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Continuous postoperative pain control using a multiple-hole catheter after iliac bone grafting: comparison between ropivacaine and levobupivacaine

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Abstract. The aim of this study was to compare the analgesic effects of ropivacaine and levobupivacaine in continuous infiltration anaesthesia delivered via a multiple-hole catheter for the purpose of postoperative analgesia after iliac bone grafting. Thirty-four patients scheduled for iliac bone grafting in the maxillofacial region participated in this study. The patients were randomized to a ropivacaine group (Ropi group) and a levobupivacaine group (Levo group). After harvesting the iliac bone for grafting, a multiple-hole catheter was placed on the periosteum of the iliac bone. When surgery was completed, continuous administration was started at 4 ml/h of 0.2% ropivacaine (Ropi group) or 0.25% levobupivacaine (Levo group). Pain was evaluated in the recovery room and at 4 h after surgery, as well as at 9:00 and 18:00 on postoperative days 1, 2, and 3, using a visual analogue scale. Side effects were also recorded. No significant difference in the visual analogue scale scores at rest or in motion was observed between the two groups. In addition, there were no side effects in the two groups. Both 0.2% ropivacaine and 0.25% levobupivacaine provided comparable analgesic effects in continuous infiltration anaesthesia delivered via a multiple-hole catheter after iliac bone grafting.

Key words: postoperative pain; local anaesthesia; ropivacaine; levobupivacaine; iliac bone grafting.

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Iliac bone grafting is often performed for reconstruction of the jaw bone after tumour resection in the maxillofacial region. Postoperative pain related to the iliac crest wound can sometimes become worse than the intraoral pain, leading to patient distress and delays in postoperative ambulation.[1] Although the administration of opioid analgesics has been the conventional treatment for postoperative pain, respiratory depression and/or nausea and vomiting are clinical issues.[2] In recent years, postoperative analgesia using local anaesthetics or non-steroidal anti-inflammatory drugs has become common because these analgesics are not accompanied by the side-effects produced by opioids and therefore improve patient satisfaction.[3] It is reported that epidural anaesthesia is effective for the management of postoperative pain.[4] However, epidural anaesthesia requires expertise in the procedure and can lead to complications, including dural puncture, hypotension, and dysuria. Infiltration anaesthesia, which involves the continuous administration of local anaesthetics via an indwelling catheter placed in the iliac crest wound, is a safer procedure because there is no risk of these complications.[5–10] The use of multiple-hole catheters in the iliac crest wound for continuous postoperative pain control has been reported previously by this study group.[6]

The long-acting amide-type local anaesthetics ropivacaine and bupivacaine have been used in epidural anaesthesia and infiltration anaesthesia for many years. Ropivacaine has fewer cardiotoxic effects and shows earlier recovery of normal motor function than bupivacaine under similar sensory block.[11,12] Levobupivacaine is the pure *S*(−)-enantiomer of bupivacaine and is reported to be less cardiotoxic than racemic bupivacaine.[13] Levobupivacaine was developed for clinical use as a long-acting local anaesthetic after ropivacaine. Both ropivacaine and levobupivacaine are now commonly used for postoperative analgesia in various settings.[14–16]

Studies comparing ropivacaine and levobupivacaine in spinal anaesthesia and epidural anaesthesia have been published. In a study that compared both agents at the same concentration in epidural analgesia, the analgesic effects were reported to be comparable.[17] In contrast, in a study that calculated the minimum effective analgesic concentration (MEAC) for a comparison of both agents in epidural analgesia, levobupivacaine was 20% more potent than ropivacaine.[18] In addition, in other clinical studies comparing the two drugs in shoulder and knee surgery, similar analgesic effects were obtained at lower concentrations of levobupivacaine.[19,20] From these results, there is no consensus of opinion on the potency of these two agents. Therefore the present study was performed to compare the analgesic effects of ropivacaine and levobupivacaine in continuous infiltration anaesthesia delivered via a multiple-hole catheter for the purpose of postoperative analgesia after iliac bone grafting.

Methods

This research was performed with the approval of the dental college ethics committee. The study enrolled patients aged ≥18 years scheduled for iliac bone grafting in the maxillofacial region under general anaesthesia at the hospital between October 2011 and September 2013. These patients were classified as American Society of Anesthesiologists (ASA) physical status I or II, and all provided informed consent to participate. Patients were excluded if they had severe heart, liver, or kidney dysfunction, had a history of hypersensitivity to amide-type local anaesthetics, had a contraindication to the use of rescue analgesics (diclofenac sodium, loxoprofen sodium), had a haemostasis or blood coagulation abnormality, or were otherwise determined by the attending doctor to be unsuitable for study enrolment. The patients were randomized to either the ropivacaine group (Ropi group) or the levobupivacaine group (Levo group).

General anaesthesia was maintained either by inhalation anaesthesia using oxygen, air, and sevoflurane, or by total intravenous anaesthesia (TIVA) using oxygen, air, and propofol. Remifentanil or fentanyl was used for analgesia during surgery. The selection of the general anaesthetic and the dose of narcotic analgesic given during surgery were decided by the dental anaesthetists in charge.

To harvest the iliac bone for grafting, the oral surgeon administered 4 ml 1% lidocaine hydrochloride with 10 μg/ml epinephrine (Xylocaine Injection 1% with Epinephrine; AstraZeneca, Osaka, Japan) to the iliac bone harvest site by infiltration anaesthesia. After harvesting the iliac bone for grafting, a multiple-hole catheter (epidural catheter; Hakko, Tokyo, Japan) was placed on the periosteum of the iliac bone and the surgical incision in the skin was closed (Fig. 1). A 17-gauge, three-hole type multiple-hole catheter was used. The holes were located at 10, 30, and 50 mm from the catheter tip with each hole rotated by 180°. The catheter tip was semicircular in shape.

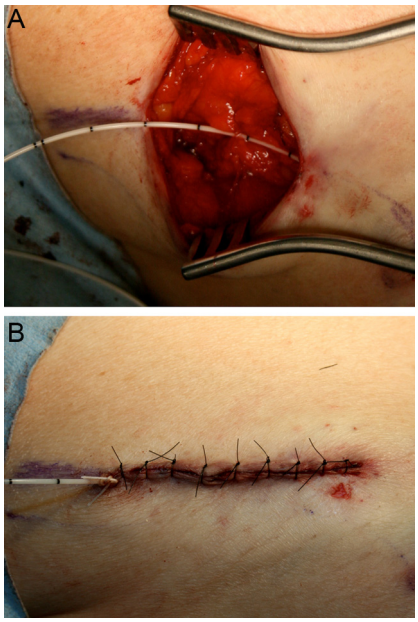

Fig. 1. A multiple-hole catheter placed in the iliac crest wound. (A) Before skin closure; the catheter is fixed on the periosteum. (B) After skin closure.

After suturing, the initial dose of infiltration anaesthesia was administered to the donor site: 5 ml 0.75% ropivacaine (Anapeine Injection; AstraZeneca, Osaka, Japan) in the Ropi group, or 5 ml 0.75% levobupivacaine (Popscaine 0.75% injection; Maruishi Pharmaceutical, Osaka, Japan) in the Levo group. When surgery to the maxillofacial region and iliac crest wound was completed, continuous administration was started at 4 ml/h of 0.2% ropivacaine in the Ropi group, or 0.25% levobupivacaine in the Levo group. The infusion was continued while the patient was transferred to the ward and for the next 48 h. After 48 h of infusion, an oral surgeon removed the catheter in the ward. A syringe-type disposable injector (Coopdech Syrinjector 120 ml, Ambulatory Infusion Pump; Daiken Medical, Osaka, Japan) was used for the continuous infiltration anaesthesia.

When the surgery was completed, all patients were administered diclofenac sodium 50 mg (Voltaren SUPPO; Novartis Pharmaceuticals, Tokyo, Japan) as a suppository. If the patient complained of pain in the ward and asked for rescue analgesics, diclofenac sodium (Voltaren Tablets; Novartis Pharmaceuticals, Tokyo, Japan) or loxoprofen sodium (Loxonin Tablets; Daiichi Sankyo, Tokyo, Japan) was administered orally. The maximum dose each time was 50 mg for diclofenac sodium

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