

Original Article

Combination of Patient Controlled Subacromial Levobupivacaine Infusion and Interscalene Block: an Alternative Technique in Pain Relief after Shoulder Arthroscopy

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Abstract

Objective: The purpose of this study was to evaluate the efficacy of subacromial infusion combined with interscalene block for postoperative pain control after arthroscopic shoulder surgery.

Methods: Forty patients underwent arthroscopic shoulder surgery participated in this prospective study and were randomized into 2 groups: patient-controlled subacromial levobupivacaine infusion combined with interscalene block (group ISB-SA) and interscalene block alone (group ISB-NSS). Interscalene blocks with 20 ml of 0.5% levobupivacaine were performed preoperatively and infusion catheters were placed in the subacromial space before the end of surgery on all patients. In the group ISB-SA, the infusion catheter was infused with 0.25% levobupivacaine, whereas, in the group ISB-NSS, it was infused with NSS both by PCA pumps. All pumps were programmed with a continuous basal rate 5 ml/hr, and on demand 5 ml bolus with a 30-minute lockout time for 24 postoperative hours. Visual analog scale (VAS) data was collected immediately after the operation and at 1, 8, and 24 hours postoperatively. Additional medication required for pain, side effects and patient satisfaction were evaluated.

Results: There were no statistically significant differences ($P>0.05$) either in VAS at any time interval or total cumulative morphine consumption between the two groups. After the analgesic effect of ISB had worn off, more than 70% of the patients in both groups still reported suboptimal postoperative pain control. The side effects and patient satisfaction in postoperative pain control between both groups was not different.

Conclusions: The patient-controlled subacromial levobupivacaine infusion combined with interscalene block did not provide more pain relief than interscalene block alone. Subacromial infusion did not enhance the postoperative analgesic effect after the block wore off.

Key words: Subacromial infusion, Interscalene block, Postoperative analgesia, Shoulder arthroscopy

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Introduction

Arthroscopic shoulder surgery has continuously gained in popularity during the past two decades. Although the outcomes between arthroscopic and open surgery are not different, the early postoperative pain control, especially in the first three months after surgery, is better for patients who received arthroscopic surgery.^{1, 2} Higher patient satisfaction, reduces hospital stays and costs which are other advantages of shoulder arthroscopy.^{3, 4}

However, one-third of patients still reported severe pain on the first postoperative day despite multimodal analgesia.⁵ In an ambulatory setting, shoulder surgery has a high chance of severe pain, which delays hospital discharge for patients.⁶ Adequate pain management after shoulder surgery is therefore important, not only to improve the patient's well being, but also to facilitate recovery, physiotherapy and rehabilitation. A combination of some postoperative pain management modalities is commonly used. These modalities include a single injection or continuous infusion of interscalene block, subacromial or intraarticular local anesthetic infusion, suprascapular nerve block, oral and intravenous analgesics, and cold compression.

Interscalene block (ISB) is a recognized effective technique for providing anesthesia-analgesia for shoulder surgery.⁷⁻⁹ In comparison with other regional techniques, ISB is the most efficient one.¹⁰⁻¹² When performed by trained anesthesiologists, the success rate of this block is higher than 96%, while the complication rate is relatively low.^{7, 13-16} Unfortunately, the pain relief provided by a single injection of ISB block lasts only 6-24 postoperative hours.^{13, 17, 18} After the block wears off, up to 20% of patients report severe pain.¹⁷

Mallon introduced the use of local anesthetic infused directly into the subacromial space as an effective means of providing analgesia after shoulder surgery.¹⁹ Various studies have supported his result. Either continuous or patient-controlled subacromial infusion of long acting local anesthetic is effective.^{20, 21} Furthermore, the subacromial infusion can be used effectively in several types of shoulder arthroscopy, not only in subacromial decompression, but also in capsular releasing, rotator cuff, and SLAP repair.²²

This technique has certain advantages over ISB for postoperative pain control. It is simple to insert and can be placed directly under arthroscopic visualization, which ensures adequate placement in the subacromial space. Also it reduces the prevalence of vascular and nerve damage.²⁰ It is also very safe. No studies have reported any serious complications, such as local anesthetic toxicity or glenohumeral condrolysis, which are commonly found commonly in the intraarticular local anesthetic injection technique.^{19, 21, 23} In a large series of studies, which included 583 patients, no cases of infection, internal catheter breakage, pump failure, or hospital admission for pain control were found. The only complication was external catheter breakage.²⁴

Delauney et al reported that continuous subacromial infusion could be an alternative technique, when continuous ISB (CISB) which provides better pain relief could not be performed.²⁵ No previous studies have demonstrated the early postoperative analgesic effect of the combined subacromial infusion and interscalene block. The aim of this study was to investigate whether the addition of patient-controlled subacromial levobupivacaine infusion (PCSA) improved the postoperative analgesic effect of a single injection interscalene block (SISB) in arthroscopic shoulder surgery. The authors hypothesized that the visual analog pain scale and amount of supplemental analgesics required over 24 postoperative hours in patients receiving ISB alone would be greater than ISB combined with patient-controlled subacromial levobupivacaine infusion.

Materials and Methods

The local institutional ethics committee of Thammasat University Hospital approved this study on the 23rd July, 2008. Forty patients at Thammasat University Hospital were scheduled for elective arthroscopic subacromial decompression surgery, with or without capsular releasing and rotator cuff repair (RCR) from August 2008 to July 2009. Each patient gave written, informed consent before enrolling in the study. The inclusion criteria were age 18 to 80 years and ASA physical status I-III. The exclusion criteria were surgery performed by open technique, allergies to any study drugs, current treatment

with a major opioid, severe heart, pulmonary, liver, or renal disease, history of chronic pain, bleeding disorder, peripheral neuropathy, cerebrovascular disease, or any other contraindication for interscalene block.

The investigators randomly assigned the patients into two groups by using sealed envelopes: which were group ISB-SA (subacromial local anesthetic administration) and group ISB-NSS (subacromial normal saline administration). Each group had 20 patients. The surgeon was blinded to the group randomisation and did not participate in postoperative pain control. All other people involved in this study, including the patients and medical staff at the postanesthetic care unit (PACU) and the ward, were also blinded to the study arms.

All the patients received ISB in the induction room. Noninvasive blood pressure, heart rate, oxygen saturation, and electrocardiogram readings were monitored, and premedication with 1-2 mgs of midazolam were given intravenously. The blocks were performed according to Winnie landmarks, with an insulated needle (PAJUNK Uniplex Nanoline insulated needle-22-gauge, 50 mm) connected to a peripheral nerve stimulator (Multi-Stim SENSOR, PAJUNK Medizintechnologie, Geisingen, Germany). The needle was directed medially towards the opposite elbow until the appropriate motor response was elicited (deltoid or triceps muscles contraction) with a current intensity that was strictly controlled between 0.2-0.5 mA, and pulse duration at 0.1 ms. After negative blood aspiration, 20 ml of 0.5% levobupivacaine (Chirocaine, Nycomed Pharma, AS, Elverum, Norway) was injected slowly with aspiration tests every 5 ml. The block was assessed by a cold test in the C5-C6 dermatomal distribution and by deltoid muscle strength every 10 mins. One patient, whose operated shoulder was not fully anesthetized 30 minutes after receiving the block, was excluded from the study.

In the operating room, general anesthesia was induced by injecting 2 mg/kg of propofol, and an endotracheal tube was intubated with the facilitation of 0.5 mg/kg of atracurium. The inhalation of oxygen (33%), nitrous oxide (67%), and 1 MAC of sevoflurane was used for maintaining anesthesia. Atracurium (0.2 mg/kg),

propofol (0.5-1 mg/kg), or fentanyl (1-2 mcg/kg) were supplemented during surgery according to clinical criteria. During surgery, anesthesiologists maintained mean arterial pressure > 70 mmHg or > 80% of preinduction value.

The operations on all patients were performed in the upright position by the same surgeon. The patients sat at 60-80 degrees on a beach chair operating table. The subacromial and intraarticular spaces were expanded by irrigation fluid, which consisted of acetated ringer's solution and epinephrine (0.67 mcg/ml) to reduce blood loss. At the end of surgery, the surgeon inserted a wound drain catheter through the anterior portal and placed an epidural catheter (Epidural Minipack, 16-gauge; Portex, Keene, NH) via a tuohy needle in the subacromial area under direct arthroscopic view. All the catheters were secured with occlusive dressing (Tegaderm; 3M Corporation, St Paul, MN). Both the wound drain and subacromial catheter were removed after 24 postoperative hours.

Before discontinuing general anesthesia, patients in the group ISB-SA were injected with 20 ml of levobupivacaine via subacromial catheters, whereas, the group ISB-NSS were administered 20 ml of NSS. In the PACU, anesthesiologists connected the subacromial catheter to the patient-controlled analgesic (PCA) pump which contained 0.25% levobupivacaine in group ISB-SA and normal saline in group ISB-NSS. All pumps were programmed with a continuous basal infusion at a rate of 5 ml/h, and on-demand 5 ml bolus with a 30-minute lockout time for 24 postoperative hours. The cumulative total of local anesthetic and NSS consumption and number of demand doses delivered were recovered from the pump memory. A visual analog scale (VAS; 0 = no pain, 10 = worst imaginable pain) was used for pain assessment. Morphine at 3 mgs was given intravenously when the VAS pain score exceeded 4 points or the patients requested supplemental analgesics. This regimen of morphine administration was explained clearly to the patients and nurses who administered the medication. After 24 postoperative hours, all subacromial pumps were stopped and removed from the patients. Routine postoperative pain management was administered.

Pain assessment (VAS) was scored immediately after the operation and at 1, 8, and 24 hours postoperatively. Pain was assessed both at rest and passive movement by PACU or ward nurses blinded from the study. The passive movement corresponded to abduction movement of the shoulder up to 90 degrees or until pain occurred.

The mean morphine consumption between both groups was compared, and the number of patients asking for morphine administration over time intervals during the 24 hours was recorded. The incidence of nausea, vomiting, pruritus, and respiratory depression was recorded during the entire study period. These events were reported by a 3-grade scale (0=no symptom, 1=mild symptoms and no treatment, 2=severe symptoms and need for treatment).

All patients were asked to state their satisfaction with the postoperative analgesic treatment during 24 postoperative hours by a VAS scale (VAS; 0=not satisfied at all, 10=absolutely satisfied).

Prospective power analysis determined a minimum requirement of 19 subjects in each group to show a difference in pain control between the groups of greater than 25% on the VAS (primary outcome measurement)

at an α level 0.05 and with a β value of 0.80. Data was reported as mean \pm S.D. unless stated otherwise. The VAS at 0, 1, and 8 hours and cumulative doses of morphine were compared with the Mann-Whitney U-Test whereas the VAS at 24 hours and satisfaction were compared with a t-Test. A Chi-Square test was used for the evaluation of the incidence of patients that needed morphine administration in 24 postoperative hours and adverse events. All descriptive and analytical statistics were calculated with SPSS version 16.0, and $P < 0.05$ was considered significant.

Results

Forty patients were enrolled in this study. One of those in group ISB-NSS was excluded from this study due to a malfunction in the PCA pump in the ward. The others completed the study (20 patients in group ISB-SA, 19 in group ISB-NSS). The patient characteristics of the study groups were comparable, as demonstrated in Table 1. No significant differences were found between groups in patient ages, gender distribution, ASA classification, operation types, sides and time (P value range, 0.36 to 0.83).

Table 1 Demographic data and details of surgical procedures by group

	Group ISB-SA	Group ISB-NSS
Patients, Nos.	20	19
Age, years	57.55 \pm 12.17	55.21 \pm 12.85
Sex, Nos.		
Males	7	8
Females	13	11
ASA		
I	9	8
II	9	10
III	2	1
Operation, types		
Subacromial decompression (SAD)	7	3
SAD with capsular release	3	2
SAD with rotator cuff repair (RCR)	10	13
SAD with capsular release and RCR	0	1
Operation, sides		
Left	8	7
Right	12	12
Operation time, minutes	144.25 \pm 42.25	151.32 \pm 47.69

The results for VAS pain score have been illustrated in Table 2 and Figure 1. No statistically significant

differences were identified for any interval over the 24-hour evaluation (P value ranged, from 0.305 to 1).

Table 2 Visual analog scales during rest and passive movement

	Group ISB-SA (20 patients)		Group ISB-NSS (19 patients)		P value
0 hour, rest (postoperative)	0 ± 0	(0-0)	0 ± 0	(0-0)	1.000
0 hour, passive	0 ± 0	(0-0)	0 ± 0	(0-0)	1.000
1 hour, rest	0 ± 0	(0-0)	0 ± 0	(0-0)	1.000
1 hour, passive	0 ± 0	(0-0)	0.05 ± 0.23(0-1)		0.305
8 hours, rest	1.3 ± 1.98(0-7)		1.37 ± 1.89(0-5)		0.925
8 hours, passive	3 ± 3.43(0-10)		3.11 ± 3.31(0-10)		0.838
24 hours, rest	3.4 ± 2.09(0-8)		2.95 ± 1.84(0-6)		0.478
24 hours, passive	5.8 ± 2.78(0-10)		5.95 ± 2.09(2-10)		0.853

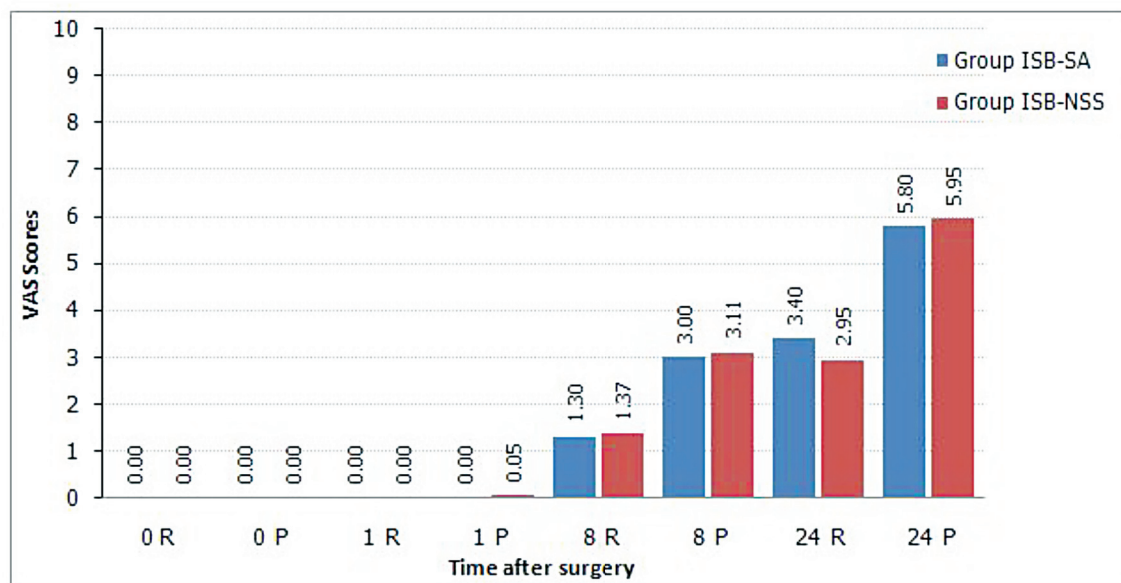


Figure 1 Comparison of VAS scores rest and passive movement over the intervals tested between group ISB-SA and group ISB-NSS. No statistically significant differences were identified for any interval over the 24-hour evaluation. (R = rest, P = passive movement)

The number of PCA demands between groups was not different (14.850 ± 13.256 in group ISB-SA VS 20.473 ± 20.068 in group ISB-NSS, $P=0.312$). Up to 70% and 79% of patients in group ISB-NSS and group ISB-SA, respectively still required sub-optimal postoperative pain relief (VAS >4) during the first postoperative day. Subgroup analysis was

performed in patients who received only arthroscopic subacromial decompression surgery. The investigators discovered a statistically significant difference of VAS at 24 postoperative hours at rest between groups (mean VAS 1.57 ± 1.72 in group ISB-SA VS 4.33 ± 1.53 in group ISB-NSS, $P=0.044$) (Fig.2).

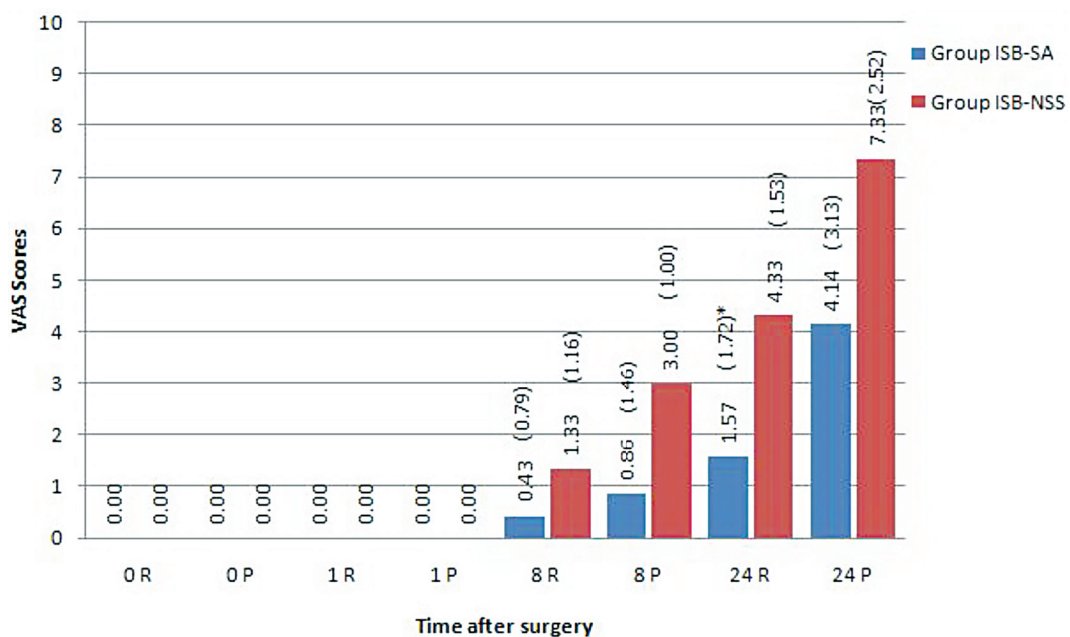


Figure 2 Comparison of VAS scores at passive movement of patients receiving only arthroscopic subacromial decompression surgery over the intervals tested between group ISB-SA and group ISB-NSS. A statistically significant difference was identified during test at 24 postoperative hours at rest ($P = 0.044$) (R = rest, P = passive movement) (SD is presented in brackets)

There was no significant difference in the mean morphine consumption between group ISB-SA and ISB-NSS for the first 24 postoperative hours: 3.15 ± 3.95 VS 5.05 ± 5.20 , $P = 0.24$ (Fig.3). The incidence of patients asking for analgesic administration in group ISB-NSS (68%) was higher than that in group ISB-SA (55%), but

the difference was not statistically significant ($P = 0.389$). The number of patients in each group requesting their first morphine administration during every 8 hour interval was recorded and compared, and the authors found no statistically significant difference in any time intervals (Fig. 4).

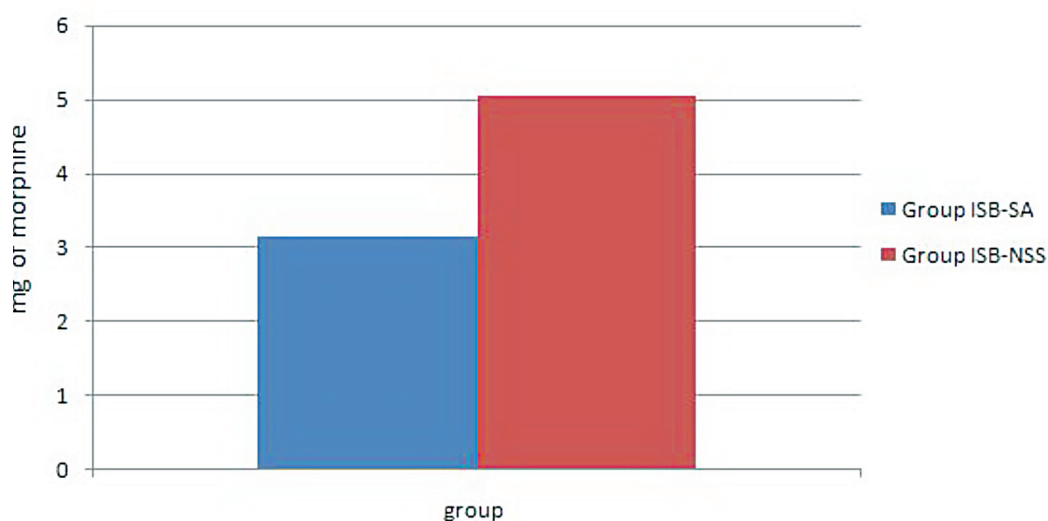


Figure 3 Comparison of the mean morphine consumption (mg) between group ISB-SA and group ISB-NSS over 24 hours postoperatively. No statistically significant difference was identified.

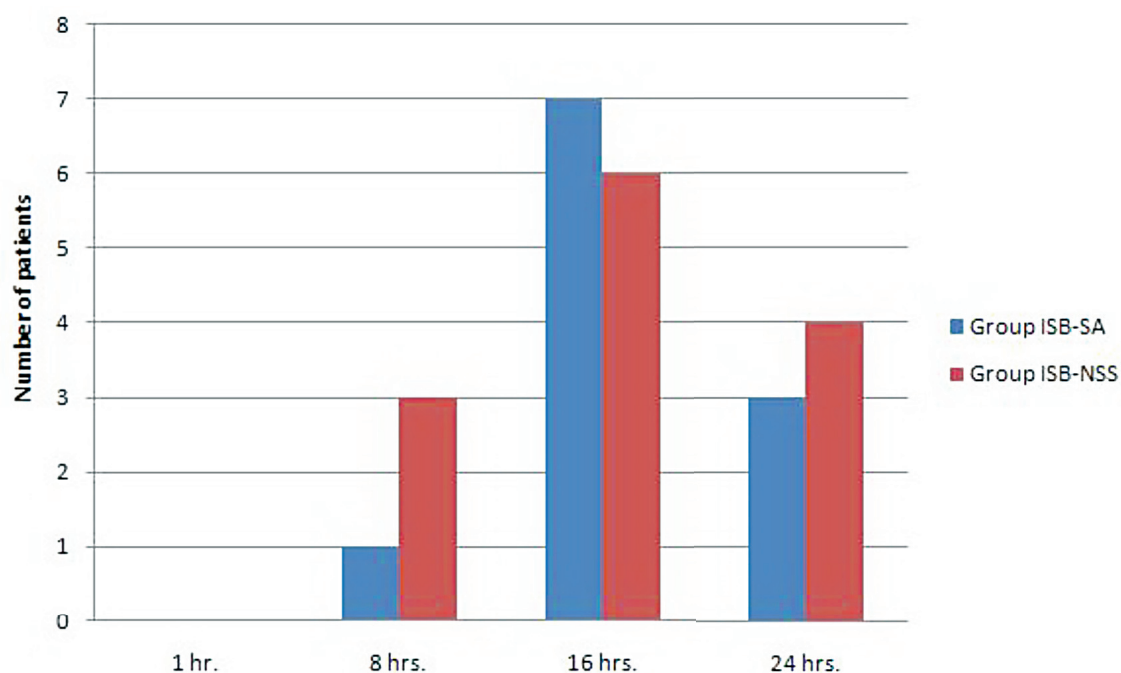


Figure 4 Comparison of the number of patients requesting the first dose morphine administration over time intervals between group ISB-SA and group ISB-NSS. No statistically significant difference was identified between groups.

No major or minor complications from ISB, catheter usage, or local anesthetic were reported in this study. The authors found no differences between the groups in the incidence of adverse events, nausea, vomiting, pruritus, and respiratory depression (Table 3).

Patient satisfaction of postoperative pain treatment of both study groups was similar on the first postoperative day (7.85 ± 2.41 in group ISB-SA VS 7.42 ± 2.29 in group ISB-NSS, $P=0.573$) (Fig.5).

Table 3 Side effects

	Group ISB-SA (n=20)	Group ISB-NSS (n=19)	P value
Nausea and vomiting			
with treatment	1	3	0.36
without treatment	3	1	
Pruritus	0	0	N/A
Respiratory depression	0	0	N/A

Values are number of patients in each group; N/A = not applicable.

Discussion

Even though continuous interscalene block (CISB) represents the gold standard for postoperative analgesia following arthroscopic shoulder surgery, it remains an invasive procedure that causes serious procedural related complications.²⁶ To reduce the risks, this procedure should be performed by trained and highly experienced anesthesiologists. Given the required special techniques of catheter placement and the high cost of catheter kits, CISB cannot be performed in every center, especially those in community, provincial, and university hospitals in developing countries. Therefore, the search for another technique, which is as effective as CISB, remains a crucial issue. In the meantime, a combination of less effective techniques is commonly used as an alternative. In the facilitation of this study, patient-controlled subacromial local anesthetic infusion (PCSA) has been used routinely in combination with SISB, which is the second most effective analgesic method when CISB is impossible.

The results of this study did not support the study hypothesis, as the patient-controlled subacromial infusion of 0.25% levobupivacaine failed to enhance a reduction of pain-score or cumulative morphine consumption in the first 24 postoperative hours in patients receiving SISB for arthroscopic shoulder surgery. Recently, the use of continuous subacromial infusion has been controversial because of discrepancies in the results between early and later studies. Initial studies demonstrated clinical benefit from continuous subacromial infusion, while recent ones did not.^{12, 19, 20, 22, 27-30} These conflicting results can be explained partially by differences in study design, kind of surgery performed, and type, concentration and volume of the local anesthetic used. However, the concentration and dose of the local anesthetic used in this study was appropriate, adequate, and safe. One of the previous studies reported the infusion of only 2 ml/hr of 0.25% bupivacaine was effective in postoperative pain relief, while, in this study, patients received the higher continuous rate.²⁰ There was no report of bupivacaine or ropivacaine overdose in previous studies even though local anesthetic doses used in previous studies were

higher than that used in the present study and Axelsson found that the free plasma of ropivacaine was far below toxic doses when 250 mg of ropivacaine was injected twice within one hour into the subacromial space.^{29, 31}

Oh reported that the combination of SISB and intralesional infusion was an effective and safe method of postoperative pain control after shoulder surgery, and intralesional infusion reduced pain more effectively than intravenous patient-controlled analgesia (IV-PCA) after the analgesic effect of ISB had decreased.³¹ His result was dissimilar to this study, which might be because of the following reasons. Firstly, the intralesional infusion technique in Oh's study was classified as intraarticular infusion, while this study used subacromial infusion. Catheters were placed in different spaces, although both studies tried to place them near tissue injured by operations. Secondly, operation procedures in this study had to include subacromial decompression, while the other did not. Thirdly, the concentration and type of local anesthetic used in both studies were different.

This study's result supported that of Ciccone, who concluded that subacromial infusion pumps did not reduce pain levels significantly after SISB had worn off, and the long term pain relief provided by pumps was not clinically relevant.³² In his study, the data was collected only at 1 and 2 hours and day 1-6 postoperatively, while most of the analgesic effect of ISB would have declined at 8-10 hours. This study focused on the early postoperative period (immediately-24 postoperative hours) and the authors found a similar result to that of Ciccone's study. Adding subacromial infusion does not show benefits, when the analgesic effect of SISB decreases at any time interval.

The subacromial space was not closed. Therefore, the dilution of local anesthetic with the irrigation fluid used in operations and the diffusion of anesthetic solution out of the space may explain the result of this study. In addition, pain after shoulder surgery might involve not only traumatized acromial bone, but also muscle spasm. Muscle spasm found in RCR could occur

from muscle traction during the reinsertion of tendon, and therefore, subacromial infusion might be ineffective.

To focus on the maximum effect of the subacromial catheter, the authors decided to subgroup analyze the VAS score of patients who underwent only arthroscopy with subacromial decompression, in which postoperative pain mainly originated from traumatized bone in the subacromial area. The result showed a statistically significant difference of pain levels at 24 postoperative hours at rest. The VAS score in the group ISB-NSS at 24 hours of movement was higher than that in the group ISB-SA, even though there were no statistically significant differences. The combination of PCSA and SISB may be an effective technique in postoperative pain control after arthroscopy with only subacromial decompression. However, the number of analyzed subgroup patients in this study (n=10) was relatively low and might not be enough to show an accurate result. Further study with a larger number of patients may be needed.

The duration of analgesia in both groups was not statistically significantly different. The number of patients who requested a first dose of supplemental analgesics dramatically increased in both groups after 8 postoperative hours, when the analgesic effect of the SISB had worn off. Sixty percent of the patients in this study needed supplemental analgesics, and 70% of them rated their VAS score at more than 4 at every interval of the study time, and this was classified as suboptimal pain control. The percentage of patients experiencing severe pain after the block had worn off was higher in this study than in previous one.¹⁷ Therefore, the result of this study demonstrated that neither the combination of both techniques nor only SISB could provide adequate pain control in the first 24 postoperative hours. CISB still plays an important role and is the most effective method of postoperative analgesia after shoulder arthroscopy.²⁶ The search for other combinations and effective techniques should continue and a multimodal approach should be used when CISB cannot be performed.

Both subacromial levobupivacaine infusion and SISB are safe. No complications were found in this study. The incidence of postoperative nausea and vomiting in this study was 20%, which did not differ from the average incidence in patients having operations under general anesthesia³³. No difference between groups was found. There was no report of pruritus or respiratory depression in this study and that might be explained from the study design, which allowed patients to receive an analgesic supplement only on demand.

To support the validity of this study, all operations were performed by a single surgeon, which ensured consistency of surgical approach and reduced the risk of confounding biases caused by differences in surgical skill, technique, and management. While conducting this research, the surgeon, patients, and medical staff who cared for the patients postoperatively were all blinded to treatment allocation, and all of the patients enrolled in this study completed the follow up. In this study, the authors decided not to use other groups of analgesic drugs because they might show bias against the effect of subacromial infusion and SISB as the sole pain management modality. To determine the maximum efficacy of the subacromial infusion technique, this study was confined to patients who underwent arthroscopic procedures which included subacromial decompression surgery.

There were also several limitations in this study as it was designed to compare the analgesic effect of subacromial levobupivacaine infusion and placebo (NSS) infusion. Therefore, the placebo effect could not be avoided. There were four types of procedure included in this study: arthroscopy with SAD, SAD and capsular release, SAD and RCR, and SAD with capsular release and RCR. Each type had different pathology and levels of postoperative pain. SAD had only one compartment of pain, which was traumatized bone. The others had at least two compartments, which comprised traumatized bone and muscle spasm. These differences might have affected the result of this study. The authors decided to include all these procedures because there were not

enough patients to study each type of surgery. It also took too much time to collect all the data, and the previous study reported that subacromial infusion was useful in all types of arthroscopic shoulder surgery.²² In addition, the sample size of this study might not reflect the real population. This research was conducted in a university hospital, to which most patients were referred from community and provincial hospitals. Therefore, the pathology of diseases was more severe and operations were more difficult than in average cases. Another limitation was the technique used in the administration of supplemental analgesics. In this study, supplemental analgesics were given by nurses when patients rated their VAS score at equal to or higher than 4. This method was less effective in postoperative pain control than the patient-controlled analgesia technique, and the data of morphine consumption used for analyzing the result may not be accurate. However, this was the routine technique used for postoperative pain management in this study center, and one of the PCA pump devices was used for administering local anesthetic and normal saline in this study. Adding another pump for infusing supplemental analgesics might confuse patients and limit their ambulation and physiotherapy. In this study, the data was collected only for 24 postoperative hours, which might be not enough to apply in clinical use because postoperative pain after shoulder arthroscopy might extend to 48 hours postoperatively. However, the authors wanted to study the analgesic effect of subacromial infusion during through the time period that the interscalene block would have worn off. The result of Ciccone's study found that, at 48 postoperative hours, there was no differences of VAS between the combination of ISB and subacromial continuous infusion and ISB alone, so the authors decided to limit time to collect data at 24 hours.

Conclusion

In this study, the patient-controlled subacromial levobupivacaine infusion combined with single shot interscalene block did not provide more pain relief than single shot interscalene block alone. Subacromial infusion did not enhance the postoperative analgesic effect after the block wore off in various types of arthroscopic shoulder surgery. Therefore, the combination may be beneficial only in patients with subacromial decompression surgery.

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บทคัดย่อ

เปรียบเทียบผลการระงับปวดหลังผ่าตัดระหว่าง interscalene block และ interscalene block ร่วมกับการให้ยาชาควบคุม โดยผู้ป่วยทาง subacromial space ในผู้ป่วยผ่าตัดส่องกล้องบริเวณไหล่

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วัตถุประสงค์: เพื่อศึกษาประสิทธิภาพของการให้ยาชาผ่านทาง subacromial space ร่วมกับการทำ interscalene block ในการระงับปวดหลังผ่าตัดส่องกล้องบริเวณไหล่

วิธีศึกษา: ผู้ป่วย ๔๐ รายแบ่งเป็น ๒ กลุ่มแบบสุ่ม ได้แก่ กลุ่ม ISB-SA และ ISB-NSS ก่อนผ่าตัดทั้งสองกลุ่มจะได้รับการทำ interscalene block และก่อนผ่าตัดตัดคลายแพทย์จะวางสายไว้ใน subacromial space ผ่านทางกล้อง สายทั้งหมดจะถูกต่อเข้ากับเครื่อง PCA โดยผู้ป่วยกลุ่ม ISB-SA จะได้รับยา 0.25% levobupivacaine ในขณะที่ผู้ป่วยกลุ่ม ISB-NSS จะได้รับ NSS ผู้ป่วยจะได้รับการประเมิน VAS, ยาแก้ปวดเพิ่มเติมที่ผู้ป่วยใช้, ภาวะแทรกซ้อนและความพึงพอใจในการระงับปวด

ผลการศึกษา: จากการศึกษพบว่า VAS ปริมาณยาแก้ปวด ผลข้างเคียง ความพึงพอใจต่อการระงับปวดในผู้ป่วยทั้งสองกลุ่มไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ (ค่า $p \geq 0.05$) และมากกว่า ร้อยละ ๗๐ ของผู้ป่วยยังได้รับการระงับปวดหลังผ่าตัดได้ไม่เพียงพอหลังจากฤทธิ์ระงับปวดของ interscalene block ลดลง

สรุป: การระงับปวดในผู้ป่วยกลุ่มที่ให้ levobupivacaine ผ่านทาง subacromial space ร่วมกับการทำ interscalene block นั้นไม่ต่างกับการทำ interscalene block เพียงอย่างเดียว การให้ยาชาผ่านทาง subacromial space ร่วมกับการทำ interscalene block จึงอาจไม่ใช่วิธีการระงับปวดที่เหมาะสมสำหรับการผ่าตัดส่องกล้องบริเวณไหล่

คำสำคัญ: การให้ยาชาผ่านทางช่องใต้ subacromial, การฉีดยาชาระงับเส้นประสาท brachial plexus การระงับปวดหลังผ่าตัด, การผ่าตัดส่องกล้องบริเวณไหล่