The analgesic effect of the ultrasound-guided transverse abdominis plane block after laparoscopic cholecystectomy

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Background: Several methods are performed to control the pain after a laparoscopic cholecystectomy. Recently, the transverse abdominis plane block has been proposed to compensate for the problems developed by preexisting methods. This study was designed to evaluate the effect of the ultrasound-guided transverse abdominis plane block (US-TAP block) and compare efficacy according to the concentration of local analgesics in patients undergoing laparoscopic cholecystectomy.

Methods: Fifty-four patients undergoing laparoscopic cholecystectomy were randomized into three groups. The patients in Group Control did not receive the US-TAP block. The patients in Group B 0.25 and Group B 0.5 received the US-TAP block with 0.25% and 0.5% levobupivacaine 30 ml respectively. After the general anesthesia, a bilateral US-TAP block was performed using an in-plane technique with 15 ml levobupivacaine on each side. Intraoperative use of remifentanil and postoperative demand of rescue analgesics in PACU were recorded. The postoperative verbal numerical rating scale (VNRS) was evaluated at 20, 30, and 60 min, and 6, 12, and 24 hr. Postoperative complications, including pneumoperitoneum, bleeding, infection, and sleep disturbance, were also checked.

Results: The intraoperative use of remifentanil, postoperative VNRS and the postoperative demand of rescue analgesics were lower in the groups receiving the US-TAP block (Group B 0.25 and Group B 0.5) than Group Control. There were no statistically or clinically significant differences between Group B 0.25 and Group B 0.5. No complications related to the US-TAP block were observed.

Conclusions: The US-TAP block with 0.25% or 0.5% levobupivacaine 30 ml (15 ml on each side) significantly reduced postoperative pain in patients undergoing laparoscopic cholecystectomy. (Korean J Anesthesiol 2010; 58: 362-368)

Key Words: Laparoscopic cholecystectomy, Levobupivacaine, Postoperative pain, Transverse abdominis plane block, Ultrasound.
Introduction

Although laparoscopic cholecystectomy, a widely performed surgery, is known for less pain compared to that of laparotomy, many patients actually complain of considerable pain after the operation [1,2].

Intravenous patient-controlled analgesia (IV-PCA), patient-controlled thoracic epidural analgesia, intraperitoneal injection of local anesthetics, low-pressure pneumoperitoneum, and warmed air supply have been used for pain control after laparoscopic cholecystectomy [1,3]. IV-PCA, while useful, has the side effects of opioids [4]. Though the analgesic effect of patient-controlled thoracic epidural analgesia is better than that of IV-PCA [5], there is a potential risk of dural puncture, infection, and epidural hematoma, as well as muscle weakness, which may cause even paralysis of respiratory muscles [6,7]. An intraperitoneal injection of local anesthetics also has the problems of insufficient pain control and short duration of analgesia [8,9].

In order to complement the problems of such analgesic methods and reduce the pain sufficiently, a peripheral nerve block can be used as an alternative method. Firstly described by Rafi [10], the transverse abdominis plane block (TAP block) enables pain control through blocking sensory nerves by injecting local anesthetics into the neurofascial plane in the abdominal muscle.

The conventional TAP block is performed at the so-called “triangle of Petit”, which is bounded posteriorly by the latissimus dorsi muscle, anteriorly by the external oblique muscle (EOM), inferiorly by the iliac crest [11], by advancing the needle for a “pop” or “double pop”, the sensation of puncturing fascia, to inject the local anesthetics, without knowing the inner structure of the abdominal cavity and the injection site [12-14]. However, this blind technique may cause an inappropriate block since the location of the needle may not be precise [15]. Fatal complications, such as large bowl puncture and liver injury, have been also reported [16,17]. Recently, complications are able to be minimized by performing an ultrasound-guided transverse abdominis plane block (US-TAP block), since precise location of the needle and diffusion of local anesthetics can be directly observed by this technique [18,19].

In this study, we have compared the analgesic effect of levobupivacaine concentration after a laparoscopic cholecystectomy by performing a US-TAP block with 0.25% and 0.5% of levobupivacaine, 15 ml each for the left and the right, at a total of 30 ml, on the patients for whom the operation was performed under general anesthesia.

Materials and Methods

This study was conducted with 54 ASA physical status I—II male and female adult patients between the ages of 20—65 who were scheduled to undergo laparoscopic cholecystectomy under general anesthesia. In addition, the study was performed after approval was obtained from the Hospital Ethics Committee and written informed consent from the patients with an explanation regarding the purpose, methods, effects, and complications. Patients were excluded if there was a history of relevant local anesthetics allergy or opioids addiction, or if they had coagulation disorder or there was infection at the needle insertion site. Patients were randomly allocated into three groups: one group to undergo general anesthesia but not perform the US-TAP block (Group Control, n = 18), another to undergo 0.25% levobupivacaine injection, 15 ml each at the left and the right, at a total of 30 ml (Group B0.25, n = 18) and the other to 0.5% levobupivacaine injection, 15 ml each at the left and the right, at a total of 30 ml (Group B0.5, n = 18). By means of the preliminary clinical study, the sample size was calculated so that reduction of VNRS 3 or more would be statistically significant with the significance level, \( \alpha \), of 0.05 and the power of test, \( 1-\beta \), of 80%. We calculated that 14.29 patients would be required per group, and elected 18 patients per group, considering the patients that might be excluded.

Premedication was not performed. Noninvasive blood pressure cuff, electrocardiograph, pulse oximetry, and bispectral index (BIS) were attached to the patients after arriving in the operating room. Induction of general anesthesia was performed by injecting glycopyrolate 0.2 mg and midazolam 0.05 mg/kg and introducing 2% propofol (Fresofol®, Fresenius Kabi, Korea Ltd, Korea) and remifentanil (Ultiva®, GlaxoSmithKlien, UK), which was diluted to 50 µg/ml with a Target Controlled Infusion (TCI, Orchestra®), Fresenius vial, France) until effective concentration became 3.0 µg/ml and 2.5 ng/ml. After unconsciousness, rocuronium 0.6 mg/kg was injected and then endotracheal intubation was performed following the 90 seconds of mask ventilation. Controlled ventilation was done by providing oxygen and nitrous oxide at the flow rate of 2 L per min each. Maintaining the effective concentration of propofol at 2 µg/ml, the blood pressure was regulated in the 20% range of the blood pressure measured when entering the operation room by regulating the concentration of remifentanil. In addition, the BIS was maintained within the range of 40 to 60 and the end-tidal carbon dioxide partial pressure within the range of 35 to 40 mmHg.

When the vital signs were stabilized after endotracheal intubation, the TAP block was performed through ultrasound (SonoSite M-Turbo®., Sonosite, USA) guided method. After draping the abdominal part between the 12th rib bone and iliac crest with umbilicus at the center, the “Petit triangle” was palpated (Fig. 1). The sterilized gel were sufficiently coated on the linear probe (HPL38x, 6−13 MHz, Sonosite, USA). External