

Efficacy of interscalene block combined with multimodal pain control for postoperative analgesia after rotator cuff repair

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Abstract

Purpose The aim of the study reported here was to compare the efficacy and safety of postoperative analgesia provided by interscalene block with multimodal pain control (IB-MPC) versus that provided by multimodal pain control (MPC) alone after arthroscopic rotator cuff repair.

Methods Sixty consecutive patients were assigned to either the IB-MPC group (30 patients) or the MPC group (30 patients). Visual analogue scale (VAS) pain scores before surgery and through day 5 after surgery, consumption of rescue analgesic, adverse effects and complications were evaluated.

Results Mean VAS pain scores immediately after surgery and on days 1 through 5 after surgery were 3.9 ± 2.6 , 4.4 ± 1.5 , 3.4 ± 1.3 , 2.7 ± 1.3 , 2.4 ± 1.2 , and 2.0 ± 1.0 , respectively, in the IB-MPC group and 6.2 ± 1.8 , 4.1 ± 1.7 , 3.2 ± 1.9 , 2.7 ± 1.4 , 2.5 ± 1.3 , and 2.0 ± 1.2 , respectively, in the MPC group. The IB-MPC group had significantly lower VAS pain score immediately after surgery than the MPC group did ($P < 0.001$). There were no statistically significant differences regarding consumption of rescue analgesic or adverse effects between the two

groups (n.s.). In the IB-MPC group, complications related to interscalene block included tingling of the hand in three patients and numbness of the neck and ear in two. However, these symptoms resolved spontaneously within a few days. No patients had major complications related to interscalene block.

Conclusions IB-MPC achieved better pain control immediately after surgery than MPC alone, without major complications related to interscalene block. It is an effective and safe method for providing postoperative analgesia after arthroscopic rotator cuff repair.

Level of evidence Prospective Comparative Study, Prognosis Study, Level II.

Keywords Rotator cuff · Arthroscopic repair · Postoperative pain · Analgesia · Interscalene block · Multimodal pain control

Introduction

Although minimally invasive arthroscopic repair for rotator cuff tear is widely performed, it is associated with severe postoperative pain, especially within the first 48 h after surgery [2, 14]. Appropriate pain control in the early postoperative period enhances postoperative rehabilitation and functional recovery [21]. Moreover, it is a major issue for patients regarding their sense of well-being and their satisfaction with the treatment of rotator cuff tear [22] and is still a challenge for the clinician to provide [5, 14].

Various techniques, including single injection or continuous infusion of local analgesic, regional nerve block, and intravenous patient-controlled analgesia, are used for postoperative pain control after rotator cuff surgery [2, 5, 6, 8, 13, 16, 24]. However, many researchers have reported

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that using a single-pain control strategy has limited effectiveness [2, 6, 7, 14, 21].

Multimodal analgesia, recently introduced, is widely used and has been reported to provide effective pain control after major orthopaedic surgery [5, 10, 12, 23, 27, 28]. We previously reported that our multimodal pain control (MPC) protocol provided better pain relief than intravenous patient-controlled analgesia after rotator cuff repair, but achieving adequate pain control within 48 h after surgery remains challenging [5].

Suprascapular nerve block is safe and reduces postoperative pain and opioid consumption following arthroscopic surgery [13, 19], but provides inferior analgesia compared with single-injection interscalene block [26]. Single-injection interscalene block provides effective anaesthesia and analgesia after rotator cuff repair [1, 3, 4, 8, 9, 13, 15, 20, 26], especially during the first 24 h after surgery [8]. Although interscalene block is associated with technical success when performed by experienced clinicians and has a low rate of long-term complications, there is still resistance to its use because of concerns about failed blocks and potential complications [1]. Therefore, the aim of this study was to compare the efficacy and safety of postoperative analgesia provided by interscalene block with multimodal pain control (IB-MPC) versus that provided by MPC alone after arthroscopic rotator cuff repair. This study was conducted based on the hypothesis that IB-MPC provides better postoperative pain relief than MPC does and that it poses no additional major risks.

Materials and methods

After obtaining approval from our institutional review board (Keimyung University Dongsan Medical Center) and written informed consent from all patients, sixty consecutive patients scheduled for arthroscopic rotator cuff repair were enrolled in our study. Inclusion criteria were as follows: (1) patients with arthroscopic rotator cuff repair for a tear of <3 cm, with no additional procedures such as biceps tenodesis, superior labral anterior and posterior repair, or distal clavicle resection; (2) American Society of Anesthesiologists (ASA) physical status 1 or 2; and (3) ability of the patient to understand and cooperate with the study protocol. Exclusion criteria were as follows: (1) ASA physical status ≥ 3 , (2) a history of drug addiction, (3) an allergy to any medication or local anaesthetics used in the study and (4) a severe neurological lesion.

Patients were sequentially assigned to receive either IB-MPC (the IB-MPC group; 30 patients) or MPC (the MPC group; 30 patients). All patients received general anaesthesia according to our standard protocol, and all

operations were performed by a single surgeon who used an arthroscopic repair technique.

For postoperative pain control for both the IB-MPC and MPC groups, we followed the MPC protocol that was devised at Keimyung University Dongsan Medical Center, Korea [5]. Before surgery, all patients were provided written and oral education about the procedure, and pre-emptive oral medication was administered 2 h before surgery. The 50-mL cocktail of local analgesics that was injected contained morphine HCl and 0.75 % ropivacaine dissolved in 0.9 % normal saline. We injected 15 mL of this mixture before creating portals, and the other 35 mL was administered as injections split among the intra-articular cavity, subacromial space, muscle layer, and fatty and subcutaneous layers after rotator cuff repair was completed. For postoperative pain control, immediate-release oxycodone HCl, acetaminophen and cyclooxygenase-2 selective inhibitor (COX-2 inhibitor) were given orally through day 2. For days 3 through 5, a COX-2 inhibitor plus a tablet containing a combination of 37.5 mg of tramadol and 325 mg of acetaminophen were prescribed. If the patient required additional pain control beyond that provided by our protocol, intramuscular diclofenac was administered.

Patients in the IB-MPC group received postoperative analgesia using the MPC protocol and an additional interscalene block. Before general anaesthesia was administered, oxygen was supplied as part of basic monitoring after administration of 1–2 mg of midazolam. Then, single-injection interscalene block was performed by an anaesthesiologist experienced in providing regional anaesthesia, using 20 mL of 0.25 % ropivacaine via the interscalene approach and a 22-gauge, short-slope, 50-mm-long needle and a peripheral nerve stimulator. The success of the interscalene block was determined by the presence of a sensory block after 10 min.

Study participants rated their pain before surgery, immediately after surgery, and on days 1 through 5 after surgery by using a visual analogue scale (VAS). The VAS pain score is rated from 0 (no pain) to 10 points (unbearable pain) using a measurement device. Participants point to the position on the line between the faces to indicate how much pain they currently feeling. The duration of functional recovery was defined as the number of days until patients could achieve 120° of flexion and 30° of external rotation. Consumption of rescue analgesic and medication-related adverse effects such as nausea, vomiting, urinary retention, dizziness, urticaria, headache and infection were recorded. Complications related to interscalene block, including cardiac arrest, seizure, pneumothorax, phrenic nerve palsy, Horner syndrome, and motor or sensory deficits, were also recorded.

Statistical analysis

According to power analysis, sample size calculation showed that there had to be at least 27 patients in each group for there to be a 20 % difference between the two groups in VAS pain scores within the first 24 h after surgery at an α level of 0.05 and a β value of 0.80.

Statistical analysis was performed using SPSS software (version 14.0E; SPSS Inc., Chicago, IL, USA). The paired *t* test and chi-square test were used to assess the significance of differences between the two groups. A *P* value of < 0.05 was considered statistically significant.

Results

No statistically significant differences were found between the two groups regarding age, sex, body mass index, duration of surgery, repair technique or preoperative VAS pain score (Table 1).

Mean VAS pain score immediately (day 0) and on days 1 through 5 after surgery were 3.9 ± 2.6 , 4.4 ± 1.5 , 3.4 ± 1.3 , 2.7 ± 1.3 , 2.4 ± 1.2 , and 2.0 ± 1.0 , respectively, in the IB-MPC group and 6.2 ± 1.8 , 4.1 ± 1.7 , 3.2 ± 1.9 , 2.7 ± 1.4 , 2.5 ± 1.3 , and 2.0 ± 1.2 , respectively, in the MPC group. The IB-MPC group had significantly lower VAS pain score immediately after surgery than the MPC group did ($P < 0.001$). There were no statistically significant differences between the two groups with regard to VAS pain scores on days 1 through 5 after surgery (n.s.) (Fig. 1).

The average duration of functional recovery was 3.9 ± 1.9 days in the IB-MPC group and 4.1 ± 2.2 days in the MPC group. The average number of times that patients

Table 1 Demographic data for patients

Parameter	IB-MPC group	MPC group	<i>P</i> value
Age (years)	55.0 ± 8.5	55.5 ± 7.6	n.s.
Sex (male:female)	14:16	17:13	n.s.
Body mass index (kg/m ²)	23.3 ± 2.2	24.0 ± 3.3	n.s.
ASA physical status (1:2)	22:8	18:12	n.s.
Duration of surgery (min)	56.2 ± 9.6	57.7 ± 11.0	n.s.
Tear size (no. of cases)			n.s.
Partial	6	5	
Small	10	10	
Medium	14	15	
Repair technique (no. of cases)			n.s.
Single row	4	5	
Double row	26	24	

ASA American Society of Anesthesiologists, IB-MPC interscalene block with multimodal pain control, MPC multimodal pain control

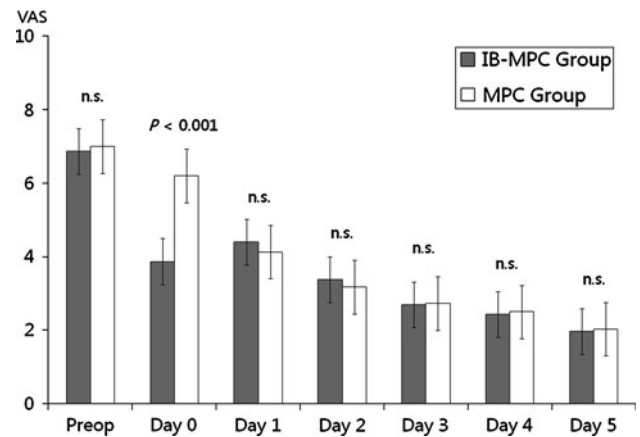


Fig. 1 Mean visual analogue scale (VAS) pain scores measured immediately after surgery (day 0) and on days 1 through 5 after surgery. The IB-MPC (interscalene block with multimodal pain control) group had significantly lower VAS pain scores immediately after surgery than the MPC (multimodal pain control) group did ($P < 0.001$)

required rescue analgesic was 1.0 ± 1.3 in the IB-MPC group and 1.1 ± 1.1 in the MPC group. There were no statistically significant differences between the two groups with regard to functional recovery or consumption of rescue analgesic (n.s.) (Table 2).

There were no statistically significant differences between the two groups regarding medication-related adverse effects, including nausea, vomiting, urinary retention, constipation, dizziness, urticaria and headache (n.s.) (Table 3). The MPC protocol could not be used in 1 patient in the MPC group because of a medication-related adverse effect. In the IB-MPC group, complications related to interscalene block occurred in 5 (16.7 %) patients. Three patients had a tingling sensation in their hand and two patients had numbness of the neck and ear. However, these symptoms resolved spontaneously within a few days. No patients had seizures, pneumothorax, cardiac events or other major complications related to interscalene block.

Discussion

The most important finding of the present study was that IB-MPC group achieves better immediately postoperative pain control than MPC group without major complications related with interscalene block.

The techniques used for postoperative analgesia after rotator cuff surgery include single injection or continuous infusion of local analgesic, regional nerve block and intravenous patient-controlled analgesia, but all have limitations and adverse effects [2, 4, 6–8, 13, 15, 16, 21, 24].

Multimodal analgesia is achieved by using combinations of analgesics (e.g. opioids, nonsteroidal anti-inflammatory

Table 2 Comparison of functional recovery and rescue analgesic requirements between two groups

Parameter	IB-MPC group	MPC group	<i>P</i> value
Functional recovery (days)	3.9 ± 1.9	4.1 ± 2.2	n.s.
Rescue analgesic (no. of times administered)	1.0 ± 1.3	1.1 ± 1.1	n.s.

IB-MPC interscalene block with multimodal pain control, *MPC* multimodal pain control

Table 3 Adverse effects related to medication and interscalene block

Adverse Effect	N (%)		<i>P</i> value
	IB-MPC group	MPC group	
Medication-related			
Nausea	6 (20.0)	5 (16.7)	n.s.
Vomiting	2 (6.7)	1 (3.3)	n.s.
Urinary retention	2 (6.7)	2 (6.7)	n.s.
Constipation	8 (26.7)	9 (30.0)	n.s.
Dizziness	1 (3.3)	2 (6.7)	n.s.
Urticaria	0 (0)	0 (0)	n.s.
Headache	0 (0)	2 (6.7)	n.s.
Interscalene block-related			
Tingling in hand	3 (10.0)		
Neck and ear numbness	2 (6.7)		

IB-MPC interscalene block with multimodal pain control, *MPC* multimodal pain control

drugs and local anaesthetics) that act simultaneously by different mechanisms, resulting in additive or synergistic analgesia and fewer adverse effects [12]. Several authors have reported its effectiveness for postoperative pain control after major orthopaedic surgery [10, 12, 23, 27, 28]. However, postoperative pain management during the first 48 h after rotator cuff repair still remains challenging [5, 13].

Suprascapular nerve block is safe and reduces postoperative pain and opioid consumption following arthroscopic surgery [13, 19], but provides inferior analgesia compared with single-injection interscalene block [26]. Single-injection interscalene block provides excellent pain relief immediately after surgery, although analgesia lasts only approximately 8–10 h. This technique is a safe alternative or adjunct to general anaesthesia for arthroscopic shoulder surgery [3, 9, 13, 16, 26, 29]. Potential advantages include an increased ability to control blood pressure during surgery, decreased pain immediately after surgery, and faster and potentially easier emergence from anaesthesia [4, 29]. Patients may also require fewer intraoperative or postoperative narcotics and fewer associated narcotics [14, 20, 29]. Singelyn et al. [26] found that interscalene block provided the best pain control and was

associated with a more important morphine-sparing effect for the first 24 h than suprascapular nerve block or single injection of local analgesic. Fredrickson et al. [13] noted that interscalene analgesia is the preferred technique for postoperative analgesia after shoulder surgery but stated that it should be combined with the use of local analgesics for effective postoperative pain control.

Therefore, this study was conducted based on the hypothesis that IB-MPC provides better pain relief than MPC does after arthroscopic rotator cuff repair and poses no additional major risks. We confirmed that using a combination of interscalene block and MPC is a more effective method for postoperative analgesia. This was demonstrated by the mean VAS pain scores immediately after surgery for our two groups: 3.9 ± 2.6 for the IB-MPC group and 6.2 ± 1.8 for the MPC group. Patients who were given MPC alone had severe pain immediately after surgery, as shown in previous studies. Although statistically significant differences for the first day on the VAS score was observed between two groups, our results showed consumption of rescue analgesic was the same between groups. However, we think this finding might be caused by those patients who took immediate postoperative pain for granted and wanted to suppress without rescue medication as possible. Although patients in the IB-MPC group had less pain immediately after surgery than those in the MPC group, we found that the mean VAS pain score was 4.4 ± 1.5 on day 1 after surgery, higher than the mean score immediately after surgery. Of patients who receive a single-injection interscalene block, 20 % develop severe pain when the block wears off [22]. We believe that this finding demonstrates rebound pain, reported as a limitation of interscalene block in that there is an increased recognition of pain at the point of loss of the effect of the block [22].

Some shoulder surgeons resist using interscalene block because it is an invasive procedure that requires anaesthesiologists trained in performing it and because there have been complications associated with it [4]. Reported complications have included cardiac arrest, central nervous system toxicity, seizure, pneumothorax, respiratory distress, hoarseness, Horner syndrome, phrenic nerve palsy, haematoma, and remnant motor or sensory deficits [11, 15, 17, 18, 20, 25, 29]. Bishop et al. [1] reported that the rate of successful blocks was 97 %, that the rate of short-term complications was 2.3 %, and that no patients had permanent disabling neurological sequelae or seizures. They also reported that the advantages of interscalene block far outweigh the disadvantages of the technique and that in the hands of a skilled practitioner, the rate of achievement of successful blocks is high and the complication rate is acceptably low. In our study, complications of interscalene block were a tingling sensation of the hand in three patients and neck and ear numbness in two patients, but for all five

patients, these effects spontaneously resolved within a few days. There were no fatal complications, such as cardiac arrest or phrenic nerve palsy. The reason for the lack of major complications might have been the high experience level of the anaesthesiologist.

Recently, ambulatory surgery including rotator cuff repair has been more popular. Viewed in our results, interscalene block combined MPC protocol is safe and effective and may be useful strategies for the prevention and treatment of postoperative pain in ambulatory shoulder surgery.

The present study has several limitations. First, the number of participants in each group is relatively small to claim strong statistical power. Second, sample randomization was lacking because study participants were enrolled consecutively. Third, this was not a blinded study using a control group with placebo. Additional randomized controlled trials with large sample sizes are necessary to determine efficacy of single-injection or continuous IB-MPC for analgesia after rotator cuff repair.

Conclusions

Interscalene block with multimodal pain control achieved better pain control immediately after surgery than MPC alone, without major complications related to interscalene block. It is a safe and effective method for providing analgesia after arthroscopic rotator cuff repair.

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