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Continuous wound infiltration with 0.2% ropivacaine versus a single intercostal nerve block with 0.75% ropivacaine for postoperative pain management after reconstructive surgery for microtia

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Summary *Background and aim:* In reconstructive surgery for microtia during childhood, costal cartilage is used for pinna formation. Postoperative pain in the region from which the costal cartilage is taken is severe, which delays recovery after surgery. We evaluated prospectively whether continuous wound infiltration (CWI) of a local anesthetic (LA) reduces pain and enables rapid recovery compared with a single intercostal nerve block (ICNB).
Method: Forty-eight patients were randomly divided into two groups. In Group I, a single ICNB with 10 ml of 0.75% ropivacaine was performed at the end of surgery. In Group C, a catheter was inserted into the space between the abdominal external oblique muscle and the rectus abdominis muscle. Then, a 0.4-ml/kg bolus of 0.2% ropivacaine was administered, followed by continuous infusion at 2–4 ml/h for 48 h. Postoperative pain intensity evaluated using the Face Scale, dose of supplemental analgesics, and time until mobilization were evaluated. In Group C, the plasma concentrations of ropivacaine were analyzed.
Results: The pain intensity at rest was significantly lower in Group C than in Group I, but the values during coughing were comparable. The number of patients receiving a supplemental analgesic and the median number of doses were significantly larger in Group I than in Group C ($P = 0.029$, $P = 0.0007$, respectively). The plasma concentrations of ropivacaine were within the safe range over 48 h. The times until mobilization were comparable.

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Conclusion: CWI of 0.2% ropivacaine is a better and safe technique for postoperative pain management after costal cartilage graft harvest in children.

Introduction

Effective postoperative analgesia management can improve clinical outcomes and patient satisfaction for both adults and children. In reconstructive surgery for microtia, costal cartilage is used as a graft for pinna formation.[1] Postoperative pain in the region from which the costal cartilage is taken is severe, and the pain delays recovery after surgery.[2–4] Epidural anesthesia and a paravertebral block are considered effective in managing the postoperative pain. However, the performance of these blocks while the patient is conscious is difficult because most patients for this surgery are children aged about 10—13 years. In addition, complications such as a nerve disorder or pneumothorax may occur. In our institution, a single intercostal nerve block with 0.75% ropivacaine was performed at the end of surgery, but effective postoperative pain relief was not achieved. When severe pain occurred, nonsteroidal anti-inflammatory drugs (NSAIDs) were administered as supplemental analgesics. However, there is a limit to the dose, because the patients are children and because of adverse effects such as decreased appetite, diarrhea, kidney or liver failure, ulcers, and prolonged bleeding after surgery.[5] Continuous wound infiltration of local anesthetic via a catheter is an easy and effective form of postoperative pain management, and it has been widely used recently.[6–8] However, the efficacy and safety of this method for the management of postoperative pain and recovery after this surgery have not been adequately clarified. The primary aim of this study was to determine whether continuous wound infiltration via a catheter with 0.2% ropivacaine reduces pain scores and the consumption of additional analgesics after reconstructive surgery for microtia in the region from which costal cartilage was taken compared with a single intercostal nerve block with 0.75% ropivacaine. The secondary aim was to determine whether it enables rapid recovery after surgery.

Patients and methods

This prospective, randomized, open-label comparative study was approved by the Ethics Committee of Sapporo Medical University Hospital on 15 January 2013 (approval code number; 24-168), and written, informed consent was obtained from a parent of each patient. Forty-eight patients aged 10—17 years with American Society of Anesthesiologists physical status I—II and scheduled for elective microtia reconstructive surgery under general anesthesia were enrolled. Patients were excluded if they had obesity (body mass index > 30 kg/m^2), a history of allergy to local anesthetics, NSAIDs, or aspirin-induced asthma, or their parents did not agree with this study.

Patients were not premedicated before arriving at the operating room. In the operating room, they were monitored via electrocardiography (ECG), and monitoring of noninvasive blood pressure, oxygen saturation, and end-tidal carbon dioxide concentration. General anesthesia was induced with 1.5—2 mg/kg of intravenous (IV) propofol or 5% sevoflurane. After muscle relaxation had been achieved by administration of 0.6 mg/kg rocuronium bromide intravenously, the trachea was intubated, and controlled ventilation was started. Anesthesia was maintained with remifentanil infused at a rate of 0.1—0.2 μg/kg/min and a mixture of air and sevoflurane (end-tidal concentration, 1—1.5%) in oxygen (40% inspired concentration). With respect to the method of costal cartilage harvest, after skin incision in the anterior chest, the layer just above the fascia was widely exposed. Then, the external oblique muscle and rectus abdominis muscles were identified. The fascia between these muscles was divided parallel to the muscle, and the costal cartilages were confirmed just below the muscles. The perichondrium was incised along the required area of the cartilages, the cartilage blocks were then harvested, and the perichondrium was closed as before. The patients were randomly divided into two groups for postoperative pain management. In Group I, intercostal nerve blocks at multiple levels (T 7—9), for which the costal cartilage was used as a graft for pinna formation, with a total of 10 ml of 0.75% ropivacaine as a single shot were performed at the end of surgery by the surgeon. In Group C, after the costal cartilage was harvested, a 17-gauge, 70-mm, multiholed catheter with 10 holes at 5-cm intervals (Pain catheter® Hakko Inc., Tokyo, Japan) was inserted by the surgeon. The end of the catheter was set in the space between the perichondrium and muscles through the divided fascia between the external oblique muscle and rectus abdominis muscle. Then, the fascia was closely sutured as before so that the infused anesthetic drugs would stay in the space. The catheter was positioned along the full length of the wound. Then, at the end of surgery, each patient received a 0.4-ml·kg^{-1} bolus of 0.2% ropivacaine through the catheter, followed by continuous infusion of 0.2% ropivacaine with a disposable multiflow rate infusion pump (COOPDECH® syrinjector, Daiken-Iki, Tokyo, Japan) at 4 ml/h for 24 h, which was then decreased to 2 ml/h for the next 24 h. The infusion was stopped at 48 h, and the catheter was removed. A total of 60 mg/day of acetaminophen was administered orally to all patients in the first 48 h postoperatively. If the patient did not obtain pain relief, 25 mg of diclofenac was given per rectum as a supplemental analgesic on patient request. After extubation, the patients were removed from the operating room.

Postoperative pain at rest and on movement was recorded at 2, 4, 12, 24, 36, 48, 60, and 72 h after the end