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Effect of infraorbital nerve block under general anesthesia on consumption of isoflurane and postoperative pain in endoscopic endonasal maxillary sinus surgery

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Abstract
Purpose. The efficacy of infraorbital nerve block in reducing isoflurane consumption and postoperative pain was evaluated in patients undergoing endoscopic endonasal maxillary sinus surgery (ESS) under general anesthesia.
Methods. Fifty patients were randomly allocated to either the block group ($n = 15$) or the nonblock group ($n = 25$). After the establishment of general anesthesia with isoflurane, nitrous oxide, and oxygen, the patients received infraorbital nerve block with 1.0 ml of either 0.5% bupivacaine (block group) or normal saline (nonblock group) administered into the soft tissue in front of the infraorbital foramen. Systolic blood pressure during anesthesia and surgery was maintained at 85–90 mmHg by adjusting the inspiratory concentration of isoflurane, and its consumption was evaluated in both groups. Pain intensity at 15 min after the end of anesthesia was also evaluated on a five-point pain scale.
Results. The consumption of isoflurane under a fresh gas flow of $6 l \cdot min^{-1}$ was $17.3 \pm 6.5 ml \cdot kg^{-1} \cdot h^{-1}$ (mean ± SD) in the block group and $27.4 \pm 9.4 ml \cdot kg^{-1} \cdot h^{-1}$ in the nonblock group during surgery ($P < 0.001$). Nicardipine was required during surgery less frequently in the block group than in the nonblock group ($P < 0.01$). Postoperative pain intensity was lower in the block group than in the nonblock group ($P < 0.01$).
Conclusion. General anesthesia combined with infraorbital nerve block is effective in reducing the consumption of isoflurane and postoperative pain intensity in ESS.

Key words Regional anesthesia · General anesthesia · Nerve block · Endoscopic endonasal sinus surgery

Introduction

Minimally invasive surgery is already a standard technique that is applied in all surgical areas. In particular, endoscopic endonasal sinus surgery (ESS) for chronic sinusitis is more comfortable, safe, and economical than the open reduction method for cases in mild or moderate stages. Although inhaled anesthesia alone is used for the patient undergoing surgery, it is desirable to have an additional technique to maintain low blood pressure and reduce the amount of inhaled anesthetic. Regional block is supposed to be effective to reduce intraoperative noxious stimuli, but there have been no previous studies to clarify the quantitative effects of regional block from the perspective of consumption of inhaled anesthetic in ESS.

Materials and methods

Fifty patients of American Society of Anesthesiologists (ASA) physical status class I or II participated in this study. All patients had chronic sinusitis and were scheduled to undergo ESS for each sinus. This protocol was approved by the Ethical Committee of Kinki University Medical Center. All patients gave informed consent before perticipating in the study. Patients were randomly allocated to either group according to a simple randomization table: 25 nerve-block patients (block group) and 25 nonblock patients (nonblock group). All patients received 0.5 mg of brotizolam orally as premedication 2 h before the induction of general anesthesia. General anesthesia was intravenously induced with $4 mg \cdot kg^{-1}$ thiamylal and $0.2 \mu g \cdot kg^{-1}$ fentanyl, and the trachea was intubated with an endotracheal tube under muscle relaxation with $0.1 mg \cdot kg^{-1}$ vecuronium. General anesthesia was maintained with 0.5%–3.0% isoflurane in 50% nitrous dioxide in oxygen with fresh gas flow of $6 l \cdot min^{-1}$. Infraorbital nerve block was performed under general anesthesia by injecting 1.0 ml of 0.5% bupivacaine into the facial soft tissue of the maxilla in front of the infraorbital foramen using a 27-gauge, 1-inch-long needle. The needle was not inserted into the

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foramen because the face of the bevel of the needle was kept upward. In patients of the nonblock group, normal saline was injected in the same way. Neither the anesthesiologists nor the surgeons were informed whether local anesthetic or normal saline was given. In both groups, 0.5% lidocaine containing a 200 000-fold dilution of epinephrine was injected into the nasal mucosa to induce vasoconstriction and regional anesthesia around the incisional area. During surgery, an additional 0.2 $\mu g \cdot kg^{-1}$ of fentanyl was administered intravenously in each group. Systolic blood pressure was maintained at 85 to 95 mmHg by controlling the concentration of isoflurane (0.5%–3.0%). Bolus 1.0-mg intravenous administration of nicardipine, a Ca^{2+} antagonist, was used if blood pressure was not effectively controlled by isoflurane. After surgery, all patients were administered 50 mg of flurbiprofen intravenously for postoperative pain relief before extubation, and they were admitted to the recovery unit for 1 h. Pain intensity was evaluated on a five-point pain scale (0, no pain; 1, mild pain; 2, moderate pain; 3, severe pain; 4, worst possible pain) in the recovery unit 15 min after the end of anesthesia. When it was confirmed that there was no significant postanesthetic complications, they were returned to their ward. The patients also received 15 mg of pentazocine intramuscularly as required for postoperative supplemental analgesia, on request.

The overall consumption of isoflurane was measured directly by the decrease in the vaporizer from the start to the end of anesthesia, and consumption during the operation was calculated by the cosumption table (1 bar, 25°C) and the overall consumption of isoflurane.

Data analysis

The results were analyzed for statistical significance using one-way analysis of variance (ANOVA) and Student's *t*-test for numerical data and the χ^2 test for countable data (pain intensity and number of patients receiving nicardipine).

Results

The background of the patients did not significantly differ between the two groups (Table 1). The consumption of isoflurane in the block group was lower than that in the nonblock group (consumption rate, $P = 0.003$; whole dose, $P = 0.007$) during anesthesia, and the consumption rate was also lower than in the nonblock group during surgery (consumption rate, $P < 0.001$), even though the administered dose of 0.5% lidocaine with epinephrine was similar in each group ($P = 0.477$) (Table 2). The number of patients who required

Table 1. Background of patients

Characteristic	Block group ($n = 25$)	Nonblock group ($n = 25$)	P
Sex (male/female)	16/9	18/7	0.544
Age (yr)	45.4 ± 16.4	42.8 ± 16.1	0.574
Height (cm)	161.4 ± 9.0	165.6 ± 9.9	0.640
Weight (kg)	59.7 ± 8.9	63.2 ± 8.6	0.162
Anesthesia time (min)	174 ± 50	175 ± 43	0.940
Surgery time (min)	106 ± 44	101 ± 46	0.681
Fluid intake ($ml \cdot kg^{-1} \cdot h^{-1}$)	5.6 ± 2.8	5.1 ± 1.5	0.451
Blood loss ($ml \cdot kg^{-1} \cdot h^{-1}$)	1.2 ± 0.7	1.0 ± 0.7	0.370
Urine output ($ml \cdot kg^{-1} \cdot h^{-1}$)	0.9 ± 0.8	1.0 ± 0.9	0.587

Values are means ± SD, except for sex

Table 2. Consumption of anesthetics

Anesthetic	Block group	Nonblock group	P
Liquid isoflurane			
Overall consumption during anesthesia (ml)	43.8 ± 20.8	60.1 ± 19.8	0.007
Consumption rate during anesthesia ($ml \cdot h^{-1}$)	15.8 ± 5.8	20.8 ± 5.8	0.003
Consumption rate during operation ($ml \cdot h^{-1}$)	17.3 ± 6.5	27.4 ± 9.4	<0.001
0.5% lidocaine with epinephrine (ml)	6.8 ± 2.2	6.4 ± 2.0	0.477

Values are means ± SD

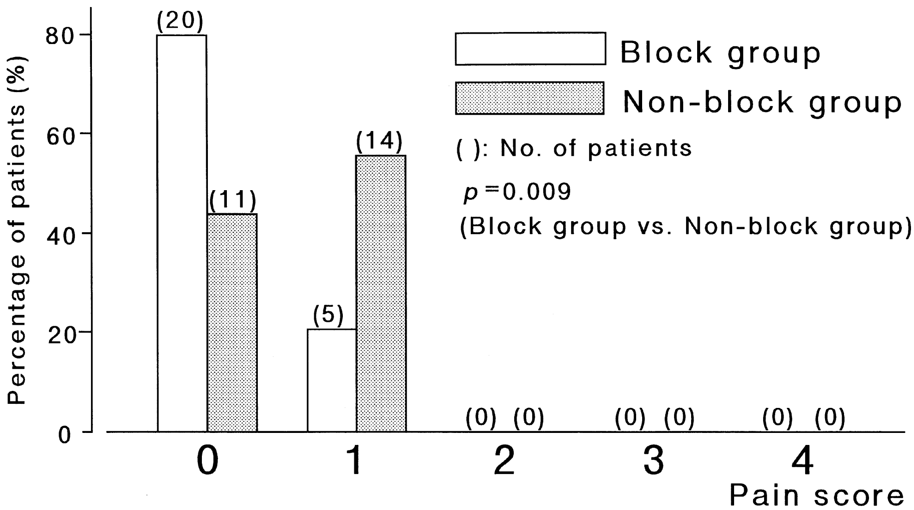

Fig. 1. Postoperative pain score 15 min after anesthesia. *Open bars*, Block group; *shaded bars*, nonblock group. Number of patients in parentheses. $P = 0.009$, block group vs nonblock group

Table 3. Incidences of nicardipine administration and its dose

Variable	Block group	Nonblock group	*P*
No. of patients	7/25	16/25	0.010
Dose per patient (mg)	3.3 ± 1.7	3.1 ± 2.3	0.869

Values are means ± SD

nicardipine was lower in the block group than in the nonblock group ($P = 0.011$), but the mean nicardipine dose in patients who required nicardipine did not differ between the two groups ($P = 0.869$) (Table 3). The pain intensity assessed on a five-point pain scale in the block group was lower than that in the nonblock group ($P = 0.009$), even though the pain intensity was 0 or 1 in all patients (Fig. 1). None of the patients required additional analgesics throughout the postoperative period.

Discussion

Modified infraorbital nerve block was effective for ESS under general anesthesia in reducing the consumption of inhalation anesthetic. In addition, the requirement of nicardipine to control blood pressure was lower in the block group than in the nonblock group.

Our infraorbital nerve block technique is simple and easy and is associated with fewer complications, because it is not necessary to insert the needle into the infraorbital foramen. The infraorbital nerve is distributed to the nose and upper lip [1]. This technique may be performed under general anesthesia, or this technique alone can be sufficient for less invasive ESS. The open reduction method for sinusitis requires the standard technique of maxillary nerve block under X-ray scanning and may be associated with complications. Therefore, the ESS procedures and our modified regional block technique are well matched. Usually, ESS is performed under regional anesthesia with some sedation [2,3], but it is only indicated for the maxillary sinus area [4]. Recently, ESS has increasingly been extended to involve deep sinus areas, such as the ethmoidal region. Such procedures cannot be performed under regional anesthesia alone, and heavy sedation or general anesthesia is required [5]. Thus, it is safer to select general anesthesia combined with appropriate regional block than to select regional anesthesia combined with heavy sedation in these cases.

In conclusion, infraorbital nerve block, when combined with general anesthesia, is effective in reducing the use of inhalation anesthetic during ESS. It is also effective in alleviating postoperative pain.

References

1. Lang J (1983) Infraorbital foramen. In: Clinical anatomy of the head. Springer-Verlag, New York, pp 38–39
2. Lee WC, Kapur TR, Ramsden WN (1997) Local and regional anesthesia for functional endoscopic sinus surgery. Ann Otol Rhinol Laryngol 106:767–769
3. Thaler ER, Gottschalk A, Samaranayake R, Lanza DC, Kennedy DW (1997) Anesthesia in endoscopic sinus sugery. Am J Rhinol 11:409–413
4. Jorissen M, Heulens H, Peters M, Feenstra L (1996) Functional endoscopic sinus surgery under local anaesthesia. Possibilities and limitations. Acta Otorhinolaryngol Belg 50:1–12
5. Milewski C (1996) Endonasal endoscopic ethmoidectomy in acute therapy refractory sinusitis. Laryngorhinootologie 75:286–289