Surgical Catheterization for Continuous Serratus Anterior Plane Block after Thoracoscopic Lobectomy: A Report of 3 Cases

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Case report

Serratus anterior plane block (SAPB) is a novel lateral chest wall blockade technique, introduced by Blanco et al. [1] in 2013, that is used for perioperative pain control in video-assisted thoracoscopic surgery (VATS) [2]. In recent studies, continuous SAPB helped manage post-thoracotomy pain effectively, and catheterization was performed by anesthesiologists during surgery under ultrasound guidance. Anatomically, the site of SAPB is a location that must be penetrated during VATS. Catheterization could therefore be performed more simply and safely by the thoracic surgeon during VATS. Continuous postoperative pain control after surgical catheterization for SAPB has not been reported. We describe 3 cases of effective continuous postoperative pain control after catheterization was performed by the surgeon.

At our institution, lobectomy is usually performed with conventional 3-port VATS. The utility port (approximately 4–5 cm in length) is created in the fourth intercostal space at the mid-axillary line. Of the other 2 ports (approximately 1 cm in length), one is created in the seventh intercostal space at the anterior axillary line, and the other at the eighth intercostal space at the posterior axillary line. During VATS, incisions are made in the skin, latissimus dorsi, serratus anterior, intercostal muscle, and parietal pleura, in that order. There are 2 ways of performing SAPB: superficial SAPB targeted between the latissimus dorsi muscle and the serratus anterior muscle and deep SAPB targeted between the serratus anterior muscle and the rib/external intercostal muscle. The thoracic surgeon can find the deep serratus anterior plane easily by detecting the rib with a finger and pressing gently to create space (Fig. 1); the skin is punctured with a 17G T-peel introducer needle approximately 5 cm below the utility port site after the side hole of the catheter is placed between the fourth and fifth intercostal spaces, and the puncture site is tagged with a purse-string suture (Fig. 2). A 20G catheter (Silver Soaker, part of the ON-Q PainBuster system; B. Braun, Melsungen, Germany) is inserted in the operating room, just before wound closure, when surgery is finished. We then administer 20 mL of 0.2% ropivacaine (40 mg) through the catheter. For continuous pain control, a single bolus injection of 20 mL of 0.2% ropivacaine is administered every 8 hours. The SAPB catheter is removed 1 day after removal of the chest tube. The patient uses a Numerical Rating Scale (NRS; 0 indicating no pain and 10 signifying the worst pain imaginable) to describe the pain level before and immediately after ropivacaine is administered. In this study, acetaminophen (650 mg) was routinely adminis-
tered, 3 times per day, to all patients postoperatively, but intravenous (IV) patient-controlled anesthesia was not used. If a patient had additional analgesic requirements between SAPB injections, ketorolac (30 mg) was injected intravenously if the NRS score was 4 or 5, while pethidine (25 mg) was injected intravenously if the NRS score was ≥6.

The patients provided formal informed consent for publication of their clinical information.

Case 1
A 73-year-old man had undergone left lower lobectomy; the tumor was confirmed to be squamous cell carcinoma, stage IIA, pT2bN0M0. After ropivacaine administration, the NRS score decreased by 2 points (NRS score, 4→2). After removal of the chest tube, the pain level decreased dramatically to an NRS score of 1; after ropivacaine re-administration, the pain was rated as 0 on the NRS.

Case 2
A 55-year-old man had undergone right upper lobectomy; the tumor was confirmed to be an adenocarcinoma (stage IA2, pT1bN0M0). After ropivacaine administration, the NRS score decreased by 1 point (NRS score, 3→2). The patient stated that the pain subsided at the time of injection, remained decreased for hours, and became aggravated just before the next injection. As in case 1, the pain level was dramatically reduced to 2 or less on the NRS after chest tube removal, and after ropivacaine re-administration, the pain level remained less than 2 on the NRS.

Case 3
A 69-year-old woman had undergone right middle lobectomy; the tumor was confirmed to be an adenocarcinoma (stage IA2, pT1bN0M0). After ropivacaine administration, the NRS score decreased by 2 points (NRS score, 6→4). The level of pain was 4 on the NRS while the chest tube remained in place and 2 on the NRS after removal of the chest tube.

Discussion
Pain control after thoracotomy not only immediately relieves acute pain, but also reduces pulmonary complications. Patient-controlled intravenous analgesia is convenient, but the drawbacks of opioids include respiratory depression, cough reflex inhibition, and nausea/vomiting [3,4]. Regional blockade (e.g., local wound infiltration, se-
lective intercostal nerve block, thoracic paravertebral block, and thoracic epidural block) has been used for postoperative pain relief, but most of these methods are invasive. SAPB is a novel lateral chest wall block technique that is becoming popular for use in VATS [2]. Because the serratus anterior muscle is superficial and easily identified, we consider it an ideal location for implementing thoracic wall blocks because the intercostal nerves pierce it and give off lateral cutaneous branches [1,5,6]. However, catheterization for SAPB is usually performed under ultrasound guidance by anesthesiologists before or after surgery. In thorascopic surgery, the serratus anterior muscle is easily identified, and the surgeon can create a space in the deep serratus anterior plane more safely. There may be space-occupying complications such as bleeding, seroma, and hematoma. However, even with the conventional ultrasonography-guided method, bolus hydrodissection is performed to create space in the serratus anterior plane by injecting 5 mL of saline solution before continuous catheterization. Therefore, space-occupying complications may be similar to those with conventional methods, but surgical catheterization is expected to be safer, as any bleeding and hematomas can be directly visualized. At our institution, surgeons place the catheter for continuous SAPB, and they function effectively in postoperative pain management.

In our 3 patients, NRS scores decreased significantly after administration of ropivacaine, and the pain intensity was well maintained at an NRS score of less than NRS 4. SAPB has been known to last for up to 800 minutes, but in our 3 patients, a single administration of 0.2% ropivacaine (20 mL) produced relief that lasted for approximately 8 hours [2,7]; in fact, the patients reported that the pain improved dramatically after ropivacaine administration. The level of pain intensity fluctuated between the time of one dose and the time of the next dose. After ropivacaine administration, all 3 patients could cough effectively and perform daily activities more conveniently. The bolus injections of ropivacaine at 8-hour intervals did not overlap with the timing of oral analgesics and IV non-steroidal anti-inflammatory drugs or opioids. Since we checked the pain score before and after ropivacaine was injected, it is believed that the ropivacaine-induced improvements had little correlation with the effects of oral and IV painkillers. The surgical placement of a catheter for continuous SAPB is easy and safe, and continuous SAPB effectively controls postoperative pain. The purpose of this report, however, is to show that catheterization for continuous SAPB can be performed by a thoracic surgeon. Further randomized, prospective studies are needed to prove whether the surgical placement of catheters for continuous SAPB provides postoperative pain control consistently and more efficiently than ultrasound-guided catheterization for continuous SAPB by anesthesiologists during VATS.

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**Author contributions**

SJP conceived the report and wrote the manuscript. DHL was the main surgeon. SJP assisted during the surgery. DHL, SJP, SK, and HJ were involved in patient care. DHL and HJ revised the manuscript. Anesthesia was done by SK. All authors have approved the final manuscript.

**Conflict of interest**

No potential conflict of interest relevant to this article was reported.

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