学 位 論 文 の 要 旨

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学 位 論 文 名　Continuous Basal Infusion Versus Programmed Intermittent Bolus for Quadratus Lumborum Block After Laparoscopic Colorectal Surgery: A Randomized-controlled, Double-blind Study

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論 文 内 容 の 要 旨

INTRODUCTION

Epidural anesthesia is an established technique and has been employed as the first choice for postoperative analgesia after open abdominal surgery for many years. However, with surgical procedures becoming less invasive recently, evidence-based outcome data have started showing that the benefits of epidural anesthesia are not as significant as previously believed. In addition, there is growing concern regarding risks and complications such as epidural hematoma, abscess, hypotension, impaired ambulation, and failure. Several abdominal wall blocks targeting fascial plane of the abdominal wall have been developed as safer alternatives to epidural anesthesia. Recent guideline recommends the use of abdominal wall block over epidural anesthesia for laparoscopic colorectal surgery. However, the duration of single shot abdominal wall block is limited, and continuous infusion of local anesthetic via a catheter inserted to the fascial plane has been thought to help prolong the duration of analgesia.

Quadratus lumborum block (QLB) is a newly developed abdominal wall block which has been shown to provide effective analgesia for patients undergoing abdominal surgery. Continuous QLB with a catheter(s) has also been reported to provide effective and prolonged analgesia in patients after several surgeries including colorectal surgery. However, the optimal regimen for the infusion of the local anesthetic is still inconclusive and continuous basal infusion has been conventionally used. Recently, intermittent boluses of local anesthetic have attracted attention due to the development of devices with programmed delivery. Previous studies have shown that intermittent bolus injection can produce wider sensory blockade and better analgesia

compared with continuous basal infusion with epidural analgesia for labor and some peripheral nerve blocks, because of its high injection pressure and volume of local anesthetics. Since QLB is a fascial compartment block where a large volume of local anesthetics producing a wide spread is preferable, it is reasonable to presume that intermittent boluses contribute to maintaining the range of cutaneous sensory blockade and, thus, result in better analgesia compared with the same volume using continuous basal infusion. Accordingly, we conducted the present randomized-controlled study to see if programmed intermittent bolus (PIB) of local anesthetic might produce better analgesia and a wider sensory blockade compared with continuous basal infusion for the posterior approach to QLB in patients undergoing laparoscopic colorectal surgery.

MATERIALS AND METHODS

The study protocol was approved by the Research Ethics Committee of Shimane University. We obtained informed consent from 50 patients aged 20–80 years, classified as American Society of Anesthesiologists physical status I–II, and scheduled for laparoscopic colorectal surgery. Exclusion criteria included contraindication to peripheral nerve block, allergy to study medication, preoperative use of opioids and steroids, and apparent neuropathy. Patients who were subsequently randomly divided into two groups to receive either continuous basal infusion (group C) or programmed intermittent boluses (group PIB) of local anesthetic for QLB. All patients received general anesthesia using propofol, remifentanil and rocuronium. Fentanyl 2 μg/kg and acetaminophen were intravenously injected during skin closure. After surgery, but prior to extubation, all patients received the bilateral posterior approach to QLB under ultrasound guidance. After injection of 20 ml of 0.25% levobupivacaine through the needle, a catheter was inserted bilaterally. Bilateral infusion of 0.15% levobupivacaine was started according to the assigned protocol. Patients in group C received a continuous infusion at 3 ml/h, and those in group PIB received a bolus of 12 ml every 4 h until 46 h after block. All patients also received intravenous patient-controlled analgesia (PCA) with fentanyl (0.5 μg/kg/h and on-demand bolus of 0.5 μg/kg, 15-min lockout time, maximum dose of 2000 μg) for 46 h postoperatively. Acetaminophen or flurbiprofen axetil was intravenously injected for rescue analgesia.

Patients were blinded to their group assignment, and anesthetists who were also blinded to the group assignment conducted measurements. Measurements were obtained at 4, 16, 22, 34, and 46 h after blocks for all of the following: postoperative fentanyl consumption, demands for PCA and other analgesics, pain scores on visual analogue scale (VAS: 0, no pain; 100, worst pain imaginable) at rest and while coughing, dermatomal sensory blocked levels as determined by loss of cold and pinprick sensation, and complications. The primary endpoint was cumulative fentanyl consumption at 22 h after block. All the variables were compared between the two groups.

RESULTS AND DISCUSSION

Nine patients were excluded and 41 patients (21 and 20 patients for group C and group PIB, respectively) completed the study. Baseline and perioperative characteristics of the patients were similar between the two groups. The primary outcome of cumulative fentanyl consumption at 22 h showed no significant difference between the groups. No significant difference was observed in fentanyl consumption, demands for PCA and other analgesics, or VAS pain scores at rest or while coughing at any time point. Postoperative nausea and vomiting were also comparable and no serious complication related to the block including local anesthetic toxicity, hematoma, and visceral organ injury was observed. Loss of cold and pinprick sensation at 16 h were observed between T6 and L4 dermatomes in either group. The median number of dermatomes with sensory blockade was comparable at any time point up to 46 h between the two groups.

This is the first prospective comparative clinical study evaluating the analgesic effect and sensory blockade of different delivery methods for continuous QLB. As opposed to our hypothesis, we observed no superiority of PIB over continuous basal infusion for either postoperative opioid consumption, postoperative pain scores, or levels of cutaneous sensory blockade. Some previous studies have shown the benefit of intermittent bolus injection with epidural analgesia for labor, femoral nerve block and thoracic paravertebral block. However, a volunteer study targeting transversus abdominis plane block, which is another fascial plane block, did not show the benefit in the spread of cutaneous sensory blockade, which is in accordance with our results.

This study has some limitations. First, with regard to continuous basal infusion as well as PIB, use of other settings, such as a different rate of infusion and/or a larger volume as a bolus, may lead to different results. Second, the sample size calculation for this study was conducted based on the data of patients undergoing open laparotomy instead of laparoscopic surgery. It is possible that the intensity and characteristics of postoperative pain differ between the two distinct surgical procedures and that the number of patients was not large enough to prove the hypothesis of this study if surgical procedure in the present study caused less severe pain.

CONCLUSIONS

PIB of local anesthetic for continuous QLB did not produce better analgesia or a wider sensory blockade compared with continuous basal infusion in patients undergoing laparoscopic colorectal surgery.