Does Combining a Suprascapular Nerve Block With an Intra-articular Corticosteroid Injection Have an Additive Effect in the Treatment of Adhesive Capsulitis?

A Comparison of Functional Outcomes After Short-term and Minimum 1-Year Follow-up

Tae Wan Jung,* MD, Seung Yeop Lee,* MD, Seul Ki Min,* MD, Sang Min Lee,* MSc, and Jae Chul Yoo,*† MD

Investigation performed at Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

Background: No therapeutic intervention is universally accepted as the most effective treatment for adhesive capsulitis. An intra-articular corticosteroid injection (IAI) with a suprascapular nerve block (SSNB), a common treatment for this disease, is a safe and effective method for the resolution of pain and restoration of shoulder range of motion (ROM).

Purpose: To compare the efficacy of combined SSNB and IAI with that of IAI alone in the treatment of adhesive capsulitis.

Study Design: Cohort study; Level of evidence, 3.

Methods: We performed a retrospective review of 102 patients with adhesive capsulitis who were treated at an outpatient clinic from July 2016 to January 2017. A combined SSNB with IAI was performed in 48 patients (SSNB + IAI group), and an IAI alone was performed in 54 patients (IAI group). Patients were assessed before the intervention and at 2 weeks and 2 months after the intervention. ROM and pain and function visual analog scales (PVAS and FVAS, respectively), the American Shoulder and Elbow Surgeons (ASES) score, the Korean Shoulder Scoring System (KSS), the Constant score, the Simple Shoulder Test (SST), and the Shoulder Pain and Disability Index (SPADI) were used for clinical assessments. PVAS, FVAS, and ASES scores at a minimum of 1 year after the intervention were assessed for 82 patients.

Results: At the 2-month assessment, all parameters significantly improved in both the SSNB + IAI and IAI groups (P < .05), however, improvements in forward flexion (FF) and abduction (ABD) between the 2-week and 2-month assessments were better in the SSNB + IAI group. At the 2-month assessment, improvements in the FVAS, ASES, SST, and SPADI scores and FF and ABD values were statistically significantly greater in the SSNB + IAI group compared with the IAI group. Improvements in FVAS and ASES scores were significantly greater in the SSNB + IAI group at a minimum of 1 year.

Conclusion: Both a combined SSNB and IAI and an IAI alone significantly improved pain and functional outcomes in patients with adhesive capsulitis. The use of an SSNB with an IAI further increased treatment efficacy, as per the FVAS, ASES, SST, and SPADI scores and FF and ABD values. Patients who underwent SSNB combined with an IAI showed better improvements in the FVAS and ASES scores compared with IAI alone at a minimum of 1 year after the intervention. Therefore, an SSNB combined with an IAI may be a good treatment choice for adhesive capsulitis.

Keywords: adhesive capsulitis; shoulder; suprascapular nerve block; intra-articular corticosteroid injection

Adhesive capsulitis, or “frozen shoulder,” is a painful condition commonly encountered in outpatient orthopaedic clinics. It has a prevalence of 2% to 5% among outpatients but of about 20% to 30% in patients with diabetes mellitus (DM). The pathogenesis of this condition remains
unclear, although associated factors include female sex, trauma, age over 40 years, DM, prolonged immobilization, thyroid disease, stroke, myocardial infarction, and autoimmune disease.3

Common nonoperative regimens for adhesive capsulitis include supervised neglect with analgesia, supervised physical therapy, an intra-articular corticosteroid injection (IAI), a suprascapular nerve block (SSNB), manual brise- ment, and saline dilatation.13,15,17,22 No therapeutic inter- vention is currently universally accepted as most effective for restoring range of motion (ROM) and decreasing pain in patients with this disease.19 It is widely accepted that phys- ical therapy and stretching with use of analgesics are use- ful in the treatment of adhesive capsulitis, leading to improved joint mobility and the restoration of function.2,17,33 However, these interventions are usually pain- ful, which negatively affects patient compliance during the rehabilitation program. Therefore, an IAI or SSNB may be beneficial before physical therapy.6,27,37 An IAI, one of the most common procedures, can lead to satisfactory results in the treatment of adhesive capsulitis, with improved ROM and prompt pain reduction.3,4,6,15,21,23,30 Previous studies have shown that an SSNB is also safe and effective, with faster and more efficient resolution of pain and restoration of ROM.11,27,37

We assumed that a combination of these 2 safe and effective modalities might be a good treatment option because of its cost-effectiveness and acceptance among patients with adhesive capsulitis. The purpose of our study was to com- pare the efficacy of combined SSNB and IAI with that of IAI alone in the treatment of adhesive capsulitis. We hypothe- sized that combined SSNB and IAI will improve pain and function better than IAI alone.

METHODS

Patient Selection

We performed a retrospective review of 102 consecutive patients diagnosed with adhesive capsulitis who were treated at an outpatient clinic from July 2016 to January 2017. This study was approved by an institutional review board, and the requirement for obtaining informed consent was waived. Among the 102 patients, magnetic resonance imaging (MRI) was performed on 55 (53.9%) patients; 44 patients underwent noncontrast MRI at another hospital, and 11 patients underwent noncontrast MRI at our instit- ute. The inclusion criteria were (1) adhesive capsulitis diagnosed by 2 orthopaedic specialists and (2) a minimum functional and radiological follow-up of 2 months. The exclusion criteria were (1) rheumatoid arthritis, (2) osteo- arthritis, (3) postoperative stiff shoulders, (4) sequelae of infection, and (5) partial- or full-thickness rotator cuff tears as confirmed by MRI or ultrasonography.

An SSNB with an IAI (SSNB + IAI) was performed in 48 patients treated between July 2016 and October 2016, whereas an IAI alone was performed in 54 patients treated between November 2016 and January 2017. All patients were assessed before the intervention and at 2 weeks and 2 months after the intervention. Missing subjective out- come data were completed with telephone interviews. Through the telephone calls, follow-up data of more than 1 year (mean, 19 months [range, 17-23 months]) for the American Shoulder and Elbow Surgeons (ASES) score, function visual analog scale (FVAS), and pain visual analog scale (PVAS) were available. After the initial intervention, nonsteroidal anti-inflammatory drugs were given in both groups. All patients in both groups underwent a shoulder rehabilitation program consisting of active and passive ROM exercises as well as strengthening exercises of the rotator cuff and scapular stabilizing muscles at the outpa- tient clinic on the day of the first intervention.

Interventions

Intra-articular Corticosteroid Injection. All injections were performed at the same site using the posterior route under ultrasonographic guidance. Each injection contained 40 mg (1 mL) of triamcinolone acetonide and 4.5 mL of 2% lidocaine. After thorough sterilization, 5 mL of the combined solution was injected from the lateral to medial direction using the in-plane technique to place the tip within the joint capsule. If the patient had a PVAS score of ≥3 at the 2-week assessment, 1 more IAI was performed.

SSNB + IAI. An SSNB was conducted using ultrasono- graphy. With the patient seated, the spine of the scap- ula was identified. A transverse scan of the scapular spine (which could be identified by palpation) was first obtained, followed by a scan of the spinoglenoid notch. Color Doppler sonography might be useful at this stage to identify the suprascapular artery, which usually courses medially to the nerve. From this site, the nerve could then be easily tracked up to the coracoid notch. A needle was positioned at the desired location in the notch around the nerve using an in-plane approach. For this injection, 9.5 mL of 0.5% bupivacaine and 20 mg (0.5 mL) of triamcinolone aceto- nine were used (Figure 1). In the SSNB + IAI group, 20 mg (0.5 mL) of triamcinolone acetonide and 4.5 mL of 2% lidocaine were used for the IAI to match the total amount of corticosteroid (40 mg) used in the IAI group. If the patient had a PVAS score of ≥3 at the 2-week assessment, 1 more IAI was performed.

1Address correspondence to Jae Chul Yoo, MD, Department of Orthopaedic Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, 81 Irwon-ro, Gangnam-gu, 06351, Seoul, Republic of Korea (email: shoulteryoo@gmail.com).
2Department of Orthopaedic Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea. The authors declared that there are no conflicts of interest in the authorship and publication of this contribution. AOSSM checks author disclosures against the Open Payments Database (OPD). AOSSM has not conducted an independent investigation on the OPD and disclaims any liability or responsibility relating thereto.

Ethical approval for this study was obtained from the Samsung Medical Center Institutional Review Board (No. 2017-09-006).
Clinical Evaluation

Patients were regularly evaluated in the outpatient clinic. The medical records of all patients were reviewed independently.

Clinical results were assessed using the PVAS, FVAS, ASES score,25 Korean Shoulder Scoring System (KSS),34 Constant score,10 Simple Shoulder Test (SST),18 and Shoulder Pain and Disability Index (SPADI)8,29 before the intervention and at 2 weeks and 2 months after the intervention. ROM, including forward flexion (FF), external rotation (ER) of the side, and abduction of the shoulder (ABD), was measured using a goniometer before the intervention and at 2 weeks and 2 months after the intervention. ROM of the contralateral shoulder was measured before the intervention to verify the difference between the involved and contralateral sides, thus clarifying the diagnosis. Internal rotation of the back was not measured with goniometry; instead, it was scored from 0 to 14 points for the region from the buttock to T4 along the level of the vertebra. The patients were asked if they had any history of DM, thyroid disease, or trauma, as these are major secondary causes of adhesive capsulitis of the shoulder.

Statistical Analysis

Statistical analysis was performed using SAS version 9.4 (SAS Institute). A power analysis revealed that a sample of 51 patients in each group was required to detect a 1-point difference on the FVAS with a power of 80% and an α of 0.05, and a sample of 42 patients in each group was required to detect a 5-point difference on the ASES with a power of 80% and an α of 0.05. In the analysis of differences between the 2 groups, the normality hypothesis was tested with the Shapiro-Wilk test; the Student t test and Wilcoxon rank-sum test were then used for parameters following and deviating from the normal distribution, respectively. The chi-square test was used to examine the association

Figure 1. Ultrasonographic images of the suprascapular nerve block (SSNB) at the spinoglenoid notch. (A) An ultrasonographic image of the suprascapular nerve. The hyperechoic line (solid arrowheads) is the inferior fascia of the supraspinatus (SSP). The suprascapular artery and nerve are located below this line. (B, C) After locating the suprascapular artery with a Doppler scan, the needle (open arrowheads) is inserted using a medial in-plane approach such that the tip is placed close to the spinoglenoid notch (solid arrows), where the suprascapular neurovascular bundle is located. As the bundle is barely visible, particular caution should be taken when performing this procedure. AC, acromion; G, glenoid. (D) Local anesthetic spreading around the suprascapular nerve after the injection (open arrows).
between 2 categorical variables in demographic data. In the analysis of changes according to time, all the measurements in both groups had a normal distribution, and the paired t test was applied. To control for the duration of symptoms and presence of the DM (the 2 confounding variables that had P values <.2 on the t test, Wilcoxon rank-sum test, or chi-square test; P = .074 and .110, respectively), a linear regression analysis was used. A P value <.05 was considered to represent a statistically significant difference.

RESULTS

The 102 study patients consisted of 28 men and 74 women with a mean age of 54.17 ± 7.12 years. In the SSNB + IAI group, there were 14 men and 34 women with a mean age of 54.31 ± 6.47 years (range, 42-67 years). Eleven (22.9%), 9 (18.8%), and 8 (16.7%) patients, respectively, named DM, thyroid disease, and trauma as the causative event. The mean duration of symptoms was 7.75 ± 7.59 months (range, 1-48 months), and the dominant shoulder was affected in 26 (54.2%) patients (Table 1).

In the IAI group, there were 14 men and 40 women with a mean age of 54.04 ± 7.71 years (range, 40-79 years). Six (11.1%), 14 (25.9%), and 6 (11.1%) patients, respectively, had a history of DM, thyroid disease, and trauma. The mean duration of symptoms was 6.26 ± 7.51 months (range, 1-44 months), and the dominant shoulder was affected in 28 (51.9%) patients (Table 1).

No complications occurred in either group. There were no significant differences between the groups in demographics and clinical characteristics before the intervention, except in the PVAS and SPADI scores (P > .05) (Tables 1 and 2). ROM of the involved shoulder before the intervention was significantly lower compared with that of the contralateral shoulder (Table 3).

At the 2-week and 2-month assessments, all the follow-up parameters significantly improved in both the SSNB + IAI and the IAI groups (Tables 4 and 5). There was no significant difference between groups in the number of patients who received an additional IAI during the second week after the intervention (n = 31 [64.6%] in SSNB + IAI group vs n = 32 [59.3%] in IAI group; P = .581) (Table 6). In addition, the ASES, PVAS, and PVAS scores at a minimum of 1-year follow-up (mean, 19 months [range, 17-23 months]) were available. The improvements from baseline scores also remained significant at 1-year follow-up among these 3 clinical measures in both groups. However, there were no significant differences in scores between the 2-month and 1-year follow-ups (Figure 2).

A comparison of the groups at the 2-week assessment revealed better FF and ABD values in the SSNB + IAI group (P = .018 and P = .045, respectively) (Table 6). At the 2-month assessment, the improvements in the PVAS, ASES, SST, and SPADI scores and FF and ABD values were significantly larger in the SSNB + IAI group than in the IAI group (Table 6). Additionally, the improvements in the PVAS, ASES, SST, and SPADI scores between the 2-week and 2-month assessments were significantly better in the SSNB + IAI group (Table 7).

A comparison of the groups at a minimum 1-year follow-up also revealed significantly better ASES and PVAS scores in the SSNB + IAI group. The improvements on the PVAS were larger in the SSNB + IAI group than in the IAI, although this difference was not statistically significant (Table 8).

### TABLE 1
Demographic Data of Patients

| Variable                  | SSNB + IAI (n = 48) | IAI (n = 54) | P  |
|---------------------------|---------------------|-------------|----|
| Age, y                    | 54.31 ± 6.47        | 54.04 ± 7.71| .847|
| Sex                       |                     | .714        |    |
| Male                      | 14 (29.2)           | 14 (25.9)   |    |
| Female                    | 34 (70.8)           | 40 (74.1)   |    |
| Shoulder                  |                     | .743        |    |
| Left                      | 26 (54.2)           | 31 (57.4)   |    |
| Right                     | 22 (45.8)           | 23 (42.6)   |    |
| Dominant shoulder         | 26 (54.2)           | 28 (51.9)   | .815|
| Duration of symptoms, mo  | 7.73 ± 7.59         | 6.26 ± 7.51 | .328|
| Diabetes mellitus         | 11 (22.9)           | 6 (11.1)    | .112|
| Thyroid disease           | 9 (18.8)            | 14 (25.9)   | .389|
| Trauma                    | 8 (16.7)            | 6 (11.1)    | .418|

*Values are presented as mean ± SD or n (%). IAI, intra-articular corticosteroid injection; SSNB, suprascapular nerve block.*

### TABLE 2
Clinical Characteristics Before Intervention

| Variable                  | SSNB + IAI | IAI | P Value |
|---------------------------|------------|-----|---------|
| PVAS                      | 6.73 ± 1.33| 6.30 ± 1.46| .158   |
| FVAS                      | 3.75 ± 1.87| 4.91 ± 1.40| .001   |
| ASES                      | 31.17 ± 11.01| 35.22 ± 11.31| .707   |
| Constant                  | 35.50 ± 8.81| 38.91 ± 10.08| .704   |
| KSS                       | 40.38 ± 11.55| 39.98 ± 10.38| .857   |
| SST                       | 3.15 ± 1.47| 3.26 ± 1.31| .770   |
| SPADI pain                | 59.92 ± 14.17| 52.28 ± 14.01| .007   |
| SPADI disability          | 63.44 ± 15.28| 57.78 ± 13.38| .049   |
| SPADI total               | 62.44 ± 14.07| 55.61 ± 12.78| .020   |
| FF                        | 121.46 ± 22.31| 126.85 ± 23.05| .181   |
| ER                        | 33.33 ± 13.26| 35.00 ± 15.14| .617   |
| IR                        | 4.67 ± 3.19| 5.09 ± 3.67| .479   |
| ABD                       | 102.50 ± 29.21| 112.41 ± 32.44| .090   |

*Values are presented as mean ± SD. Bolded P values indicate statistically significant between-group differences (P < .05). ABD, abduction; ASES, American Shoulder and Elbow Surgeons; ER, external rotation; FF, forward flexion; PVAS, function visual analog scale; IAI, intra-articular corticosteroid injection; IR, internal rotation; KSS, Korean Shoulder Scoring System; PVAS, pain visual analog scale; SPADI, Shoulder Pain and Disability Index; SSNB, suprascapular nerve block; SST, Simple Shoulder Test.*


**TABLE 3**

| SSNB + IAI | IAI |
|-----------|-----|
| Involved  | Contralateral | P Value | Involved  | Contralateral | P Value |
| FF        | 121.46 ± 22.31 | 159.79 ± 10.20 | <.001 | 126.85 ± 23.05 | 163.70 ± 8.96 | <.001 |
| ER        | 33.33 ± 13.26 | 63.12 ± 17.03 | <.001 | 35.00 ± 15.14 | 67.22 ± 10.88 | <.001 |
| IR        | 4.67 ± 3.19 | 11.37 ± 1.99 | <.001 | 5.09 ± 3.67 | 12.18 ± 1.86 | <.001 |
| ABD       | 102.50 ± 29.21 | 157.50 ± 15.64 | <.001 | 112.41 ± 32.44 | 163.13 ± 15.01 | <.001 |

 Values are presented as mean ± SD. There were significant differences between the involved and contralateral shoulders on all ROM parameters (P < .05). ABD, abduction; ER, external rotation; FF, forward flexion; IAI, intra-articular corticosteroid injection; IR, internal rotation; ROM, range of motion; SSNB, suprascapular nerve block.

**TABLE 4**

| Before Intervention | 2 wk | P Value | 2 mo | P Value |
|---------------------|------|---------|------|---------|
| PVAS                | 6.73 ± 1.33 | 4.27 ± 1.65 | .001 | 3.25 ± 1.31 |<.001 |
| FVAS                | 3.75 ± 1.87 | 5.73 ± 1.83 | <.001 | 6.77 ± 1.29 |<.001 |
| ASES                | 31.17 ± 11.01 | 54.06 ± 13.35 | <.001 | 64.21 ± 11.05 |<.001 |
| Constant            | 35.50 ± 8.81 | 52.04 ± 10.73 | <.001 | 60.73 ± 10.32 |<.001 |
| KSS                 | 40.38 ± 11.55 | 58.46 ± 12.26 | <.001 | 66.00 ± 11.22 |<.001 |
| SST                 | 3.15 ± 1.47 | 5.44 ± 1.43 | .005 | 6.90 ± 1.29 |<.001 |
| SPADI pain          | 59.92 ± 14.17 | 38.92 ± 14.01 | <.001 | 31.10 ± 11.24 |<.001 |
| SPADI disability    | 63.44 ± 15.28 | 45.25 ± 13.72 | <.001 | 35.00 ± 11.63 |<.001 |
| SPADI total         | 62.44 ± 14.07 | 42.83 ± 12.87 | <.001 | 34.15 ± 11.10 |<.001 |
| FF                  | 121.46 ± 22.31 | 143.13 ± 20.44 | <.001 | 153.13 ± 17.15 |<.001 |
| ER                  | 33.33 ± 13.26 | 46.46 ± 13.45 | .010 | 54.79 ± 13.84 |<.001 |
| IR                  | 4.67 ± 3.19 | 7.81 ± 3.11 | .009 | 9.02 ± 2.76 |.005 |
| ABD                 | 102.50 ± 29.21 | 134.79 ± 23.97 | <.001 | 151.25 ± 20.28 |<.001 |

 Values are presented as mean ± SD. All parameters at both follow-up times showed significant improvements compared with before intervention (P < .05). ABD, abduction; ASES, American Shoulder and Elbow Surgeons; ER, external rotation; FF, forward flexion; FVAS, function visual analog scale; IAI, intra-articular corticosteroid injection; IR, internal rotation; KSS, Korean Shoulder Scoring System; PVAS, pain visual analog scale; SPADI, Shoulder Pain and Disability Index; SSNB, suprascapular nerve block; SST, Simple Shoulder Test.

**TABLE 5**

| Before Intervention | 2 wk | P Value | 2 mo | P Value |
|---------------------|------|---------|------|---------|
| PVAS                | 6.30 ± 1.46 | 3.48 ± 1.51 | <.001 | 2.81 ± 1.29 |<.001 |
| FVAS                | 4.91 ± 1.40 | 6.31 ± 1.49 | <.001 | 7.13 ± 1.26 |<.001 |
| ASES                | 35.22 ± 11.31 | 57.11 ± 13.19 | <.001 | 63.76 ± 11.49 |<.001 |
| Constant            | 38.91 ± 10.08 | 53.59 ± 11.59 | <.001 | 61.09 ± 10.34 |<.001 |
| KSS                 | 39.98 ± 10.38 | 58.48 ± 12.61 | <.001 | 67.35 ± 1.51 |<.001 |
| SST                 | 3.26 ± 1.31 | 5.52 ± 1.59 | .010 | 6.56 ± 1.48 |<.001 |
| SPADI pain          | 52.28 ± 14.01 | 34.52 ± 12.12 | <.001 | 29.54 ± 10.01 |<.001 |
| SPADI disability    | 57.78 ± 13.38 | 41.26 ± 14.19 | <.001 | 34.76 ± 12.41 |<.001 |
| SPADI total         | 55.61 ± 12.78 | 38.20 ± 12.30 | <.001 | 32.44 ± 10.23 |<.001 |
| FF                  | 126.83 ± 23.05 | 142.41 ± 19.32 | <.001 | 151.48 ± 16.53 |<.001 |
| ER                  | 35.00 ± 15.14 | 47.41 ± 14.94 | .029 | 55.00 ± 12.70 |<.001 |
| IR                  | 5.09 ± 3.67 | 7.80 ± 3.59 | .013 | 9.24 ± 3.35 |<.001 |
| ABD                 | 112.41 ± 32.44 | 135.93 ± 29.17 | <.001 | 148.33 ± 22.04 |<.001 |

 Values are presented as mean ± SD. All parameters at both follow-up times showed significant improvements compared with before intervention (P < .05). ABD, abduction; ASES, American Shoulder and Elbow Surgeons; ER, external rotation; FF, forward flexion; FVAS, function visual analog scale; IAI, intra-articular corticosteroid injection; IR, internal rotation; KSS, Korean Shoulder Scoring System; PVAS, pain visual analog scale; SPADI, Shoulder Pain and Disability Index; SST, Simple Shoulder Test.
In general, the symptoms of adhesive capsulitis, severe pain and limitation of ROM, peak at 3 to 6 months after the onset of this disease. It is the physician's task to alleviate this flare. Therefore, an early intervention, such as an IAI or SSNB, during this period is crucial and may precede physical therapy to allow patients to fully participate in a rehabilitation program. This study investigated whether the combined effect of an SSNB and IAI improves pain and functional scores during this severe flare phase. Based on our findings, both SSBI + IAI and IAI alone resulted in significantly improved outcome parameters in patients with adhesive capsulitis unresponsive to IAI. In contrast, the present study compared the effectiveness of an SSNB with that of a series of IAIs in the treatment of adhesive capsulitis. Although some concluded that SSNB and IAI had similar efficacy, others demonstrated that SSNB provided better pain relief and greater functional improvement than IAI.

In terms of the effects of SSNB in the treatment of adhesive capsulitis, our study is in agreement with previous studies. Ozkan et al compared the effects of SSNB in patients with adhesive capsulitis unresponsive to IAI. In that study, patients' simple pain scores and total pain scores, as well as ABD, ER, and internal rotation values, improved significantly after SSNB. A double-blind randomized clinical trial by Dahan et al compared a treatment group that received 10 mL of bupivacaine SSNB with a placebo group that received 10 mL of physiological saline. The authors concluded that the bupivacaine SSNB was effective in reducing pain in adhesive capsulitis at 1 month.

Our findings on the use of an IAI for the treatment of adhesive capsulitis are consistent with those in the literature. Previous systematic reviews on the use of corticosteroids mostly found evidence of their short-term effectiveness. In 2016, Koh performed a systematic review of randomized clinical trials on the use of corticosteroid injections in adhesive capsulitis suggested that multiple injections...
2-Months Post-intervention
Final follow-up

have suggested that a combination of corticosteroids with local anesthetics prolongs the efficacy of nerve blockage up to 1.5 to 2 times and decreases pain scores.28,39 Therefore, a combination with a corticosteroid was selected in this study to prolong the blockage duration and increase the analgesic effects. Although bupivacaine is the most widely used long-acting local anesthetic agent, it is associated with various central nervous system and cardiac toxicities.9,26,35 Ropivacaine has been proposed as a promising drug with fewer cardiovascular and central nervous system toxicity effects compared with bupivacaine.31 However, comparative studies of cardiovascular safety have reported that these 2 anesthetic agents have similar efficacy and incidences of cardio toxicity.16,38 There were no cardiovascular adverse effects in our study.

Our study has several limitations. First, although a sample of 51 patients in each group was required according to the power analysis, loss to follow-up reduced the size of our SSNB + IAI group to 48 patients. Nevertheless, a sample of

**Figure 2.** Clinical outcomes of both groups between before intervention, 2 months, and final follow-up. *Significant difference (P < .05). ABD, abduction; ASES, American Shoulder and Elbow Surgeons; ER, external rotation; FF, forward flexion; FVAS, function visual analog scale; IAI, intra-articular corticosteroid injection; PVAS, pain visual analog scale; SSNB, suprascapular nerve block.

are beneficial until 16 weeks from the date of the first injection. Up to 3 injections were beneficial, and there was limited evidence that 4 to 6 injections also had a positive effect. There was no evidence to support more than 6 injections.

We used a common combination of 9.5 mL of 0.5% bupivacaine and 0.5 mL (20 mg) of triamcinolone acetonide for the SSNB in this study. Bupivacaine is the first choice for regional anesthesia owing to its effectiveness, long duration, and milder motor blockade. In addition, some studies have suggested that a combination of corticosteroids with

| TABLE 7 | Differences in Improvements Between Groups From 2-Week to 2-Month Assessments* |
|---------|---------------------------------|
|         | SSNB + IAI | IAI | P Value |
| PVAS    | –1.02 ± 1.00 | –0.67 ± 0.75 | .043 |
| FVAS    | 1.04 ± 1.46  | 0.81 ± 1.10  | .286 |
| ASES    | 10.15 ± 6.23 | 6.65 ± 6.18  | .005 |
| Constant| 8.69 ± 5.36  | 7.50 ± 4.40  | .161 |
| KSS     | 7.54 ± 5.05  | 8.87 ± 5.80  | .258 |
| SST     | 1.46 ± 0.62  | 1.04 ± 0.67  | .002 |
| SPADI pain | –7.81 ± 7.82 | –4.98 ± 5.92 | .037 |
| SPADI disability | –10.25 ± 5.65 | –6.50 ± 7.11 | .002 |
| SPADI total | –8.69 ± 6.42 | –5.76 ± 6.58 | .019 |
| FF      | 10.00 ± 8.25 | 9.07 ± 8.30  | .535 |
| ER      | 8.33 ± 9.07  | 7.59 ± 6.71  | .580 |
| IR      | 1.21 ± 1.47  | 1.44 ± 1.74  | .440 |
| ABD     | 16.46 ± 11.76 | 12.41 ± 15.65 | .135 |

*Values are presented as mean ± SD. Bolded P values indicate statistically significant between-group differences (P < .05). ABD, abduction; ASES, American Shoulder and Elbow Surgeons; ER, external rotation; FF, forward flexion; FVAS, function visual analog scale; IAI, intra-articular corticosteroid injection; PVAS, pain visual analog scale; SSNB, suprascapular nerve block.

**TABLE 8**

Differences in Improvements Between Groups From Before Intervention to Final Follow-up*

|         | SSNB + IAI | IAI | P Value |
|---------|---------------------------------|
| PVAS    | –3.35 ± 1.57 | –2.73 ± 1.57 | .084 |
| FVAS    | 3.27 ± 2.13  | 1.93 ± 1.56  | .005 |
| ASES    | 35.46 ± 13.86 | 28.03 ± 12.24 | .015 |

*Values are presented as mean ± SD. Bolded P values indicate statistically significant between-group differences (P < .05). ABD, abduction; ASES, American Shoulder and Elbow Surgeons; ER, external rotation; FF, forward flexion; FVAS, function visual analog scale; IAI, intra-articular corticosteroid injection; PVAS, pain visual analog scale; SSNB, suprascapular nerve block.
CONCLUSION

Both SSNB + IAI and IAI alone significantly improved pain and functional outcomes in patients with adhesive capsulitis. Moreover, the application of an SSNB with IAI further increased the efficacy, as per the FVAS, ASES, SST, and SPADI scores and FP and ABD values. Furthermore, SSNB + IAI treatment led to greater improvements in FVAS and ASES scores compared with IAI alone at a minimum of 1 year after the intervention. Therefore, an SSNB with an IAI may be a better choice for the treatment of adhesive capsulitis accompanied with severe pain and functional loss.

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