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The Comparison of Effects of Suprascapular Nerve Block, Intra-articular Steroid Injection, and a Combination Therapy on Hemiplegic Shoulder Pain: Pilot Study

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Objective To assess the relative effectiveness of three injections methods suprascapular nerve block (SSNB) alone, intra-articular steroid injection (IAI) alone, or both—on relief of hemiplegic shoulder pain.

Methods We recruited 30 patients with hemiplegic shoulder pain after stroke. SSNB was performed in 10 patients, IAI in 10 patients, and a combination of two injections in 10 patients. All were ultrasonography guided. Each patient's maximum passive range of motion (ROM) in the shoulder was measured, and the pain intensity level was assessed with a visual analogue scale (VAS). Repeated measures were performed on pre-injection, and after injection at 1 hour, 1 week, and 1 month. Data were analyzed by Kruskal-Wallis and Friedman tests.

Results All variables that were repeatedly measured showed significant differences in shoulder ROM with time ($p<0.05$), but there was no difference according injection method. In addition, VAS was statistically significantly different with time, but there was no difference by injection method. Pain significantly decreased until a week after injection, but pain after a month was relatively increased. However, pain was decreased compared to pre-injection.

Conclusion The three injection methods significantly improved shoulder ROM and pain with time, but no statistically significant difference was found between them.

Keywords Stroke, Shoulder pain, Nerve block, Intra-articular injections

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INTRODUCTION

Hemiplegic shoulder pain is a common complication after stroke, with a prevalence of 16% to 84% [1-8]. Shoulder pain extends the duration of post-stroke hospitalization, and can be a major factor that hinders appropriate rehabilitation. This pain limits range of motion (ROM), limits joint contracture, decreases hand function, delays functional recovery in the patients, limits activities of daily living, and can be a major factor that decreases treatment efficiency and quality of life [9,10]. It can also lead to decreased functional movement and depression [11].

Hemiplegic shoulder pain is caused by unstable shoulder structures due to sensory and motor nerve injury on the affected side that leads to shoulder subluxation, articular capsule contracture, rotator cuff or biceps disease, stiffness (spasticity), and complex regional pain syndrome [12]. A recent study implicated more complex causes [13].

Management of hemiplegic shoulder pain focuses on reducing pain and increasing ROM. To relieve these symptoms, various physical therapies including heat therapy and electrical therapy are currently used. In case of shoulder subluxation, arm sling and functional electrical stimulation are used; for adhesive capsulitis, intra-articular or intrabursal steroid injection is used and for type 1 complex regional pain syndrome, stellate ganglion block and oral steroids are used [14]. Recently, intra-articular steroid injection (IAI) and suprascapular nerve block (SSNB) have become popular. This prospective study compared the effects of IAI alone, SSNB alone, and both used in combination.

MATERIALS AND METHODS

Subjects

This study recruited 33 stroke patients (16 males, 17 females) who were hospitalized in the Rehabilitation Department at Dong-Eui Hospital between August 2011 and March 2012. The inclusion criteria were brain lesion can be recognized by brain computed tomography or magnetic resonance imaging, hemiplegia as a stroke sequelae, localized shoulder joint pain and limited ROM (LOM) in the proximal arm for a minimum of 2 weeks on the hemiplegic side, and Korean version of Mini-Mental State Examination score of 23 or higher. The exclusion criteria were previous trauma history affecting shoulder pain, shoulder pain and LOM before stroke, difficulty in cooperating due to aphasia, hemi-neglect assessed by line bisection test, electrodiagnosis as cervical radiculopathy or peripheral nerve lesion, and any kind of shoulder injection before participate in this study. Thirty-three patients met the inclusion criteria. Three subsequently dropped out: 2 patients had trauma history and 1 patient felled and aggravated shoulder pain. The remaining 30 patients were hospitalized in the Department of Rehabilitation Medicine. They were divided into three groups (IAI alone, SSNB alone, and IAI+SSNB) by orders of admission or transfer. All patients granted written informed consent to participate.

Methods

Age, gender, stroke type, onset of stroke, and duration of injection treatment were included, and pain and spasticity were assessed in supine position. During the study, anti-inflammatory medication and therapeutic modalities including hot pack, transcutaneous electrical nerve stimulation, and microwave were not prescribed.

IAI and SSNB were ultrasound-guided, and were conducted by a skilled rehabilitation medical doctor who had no information about the patients. For IAI, 1% lidocaine 10 mL+triamcinolone acetonide 40 mg was used. With ultrasound guidance, the patient's arm was internally rotated, and the probe was placed along the posterior axis of the patient's infraspinous muscle. After adjusting the probe to have a clear view on the infraspinous muscle, humeral head, glenoid cavity, and labrum, the injection was performed by a posterior approach after checking that the injection was made into the articular space. For SSNB, 1% lidocaine 5 mL was used, and the injection was made after checking the pulse on the suprascapular artery by locating the suprascapular notch while the patient was in a sitting position. The injection needle was placed near the suprascapular nerve inside the suprascapular notch. For the combined treatment, IAI was done immediately after SSNB.

ROMs for flexion, abduction, internal rotation, and external rotation were measured, and degree of pain was assessed with a visual analog scale (VAS). Each patient's ROM and degree of pain were measured immediately before the injection and post-injection at 1 hour, 1 week, and 1 month. Degree of pain was calculated with the average value of VAS of flexion, abduction, internal rotation, and external rotation. These measurements were conducted by another medical doctor blinded to this study, and the injection methods were not explained to the evaluator and patients to avoid bias. All patients received continuous neurodevelopmental therapy for stroke.

SPSS ver. 17.0K for Windows (SPSS Inc., Chicago, IL, USA) was used for statistical analyses. Kruskal-Wallis and

Table 1. Comparisons of clinical characteristics among IAI, SSNB, and combined treatment groups

	IAI	SSNB	combined	p-value
Gender (male:female)	4:6	5:5	5:5	-
Age (yr)	64.30±16.21	64.00±8.44	61.00±11.25	0.662
Time since stroke (wk)	16.30±14.36	19.80±16.19	19.60±15.79	0.843
Etiology				0.668
Hemorrhagic stroke	5	3	4	
Ischemic stroke	5	7	6	
Affected side				0.085
Right	5	2	7	
Left	5	8	3	
Pain (VAS)	6.23±1.04	6.13±1.23	6.28±2.05	0.796
Spasticity (MAS)	0.60±0.70	0.70±0.82	0.50±0.71	0.849
MMSE	25.00±2.49	26.40±2.87	25.20±2.48	0.225

Values are presented as number or mean±standard deviation.
IAI, intra-articular steroid injection; SSNB, suprascapular nerve block; combined, IAI+SSNB; VAS, visual analog scale; MAS, Modified Ashworth Scale; MMSE, Mini-Mental State Examination.

Friedman tests were used for the changes in shoulder pain and ROM with time in all groups. A p-value <0.05 was considered statistically significant.

RESULTS

There were more females (16 females, 53%) than males (14 males, 47%). Average age of IAI group, SSNB group, and combination treatment group was 64.30±16.21, 64.00±8.44, and 61.00±11.25 years, respectively, with no significant difference (p=0.662). The average duration from the onset of stroke to the injection treatment in the same respective order was 16.30±14.36, 19.80±16.19, and 19.60±15.79 weeks, with no significant difference (p=0.843). No statistically significant differences were evident in etiology (p=0.668) and the affected side (p=0.085) among the three groups (Table 1).

Kruskal-Wallis and Friedman tests were used to evaluate differences in efficacy of the injection regimens for hemiplegic shoulder pain. All variables that were repeatedly measured showed significant differences in shoulder ROM with time, but there was no significant difference according to the injection method (Fig. 1). VAS showed statistically significant differences with time (p=0.000), but no difference by injection method. Pain was significantly decreased a week following injection, was comparatively greater after 1 month. However, pain following treatment was always decreased compared to pre-injection (Fig. 2).

DISCUSSION

IAI alone, SSNB alone, and the combination are relatively safe and accurate, and are commonly used for relief of shoulder pain caused by shoulder lesions, such as rotator cuff problems and frozen shoulder. But, the relative efficacy of the regimens for hemiplegic shoulder pain has been unclear. Presently, statistically significant changes in shoulder ROM and pain were evident over time, with no significant difference between the three injection methods.

The exact etiological cause for hemiplegic shoulder pain in stroke patients has not been established. Various factors have been implicated. Most hemiplegic patients have damaged sensory and motor nerves on the affected side that causes shoulder joint disease and rotator cuff injury [15,16], shoulder joint subluxation due to decreased muscle tone in the flaccid stage of early post-stroke [15,17], and rotator cuff muscle collision due to loss of rotator cuff protection caused by paralysis. These microtrauma, injury, and inflammation can lead to tendinitis or tendon rupture [9,12,15]. Limited active ROM and shoulder joint capsule contracture that develop after hemiplegia increases the prevalence of contractured articular inflammation and tendinitis [15]. Spasticity that develops during stroke recovery is related to shoulder

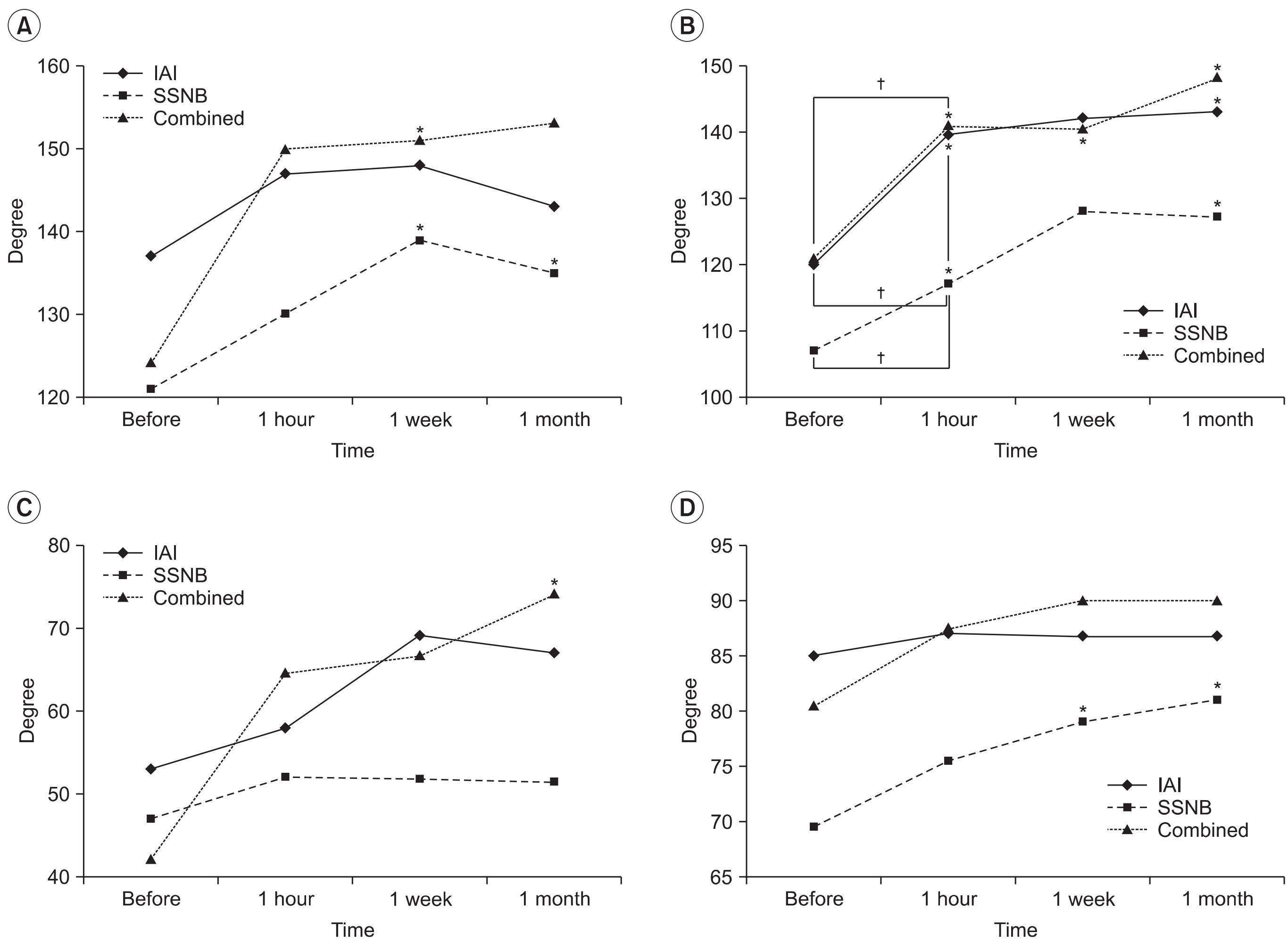

Fig. 1. Changes in passive range of motion (ROM) after injection with time. (A) Changes in passive flexion ROM after injection with time. (B) Changes in passive abduction ROM after injection with time. (C) Changes in passive external rotation ROM after injection with time. (D) Changes in passive internal rotation ROM after injection with time. IAI, intra-articular steroid injection; SSNB, suprascapular nerve block; combined, IAI+SSNB.

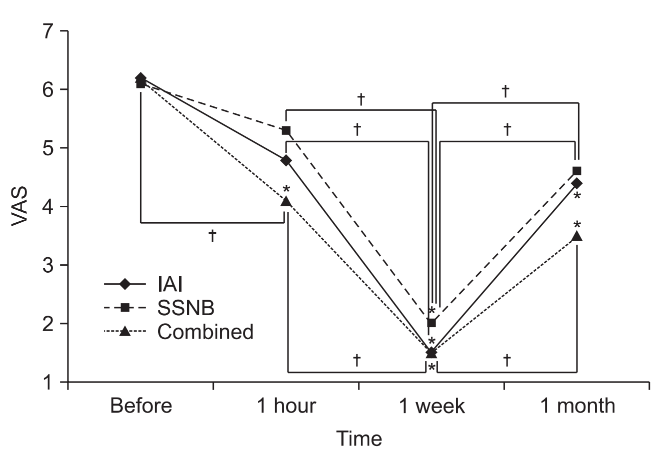

Fig. 2. Changes in visual analogue scale (VAS) after injection with time. IAI, intra-articular steroid injection; SSNB, suprascapular nerve block; combined, IAI+SSNB.

pain [18]. Complex regional pain syndrome also develops in 10%–31% of hemiplegic stroke patients and can be diagnosed by clinical findings and using bone scan [19-21].

Lo et al. [22] reported that 50% of the hemiplegic shoulder pain on the affected side is contractured articular inflammation, 44% is shoulder subluxation, 22% is rotator cuff damage, and 16% is complex regional pain syndrome. Persons with hemiplegic shoulder pain often have more than two factors that cause the pain [13,22].

IAI can be done accurately with injection inside the articular space without radiation hazards when performed under ultrasound guidance. As the patient's arm is internally rotated, the probe is placed along the posterior axis of the patient's infraspinous muscle. After adjusting the probe to have a clear view on the infraspinous muscle, humeral head, glenoid cavity, and labrum, the injection needle is inserted from the lateral side of the probe horizontal to the probe along the axis of supraspinous muscle [23]. IAI is effective for contractured articular inflammation, but not hemiplegia. The effects on hemiplegic shoulder pain are controversial. In one study, no significant difference was found between IAI using triamcinolone acetonide and normal saline for the pain that developed in hemiplegic patients [24]. However, the regimen is still widely used in clinics for pain and steroid-mediated inflammation reduction.

The suprascapular nerve takes up about 70% of the sensory nerves in the shoulder joint. Blockage of the nerve is very effective in relieving pain. For injection, the patient is in a sitting position, and is instructed to put the testing arm on the other side of the shoulder. The probe is placed horizontal to the scapular spine and the supraspinous fossa is checked by moving the probe anteriorly. The suprascapular notch is found by slowly locating the probe laterally. The pulsating suprascapular artery is found on color Doppler ultrasound, and is a good indicator for the location of suprascapular nerve. Injection is then done at this location [23].

The few studies of SSNB for hemiplegic shoulder pain have reported it to be, a potentially safe and effective treatment [25]. A comparison of IAI and SSNB for unspecified (not hemiplegic) shoulder pain reported both approaches, were effective, with no difference in the treatment. Better results were evident when both approaches for used [26]. However, the study involved non-hemiplegic patients, so the results cannot be applied on the patients with hemiplegic shoulder pain. A study that compared IAI and SSNB for hemiplegic shoulder pain reported improvements in pain and shoulder ROM with both approaches, with no significant difference. However, the study used a blinded approach for the injection treatments [27]. A blinded approach for IAI for shoulder joints has a low success rate of 33%–46% depending on the injection method and conductor experience, while injection under ultrasound guidance has a much better success rate of 93% [28]. A significant difference between blinded SSNB and ultrasound-guided nerve block was reported, but the ultrasound-guided nerve block showed significantly decreased amplitude when pre- and post-nerve block electromyography was compared [29]. Presently, IAI and SSNB were ultrasound-guided.

Injection of glucocorticoid typically involves a lot of. This changes the glucose metabolism in the liver and other organs, which can decrease insulin sensitivity [30,31]. IAI is limited for patients with underlying diseases like diabetes because steroids can produce adverse effects, albeit atypically. The injection approach should be carefully considered.

In this study, significant changes in all shoulder ROMs and pain were observed in all three injection methods. Degree of pain was significantly decreased a week after injection, although the pain was increased after a month. However, pain was always decreased compared to that before injection. Increased spasticity or subluxation may be positively related with increasing shoulder pain with time in hemiplegic patients. The benefits of combination treatments were not as significant as those of IAI and SSNB alone.

Pain and ROM in the patients with hemiplegic shoulder pain can be improved with selection of proper injection method and rehabilitation therapy for each individual. This is considered to be helpful in improving the efficacy and compliance of the rehabilitation therapy for stroke patients.

Limitations of this pilot study include small number of subjects, lack of control group, and short (4-week) follow-up, and lack of control of neurodevelopmental therapy for hemiplegic patients. These limitations hinder an absolute determination of the effects of injection. Broader and long-term follow-up studies are needed.

In conclusion, thirty patients with hemiplegic shoulder pain and LOM were treated with IAI, SSNB, or IAI+SSNB. All three methods significantly improved shoulder ROM and pain with time in a statistically similar fashion. Therefore, injection treatments that are appropriate for the patient's symptoms and condition may be helpful in post-stroke rehabilitation and functional recovery for the patients with hemiplegic shoulder pain and LOM.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article.

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