



ROPIVACAINE 0.75%, LIDOCAINE 1%, OR COMBINATION IN INTERSCALENE BLOCK FOR UPPER EXTREMITY SURGERY

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ABSTRACT

It is a common practice to mix fast onset and long acting local anesthetics in brachial plexus block. However, whether the combination induce fast onset and long duration of the block is still controversial. The present study was performed to clarify whether adding lidocaine to ropivacaine shortens onset time and keeps duration of interscalene block or not. Sixty patients aged 20 to 70 years with ASA physical status I or II for surgery of upper extremity were involved in the study. Interscalene block was performed with 1% lidocaine 30 ml (Lidocaine group, 20 patients), 0.75% ropivacaine 30 ml (Ropivacaine group, 20 patients), or 1% lidocaine 15 ml + 0.75% ropivacaine 15 ml (Combination group, 20 patients). Onset time and duration of the block were measured with loss of pain sensation at surgical field (sensory onset time) and loss of finger movement (motor onset time). Side effects such as convulsion, arrhythmia, nausea, vomit, hypotension, and bradycardia were checked until 12 hour after surgery. The Ropivacaine group had significantly slower onset in both sensory and motor blocks than other two groups. The duration of sensory and motor block of the Lidocaine group was significantly shorter than other two groups. Number of patients with side effects were not different among the groups. In conclusion, in interscalene block, combination of 1% lidocaine 15 mL and 0.75% ropivacaine 15 mL induced faster onset of the block than 0.75% ropivacaine 30 mL, and longer duration of the block than 1% lidocaine 30 mL, without increasing side effects.

KEYWORDS: Interscalene block, lidocaine, ropivacaine, onset time, block duration.

1. INTRODUCTION

For upper limb surgery, brachial plexus block with local anesthetics is usually used. Lidocaine and mepivacaine have fast onset and short duration, while bupivacaine and ropivacaine have slow onset and long duration.^[1] It is a common practice to mix lidocaine or mepivacaine with bupivacaine or ropivacaine to expect faster onset and longer duration of the block.^[2] There are some studies to investigate onset time and duration of the block in combination of two local anesthetics in brachial plexus block.^[3-7] However, the results are still controversial. The present study was performed to clarify whether adding lidocaine to ropivacaine shorten onset time and keep duration of interscalene block or not.

2. MATERIALS AND METHODS

After the approval of the ethics committee of the hospital (Kamakura Hospital Ethics Committee approve No. 4) and informed consent from the patients, 60 patients aged 20 to 70 years with ASA physical status I or II for surgery of upper extremity were involved in the study. Those who had liver, renal, mental, or severe cardiac diseases, who had coagulation disorder, allergy to the agents scheduled to use, or habits of hypnotics or

analgesics, and who were obese (body mass index > 30) were excluded from the study.

After intravenous midazolam 1 mg and fentanyl 50 µg under oxygen 3 L/min by a face mask, interscalene block was performed using 50 mm 23 G needle and nerve stimulator with 1% lidocaine 30 ml (Lidocaine group, 20 patients), 0.75% ropivacaine 30 ml (Ropivacaine group), or 1% lidocaine 15 ml + 0.75% ropivacaine 15 ml (Combination group). Nerve stimulator was at first set to 1.0 mA, and after getting good stimulation, current was decreased to 0.5 mA. When good stimulation was obtained at 0.5 mA, local anesthetic was injected.

Onset time was measured with loss of pain sensation at surgical field (sensory onset time) and loss of finger movement (motor onset time) every 3 minutes until 45 minutes after the block. Then propofol infusion was started and continued at 2 - 4 mg/kg/min to keep Bispectral index between 40 and 60. For patients without sensory block in 45 minutes, they were judged as block failure, and general anesthesia was performed with fentanyl and propofol. During surgery, when anesthesiologist thought that anesthesia was not enough,

fentanyl was administered, and they were also judged as block failure. Duration of the block was measured with pain sensation at surgical site (sensory block) and finger movement (motor block) after surgery every 30 minutes. Side effects such as convulsion, arrhythmia, nausea, vomit, hypotension, and bradycardia were checked until 12 hour after surgery.

Data were expressed as number of patients or mean \pm standard deviation. Power analysis was performed using MANOVA global effects with effect size 0.25 and power

0.95 for onset time and duration of sensory and motor blocks (G Power™ 3.1, Kiel University, Germany). Statistical analysis was performed with factorial analysis of variance (ANOVA) and chi-square test (StatView-J 5.0). The p value less than 0.05 was considered to be statistically significant.

3. RESULTS

Power analysis showed that total sample size should be 51, therefore we enrolled 60 patients. Demographic data were not different among the groups (Table 1).

Table 1: Demographic data.

	Lidocaine	Ropivacaine	Combination
Male/Female	9/11	12/8	11/9
Age (years)	45 \pm 12	50 \pm 13	48 \pm 10
Body weight (kg)	59 \pm 9	61 \pm 7	63 \pm 10
Height (cm)	160 \pm 6	157 \pm 5	162 \pm 9
Duration of surgery (min)	119 \pm 21	112 \pm 16	121 \pm 18

Mean \pm standard deviation or number of patients.

Three patients in the Lidocaine group, each one in the Ropivacaine and Combination group were excluded from calculation of onset time and duration of surgery because two in the Lidocaine group did not show sensory block and other three needed additional fentanyl during surgery (Table 2). The Ropivacaine group had significantly slower onset in both sensory and motor blocks than other two groups (Table 2). The Combination group had

slightly slower onset times of sensory and motor blocks than Lidocaine group, but not statistically significant. The duration of sensory and motor block of the Lidocaine group was significantly shorter than other two groups (Table 2). The Combination group had slightly shorter duration of sensory and motor blocks than Ropivacaine group, but not statistically significant.

Table 2: Block effects.

	Lidocaine	Ropivacaine	Combination
Success of block	17/20	19/20	19/20
Onset time			
Sensory block (min)	11.5 \pm 3.9	26.0 \pm 6.5* ⁺	12.8 \pm 4.7
Motor block (min)	12.9 \pm 3.0	29.3 \pm 8.4* ⁺	14.0 \pm 5.1
Duration of block			
Sensory block (h)	2.6 \pm 1.0	9.5 \pm 3.8*	8.8 \pm 3.2*
Motor block (h)	2.1 \pm 0.7	6.3 \pm 2.8*	5.6 \pm 2.7*

Number of patients or mean \pm standard deviation

*: P < 0.05 vs. Lidocaine group, ⁺: P < 0.05 vs. Combination group

Number of patients with side effects such as convulsion, arrhythmia, hypotension, bradycardia, nausea, and vomit were not different among the groups (Table 3).

Table 3: Side effects.

	Lidocaine	Ropivacaine	Combination
Convulsion	0/20	3/20	0/20
Arrhythmia	0/20	0/20	0/20
Hypotension	4/20	9/20	7/20
Bradycardia	3/20	8/20	6/20
Nausea	1/20	1/20	1/20
Vomit	0/20	0/20	0/20

Number of patients

No statistical differences were observed among the groups.

4. DISCUSSION

This study showed that combination of 1% lidocaine 15mL and 0.75% ropivacaine 15 mL in interscalene block had faster onset time and similar duration of the block in comparison with ropivacaine 30 mL alone.

We had 5 patients with block failure while we used nerve stimulation for the block.

The minimum concentration to get success of supraclavicular block by ropivacaine is reported to be 0.26%.^[8] In our study, ropivacaine concentrations were 0.75% and 0.375% in the Ropivacaine and Combination groups, respectively, which should be enough for the block. We could not find any studies to investigate minimum concentration of lidocaine in brachial plexus block. However, many studies^[4,6,9] used 2% lidocaine in brachial plexus block. In interscalene block, combination of 1% lidocaine 15 mL and 0.375% ropivacaine 15 mL did not induce motor block in 3 of 25 patients.^[3] Therefore, 1% lidocaine in our study might not be enough for the block, which could be the reason of block failure in 3 and one patients in the Lidocaine and Combination groups, respectively.

Casati et al.^[9] reported that onset of the block was 7.5 min with 1.5% lidocaine 30 mL and 30 min with 0.5% ropivacaine 30 mL in interscalene block. Their duration of the block by ropivacaine was similar to our present results. Onset time of lidocaine in our study was slower than the study by Casati et al.,^[9] which might be due to lower concentration of lidocaine in our study. In interscalene block, 1% ropivacaine 20 mL induced faster onset of anesthesia than 2% mepivacaine 20 mL, but 0.5% and 0.75% ropivacaine had similar onset with mepivacaine.^[10] Thus, concentration of local anesthetics could affect onset time of the block.

There are some studies to compare onset time and duration of the brachial plexus block between single local anesthetic and combination of two local anesthetics. In interscalene block, combination of 1.5% mepivacaine and 0.5% bupivacaine had similar onset time of the block with either agent alone, and duration of the block with combination was significantly longer than that with mepivacaine alone and shorter than that with bupivacaine alone.^[5] Pongraweevan et al.^[6] reported that in infraclavicular block, adding 2% lidocaine 10 mL to 0.5% bupivacaine 20 mL did not shorten the onset time of the block compared to 0.5% bupivacaine 30 mL. Adding 2% lidocaine 10 mL with epinephrine (1:200,000) to 0.75% ropivacaine 20 mL in supraclavicular block induced earlier onset of sensory block, but did not change duration of analgesia in comparison with ropivacaine alone.^[7] From these studies, effects of the combination were different according to the concentration and kinds of local anesthetics used. Rohan et al.^[7] added epinephrine to lidocaine, therefore, our study is the only one to compare onset time and duration of the brachial plexus block in combination of lidocaine

and ropivacaine with ropivacaine alone. The onset time shortened by adding 1% lidocaine to 0.75% ropivacaine without changing the duration of the block in comparison with ropivacaine alone as similar to the results of the study by Rohan et al.,^[14] in which epinephrine was also added.

In the study of sciatic nerve block, 2% lidocaine induced faster onset time, decreased duration of the block, and increased the AUC (area under the curve) and C_{MAX} (maximum concentration) of 0.75% ropivacaine.^[4] The reason of increased AUC and C_{MAX} of ropivacaine by lidocaine might be that vasodilative effects of lidocaine weakened vasoconstrictive effect of ropivacaine, then blood absorption of ropivacaine increases, or that metabolism of ropivacaine in liver was hindered by lidocaine by compete cytochrome P450. Our results did not decrease duration of the block. Lidocaine 1% might not be enough to inhibit vasoconstrictive effect of ropivacaine or to compete cytochrome P450.

There is a case report of cardiac arrest by interscalene block with lidocaine 360 mg and ropivacaine 150 mg.^[11] A case was reported with convulsion by interscalene and axillary block using ropivacaine 300mg.^[12] In this study, we used 300 mg lidocaine, 225 mg ropivacaine, and combination of 150 mg lidocaine and 112.5 mg ropivacaine. Those were smaller than the doses induced side effects in these reports.^[11,12] Therefore, we did not observe such kinds of side effects.

5. CONCLUSION

In interscalene block, combination of 1% lidocaine 15 mL and 0.75% ropivacaine 15 mL induced faster onset of the block than 0.75% ropivacaine 30 mL, and longer duration of the block than 1% lidocaine 30 mL, without increasing side effects.

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