

# **Ultrasound-guided Subacromial-subdeltoid Bursa Steroid Injections: Retrospective Comparison of Two Approaches and the Assessment of Impingement Tests to Predict Efficacy**

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## **ABSTRACT**

**Objective:** Compare the efficacy of two approaches to ultrasound-guided subacromial-subdeltoid bursa injections and to assess whether shoulder impingement tests acts as a predictive factor for efficacy of the injection.

**Design:** Retrospective chart review and telephone survey of 40 Patients who received ultrasound-guided subacromial-subdeltoid injections using 4cc 1% lidocaine and 80mg methylprednisolone from January 2011 to December 2011. Outcome measures included: number of positive shoulder impingement tests (Neer, Hawkin, Yocum), pain level (10-Point VAS), and duration of pain relief (<4 weeks, 4-12 weeks, >12 weeks).

**Results:** 19 patients received the injection through an anterior-superior approach, while 21 patients received the injection through a posterior approach. Mean reduction of the VAS score with the anterior-superior approach was 3.42 (SD-2.36); the posterior approach was 4.71 (SD-2.70). There was no significant difference in the mean reduction of the VAS score between the two groups ( $p = 0.11$ ). Mean reduction of the VAS score after injection for patients with 1 positive impingement test was 2.57 (SD-3.04), 2 positive impingement tests was 4.47 (SD-2.50), and 3 positive impingement tests was 4.50 (SD-2.46). Single-factor ANOVA analysis revealed a  $p$ -value of 0.22. The number of impingement signs had a statistically significant effect on duration of pain relief ( $p=0.01$ ).

**Conclusion:** There was no statistically significant difference in the efficacy measured by change in the VAS score or the duration of relief between the two ultrasound-guided approaches to the subacromial-subdeltoid injection. The number of positive impingement tests on physical examination had a significant effect on duration of pain relief from the injections.

**Keywords:** Injection, impingement shoulder, ultrasound

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## **INTRODUCTION**

Shoulder impingement syndrome is a term used to describe any painful condition that results from a compression of soft tissue structures between the humeral head inferiorly, and either acromion or coracoacromial arch superiorly (1). The compression results in a presentation that may include: anterior-lateral shoulder pain with overhead activities, decreased range of motion, and positive “impingement signs” on physical examination (2).

One of the common modalities of treatment includes glucocorticoid injections to the subacromial-subdeltoid bursa (2). The injections are typically performed through a technique that involves palpation of the acromion (3). However, it is now becoming a common practice to perform subacromial-subdeltoid injections under ultrasound guidance (4). Prior studies have demonstrated that ultrasound-guided injections are more accurate than palpation-guided injections (5). Some studies even suggest improved clinical outcomes in patients when comparing ultrasound-guided and palpation-guided techniques (6–10).

The aim of this study is to retrospectively compare the efficacy and duration of relief between two approaches to ultrasound-guided subacromial-subdeltoid injections performed in our outpatient musculoskeletal clinic. The study also attempts to assess shoulder impingement tests as a predictive factor for efficacy and duration of pain relief of ultrasound-guided subacromial-subdeltoid injections.

## **MATERIALS AND METHODS**

Institutional review board approval was obtained for the study. A retrospective chart review of forty patients who received ultrasound-guided subacromial-subdeltoid bursa injections from

January 2011 to December 2011 in the outpatient musculoskeletal clinic was performed. Age, sex, number of impingement exam findings (Neer, Hawkin, Yocum), pain level (10-point visual analog scale) before and after the injection, and duration of pain relief (<4 weeks, 4-12 weeks, and >12 weeks) were recorded. If the data was not available in the patient chart, the study subjects were called by telephone.

The injections were performed by two physical medicine and rehabilitation physicians with approximately two years of experience with ultrasound-guided shoulder injections. All injections were given in the routine management of shoulder pain. The injectate contained a mixture of 4cc 1% lidocaine and 80mg methylprednisolone.

The injections were performed either through the anterior-superior or posterior approach using a Sonosite M-Turbo ultrasound system (Sonosite, Bothell, WA, USA) equipped with a 13-6 MHz multifrequency, linear transducer.

Statistical analysis was performed using a two-tailed t-test to compare the mean reduction of VAS between the anterior-superior versus the posterior approach. Analysis of variance was used to compare the mean reduction of VAS score with respect to the number of positive impingement tests on physical examination. Chi-squared analysis was used to compare the duration of pain relief.

### **Injection approaches**

#### *Anterior-superior approach*

The anterior-superior approach was performed with the patient in a sitting position. The injected extremity was placed in the Crass position (arm positioned behind the back and with the elbows bent). The transducer was placed in an orientation parallel to the underlying supraspinatus tendon (Figure 1). In this view, the subacromial-subdeltoid bursa was easily visualized between

the deltoid and the supraspinatus muscles (Figure 1). After identification of the bursa, the area was prepped in a sterile manner. The needle was then advanced in a superior to inferior approach along the long axis of the transducer until the subacromial-subdeltoid bursa was reached and the medication was injected.

#### *Posterior approach*

The posterior approach was performed with the patient in a sitting position. The injected extremity was placed resting on the patient's side. The transducer was placed in an orientation perpendicular to the underlying supraspinatus tendon (Figure 2). In this view, the subacromial-subdeltoid bursa was easily visualized in cross-section between the deltoid and the supraspinatus muscles (Figure 2). After identification of the bursa, the area was prepped in a sterile manner. The needle was then advanced in a posterior to anterior approach along the long axis of the transducer until the subacromial-subdeltoid bursa was reached and the medication was injected.

## **RESULTS**

#### *Approach to ultrasound injection*

19 patients received ultrasound-guided subacromial-subdeltoid injections through an anterior-superior approach, while 21 patients received ultrasound-guided subacromial-subdeltoid injections through a posterior approach. Mean reduction of the VAS score for all patients was 4.15 (SD-2.62). Both approaches resulted in significant reductions in the Visual Analog Scale (VAS) Score ( $P < 0.01$ ). Mean reduction of the VAS score with the anterior-superior approach was 3.42 (SD-2.36). Mean reduction of the VAS score with the posterior approach was 4.71 (SD-2.70). There was no significant difference in the mean reduction of the VAS score between the two groups ( $p = 0.11$ ).

In the Anterior-superior group, 8 patients had <4 weeks of relief, 5 patients had 4-12 weeks of relief, and 6 patients had >12 weeks of relief. In the posterior group, 6 patients had <4 weeks of relief, 7 patients had 4-12 weeks of relief, and 8 patients had >12 weeks of relief. Chi-squared analysis revealed a There was no difference in the duration of relief between the two injection approaches ( $p=0.67$ ) with chi-squared analysis.

#### *Number of Positive Impingement Tests on Physical Examination*

7 patients had 1 positive impingement test, 15 patients had 2 positive impingement tests, and 18 patients had 3 positive impingement tests. The mean reduction of the VAS score after injection for patients with 1 positive impingement test on physical exam was 2.57 (SD-3.04), 2 positive impingement tests was 4.47 (SD-2.50), and 3 positive impingement tests was 4.50 (SD-2.46). Single-factor ANOVA analysis revealed a p-value of 0.22.

In the 1 positive impingement test group, 6 patients had <4 weeks of relief and 1 patient had >12 weeks of relief. In the 2 positive impingement tests group, 6 patients had <4 weeks of relief, 4 patients had 4-12 weeks of relief, and 5 patients had >12 weeks of relief. In the 3 positive impingement test group, 2 patients had <4 weeks of relief, 8 patients had 4-12 weeks of relief, and 8 patients had >12 weeks of relief. There was a significant difference in the duration of relief between the number of impingement signs elicited on physical exam ( $p=0.01$ ) with chi-squared analysis.

## **DISCUSSION**

Subacromial injections of corticosteroids are a common treatment option for shoulder impingement syndrome (11). The results of studies assessing the accuracy of palpation-guided

injections into the subacromial bursa vary and range from 29% to 70% (12). Ultrasound has improved the accuracy and even clinical outcome of shoulder injections when compared to a palpation-guided approach (5–9, 13)

Our study retrospectively compared the efficacy and duration of relief between two approaches to ultrasound-guided subacromial-subdeltoid injections. The results demonstrated that there was no statistically significant difference in the efficacy measured by change in the VAS score or the duration of relief between the two ultrasound-guided approaches. This is in contradistinction to blind injections, where various approaches may result in differences in accuracy and efficacy (14). Ultrasound allows for real-time visualization of the needle, so the practitioner is able to precisely deposit the medication at the desired target. With a palpation guided approach, the medication may be deposited in undesired locations, possibly resulting in complications or lower efficacy.

As for the number of positive impingement tests on examination, there was no difference in the mean reduction of VAS score after injection among the groups. There was a significant difference in the duration of relief between the groups. This suggests that impingement tests on physical examination may affect the duration of relief from subacromial-subdeltoid steroid injections.

Despite the findings in this study, more studies should be performed to prospectively evaluate the ultrasound-guided approaches to subacromial-subdeltoid injection as well as the number of impingement signs and its effects of the efficacy of the injection.

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Fig. 1: Orientation of the probe for the anterior-superior approach. The injection trajectory is demonstrated by the arrow.



Fig. 2: Orientation of the probe for the posterior approach. The injection trajectory is demonstrated by the arrow