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Effect of local wound infiltration and transversus abdominis plane block on morphine use after laparoscopic colectomy: a nonrandomized, single-blind prospective study



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ABSTRACT

Background: Recently, nonopioid-based treatment modalities have been used to improve analgesia and decrease opioid-related side effects after surgery. Transversus abdominis plane (TAP) block and local infiltration of the surgical wound are commonly used multimodal analgesia techniques after abdominal surgery; however, few studies have compared the effectiveness of a TAP block with that of local infiltration of surgical wounds in patients who have undergone laparoscopic colorectal surgery.

Materials and methods: Sixty patients undergoing laparoscopic colorectal surgery participated in this prospective comparative study. All patients were allocated to 1 of 2 groups as follows: the TAP group or the infiltration group. Patients in the TAP group received bilateral TAP blocks at the end of the surgery. Patients in the infiltration group received local infiltration of anesthetics in the surgical wounds after closure of the peritoneum. All patients received postoperative analgesia with morphine as a patient-controlled analgesia. Opioid consumption and pain scores were recorded at 2, 6, 24, and 48 h after the operation. **Results:** The characteristics of patients in the TAP group ($n = 30$) and local infiltration group ($n = 29$) were comparable. Pain scores while coughing and at rest were not different between the two groups. Postoperative morphine use was significantly reduced in the TAP group compared with that in the local infiltration group at 2–6 h (2.9 ± 1.9 mg versus 4.5 ± 3.2 mg, $P = 0.02$), 6–24 h (5.5 ± 3.3 mg versus 10.2 ± 8.4 mg, $P = 0.00$), the first 24 h (16.6 ± 6.6 mg versus 24.0 ± 9.7 mg), and 48 h (23.6 ± 8.2 mg versus 31.8 ± 12.5 mg, $P = 0.00$). No differences in rescue analgesic use or side effects were noted between the groups.

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Conclusions: Compared with local anesthetic infiltration, bilateral TAP blocks decreased the cumulative morphine use at 24 h and 48 h postoperatively in patients who had undergone laparoscopic colorectal surgery.

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1. Introduction

Postoperative analgesia is important in multimodal approaches to postoperative recovery [1]. Although the laparoscopic approach reduces incisions and pain associated with colorectal surgery [2], postoperative pain continues to be a problem. Opiate-based analgesia is commonly used to reduce postoperative pain, but it can delay postoperative recovery of gastrointestinal mobility and increase postoperative nausea and vomiting (PONV). Recently, nonopioid-based treatment modalities have been introduced to improve analgesia and decrease opioid-related side effects [3].

Transversus abdominis plane (TAP) blocks and local infiltration of surgical wounds are currently used in multimodal postoperative pain treatment. TAP block is performed by injecting a local anesthetic solution between the internal oblique and transversus abdominis muscles to block the sensory nerves arising from the lower six thoracic and first lumbar nerve roots and produce a regional abdominal wall nerve block [4]. Unlike the epidural block, the TAP block does not produce an unwanted motor block, hypotension, and urinary retention. Wound infiltration using local anesthetics is another minimally invasive and low-cost treatment modality with few adverse effects. Local infiltration is effective after minor surgical procedures, but the effectiveness of this method in extensive surgeries has been inconsistent [5].

To our knowledge, no prospective trial has compared the use of TAP block and local infiltration of anesthetics in surgical wounds of patients after laparoscopic colorectal surgery. Therefore, we performed this prospective, single-blind controlled study to compare the effects of TAP block and local infiltration of anesthetics on pain scores and postoperative morphine use in patients who underwent laparoscopic colorectal surgery.

2. Materials and methods

2.1. Patients

After the Kyungpook National University Medical Center's medical ethics committee approved this prospective comparative study, we recruited patients aged 20–75-y-old who were scheduled to undergo elective laparoscopic colectomy under general anesthesia. Patients with a history of allergy to local anesthetics or systemic opioids, impaired kidney function, coagulopathy, chronic pain syndrome, chronic opioid use, and those weighing <40 kg or >80 kg were excluded. A member of the research team contacted patients, explained the study procedures, and obtained informed consent for enrollment in the study. The day before the surgery, all patients were instructed on how to use a patient-controlled analgesia (PCA) pump and how to rate pain intensity on a

numeric rating scale (NRS), which indicated 0 as “no pain” and 10 as “worst pain imaginable.”

2.2. Experimental design

All patients received a standardized anesthetic by using standard American Society of Anesthesiologists monitors. Propofol (1–2 mg/kg) was administered for induction of anesthesia, an infusion of remifentanyl (0.1 µg/kg/min) was initiated, and rocuronium (0.4 mg/kg) was intravenously administered to facilitate intubation. Anesthesia was maintained using 4%–8% desflurane in a mixture of 50% oxygen in air in addition to a remifentanyl infusion. Additional doses of rocuronium were administered to maintain muscle relaxation. During surgery, the patients received an intravenous infusion of lactated Ringer solution at a rate of 6–12 mL/kg/h. No additional analgesics were injected during surgery. All laparoscopic resections were performed using a 4-port technique. The specimen was extracted through a 4–6 cm minilaparotomy incision using the camera port below the umbilicus [6].

Patients were allocated to two separate groups as follows: the TAP block group and the local anesthetic infiltration group. Group allocation was performed according to ultrasound (US) device availability. TAP block was performed immediately after wound closure by an anesthesiologist with considerable experience in US-guided nerve blocks. A high-frequency linear US transducer (UST5411; Aloka, Tokyo, Japan) was placed in the transverse plane at the midaxillary line between the lower costal margin and the iliac crest. TAP was identified, and a 22G Tuohy needle was introduced using an in-plane approach. When the tip of the needle was in the TAP, 2 mL of saline was injected to verify the correct position. Then, 20 mL of 0.25% ropivacaine was injected. All TAP blocks were performed bilaterally.

Infiltration of local anesthetics was performed immediately after closure of the anterior peritoneum. A syringe containing 40 mL of 0.25% ropivacaine was prepared and given to the surgeon, who selectively infiltrated the subcutaneous and muscle layers of the incision site (25 mL at the minilaparotomy site and 5 mL at each other port site). After wound closure, dressings that covered the incision site and actual or estimated needle insertion site of the TAP block were applied for all patients. These dressings were retained for a minimum of 48 h to maintain blinding of the patients and medical personnel. During the procedure, we monitored the time required to perform the TAP block and local infiltration procedures.

The postoperative intravenous antiemetic regimen consisted of 0.3 mg ramosetron administered at induction. To control postoperative pain, intravenous morphine was administered using a PCA system (AIM plus; Hospira, Lake Forest, IL). The PCA delivered a bolus injection of morphine 1 mg/mL with a lockout interval of 5 min and no continuous

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