trial

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INTRODUCTION:

Steroid injection is a well-established treatment for impingement syndrome and shoulder stiffness. However, the effectiveness of this treatment may vary depending on the site of injection, particularly in relation to the primary diagnosis. Despite the prevalence of impingement syndrome accompanied by mild secondary stiffness in outpatient settings, there is a lack of literature addressing the optimal injection site for such cases. Specifically, it remains uncertain whether addressing bursal pain through a subacromial injection or targeting the stiff capsule with a glenohumeral injection would yield better functional outcomes. Therefore, the objective of this study is to compare the effectiveness of ultrasound-guided steroid injections in the subacromial and glenohumeral spaces for impingement syndrome with mild stiffness.

METHODS:

A prospective randomized controlled trial enrolled 51 patients diagnosed with shoulder impingement syndrome and mild stiffness. The criteria for mild stiffness included the following ranges of motion (ROM): abduction between 110˚ and 150˚, forward elevation between 120˚ and 140˚, external rotation at the side between 30˚ and 50˚, and internal rotation at 90˚ of abduction between 30˚ and 50˚.

Patients were randomly assigned to two groups: the glenohumeral injection group (Group GH) or the subacromial injection group (Group SA). After the final follow up, 48 patients (24 in each group) were included for analysis (Figure 1).

Using ultrasound guidance, a solution containing 1mL of triamcinolone, 4mL of 1% lidocaine, and 7mL of 0.9% normal saline was injected into either the glenohumeral or the subacromial space. The following assessments were conducted at baseline and during follow-up visits at weeks 3, 7, and 13: ROM measurements for forward elevation, external rotation, and internal rotation; clinical scores including VAS, ASES, and Constant. The improvement in ROM was calculated by subtracting the pre-injection measurements from the measurements at each follow-up visit.

RESULTS:

The demographic data and pre-injection baseline clinical evaluation were comparable between the two groups (Table 1). Significant improvement in ROM and clinical scores were observed within both groups from pre-injection to the final 13-week follow-up (Table 2). Generally, an early improvement of ROM was seen in the GH group in three weeks (Table 3).

Both groups exhibited a significant improvement in range of motion (ROM) and clinical scores from pre-injection to the final follow up at 13 weeks (Table 2). However, the GH group demonstrated an earlier gain FE, ER, and IR ROM in three weeks ($p<0.001$, $p=0.012$, and $p=0.002$) and of ER and the Constant score in seven weeks ($p<0.001$ and $p=0.046$) compared to the SA group. Nevertheless, the improvements between the two groups were similar in subsequent follow ups (Table 3, Figure 2A-F).

DISCUSSION AND CONCLUSION:

The subacromial space has traditionally been the preferred injection site for treating impingement syndrome. However, in cases of mild stiffness, the current study suggests that glenohumeral injections may lead to an earlier improvement than the subacromial approach, within seven weeks post-injection. Overall, targeting the glenohumeral joint resulted in a earlier ROM gain. Also, there was no significant advantage of subacromial injections over the glenohumeral injections in terms of reducing pain. Nonetheless, both injection groups demonstrated a significant improvement in symptoms after 13 weeks.

Accuracy concerns surround subacromial injections due to difficulties in precise infiltration of the collapsed bursa, often resulting in unintended infiltration of structures like the rotator cuff. This can potentially harm tenocytes and collagen synthesis. In contrast, the glenohumeral joint offers a readily accessible space for reliable needle placement without risking rotator cuff injection. Moreover, the non-dependent position of the rotator cuff minimizes direct steroid infiltration, with reported safety and efficacy in glenohumeral steroid injections following rotator cuff repair.

The ideal technique for steroid injections should prioritize successful placement and minimize deleterious effects. Considering the current study's findings, there is no reason to exclusively rely on subacromial injections for impingement syndrome treatment, especially when accompanied by stiffness.

FIGURE 1. Flow Diagram of Patient Enrollment

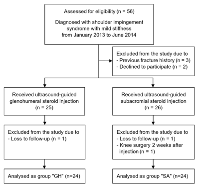

FIGURE 2. Serial Measurements from Pre injection to Last Follow up

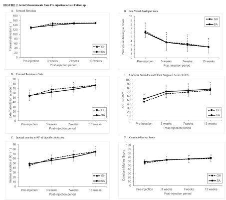

TABLE 1. Demographic and Pre-injection Data: Inter-group Analysis

	Group GH (n=24)	Group SA (n=24)	*P* Value
Demographic			
Age, mean ± SD, years	52.1 ± 7.5	51.4 ± 12.7	0.992
Symptom duration, mean ± SD, months	16.3 ± 48.1	16.2 ± 36.0	0.612
Sex, male : female, n	7 : 17	9 : 15	0.540
Laterality, right : left, n	10 : 14	15 : 9	0.149
Hand dominance, n (%)	12 (50.0%)	11 (45.8%)	0.773
Pre-injection			
FE ROM, mean ± SD, ˚	127.5 ± 7.4	129.2 ± 8.3	0.494
ER at side ROM, mean ± SD, ˚	53.8 ± 13.1	54.6 ± 10.8	0.934
IR at 90˚ ROM, mean ± SD, ˚	45.4 ± 7.2	48.8 ± 9.0	0.303
pVAS score, mean ± SD	6.3 ± 2.0	6.0 ± 1.2	0.240
ASES score, mean ± SD	46.1 ± 18.4	53.0 ± 8.9	0.106
Constant score, mean ± SD	55.9 ± 7.9	59.2 ± 7.6	0.149

GH, ultrasound-guided glenohumeral steroid injection; SA, ultrasound-guided subacromial steroid injection; SD, standard deviation; FE, forward elevation; ROM, range of motion; ER, external rotation at side; IR, internal rotation at 90˚ of shoulder abduction; pVAS, pain visual analogue scale; ASES, American Shoulder and Elbow Surgeons; Constant, Constant-Murley.

TABLE 2. Pre-injection versus Final Follow-up in 13 Weeks: Intra-group Analysis

	Pre-injection (n=24)	Final follow-up (n=24)	*P* Value
Group GH (n=24)			
FE ROM, mean ± SD, ˚	127.5 ± 7.4	148.8 ± 3.4	**<0.001***
ER at side ROM, mean ± SD, ˚	53.8 ± 13.1	76.9 ± 13.0	**<0.001***
IR at 90˚ ROM, mean ± SD, ˚	45.4 ± 7.2	75.0 ± 11.5	**<0.001***
pVAS score, mean ± SD	6.3 ± 2.0	2.6 ± 2.1	**<0.001***
ASES score, mean ± SD	46.1 ± 18.4	74.5 ± 19.0	**<0.001***
Constant score, mean ± SD	55.9 ± 7.9	67.2 ± 8.8	**<0.001***
Group SA (n=24)			
FE ROM, mean ± SD, ˚	129.2 ± 8.3	148.3 ± 3.8	**<0.001***
ER at side ROM, mean ± SD, ˚	54.6 ± 10.8	76.5 ± 8.0	**<0.001***
IR at 90˚ ROM, mean ± SD, ˚	48.8 ± 9.0	74.4 ± 8.9	**<0.001***
pVAS score, mean ± SD	6.0 ± 1.2	2.6 ± 1.5	**<0.001***
ASES score, mean ± SD	53.0 ± 8.9	77.1 ± 12.9	**<0.001***
Constant score, mean ± SD	59.2 ± 7.6	68.7 ± 9.9	**<0.001***

GH, ultrasound-guided glenohumeral steroid injection; SA, ultrasound-guided subacromial steroid injection; SD, standard deviation; FE, forward elevation; ROM, range of motion; ER, external rotation at side; IR, internal rotation at 90˚ of shoulder abduction; pVAS, pain visual analogue scale; ASES, American Shoulder and Elbow Surgeons; Constant, Constant-Murley. **** P value < 0.05.***

TABLE 3. Comparison of the Amount of Improvement from Pre-Injection: Inter-group Analysis

	P value					
GH vs. SA	Δ FE ROM	Δ ER ROM	Δ IR ROM	Δ pVAS	Δ ASES	Δ Constant
3wk – Pre	**<0.001***	**0.012***	**0.002***	0.637	0.768	0.078
7wk – Pre	0.082	0.112	**<0.001***	0.730	0.558	**0.046***
13wk – Pre	0.288	0.402	0.129	0.333	0.366	0.228

Δ Amount of Improvement = Follow-up measurement subtracted by the pre-injection measurement.

GH, ultrasound-guided glenohumeral steroid injection; SA, ultrasound-guided subacromial steroid injection; FE, forward elevation; ROM, range of motion; ER, external rotation at side; IR, internal rotation at 90˚ of shoulder abduction; pVAS, pain visual analogue scale; ASES, American Shoulder and Elbow Surgeons; Constant, Constant-Murley. **** P value < 0.05.***