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Original Contribution

Ultrasound-assisted transversus abdominis plane block vs wound infiltration in pediatric patient with inguinal hernia: randomized controlled trial☆,☆☆,★,★★

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Abstract

Study Objective: To compare the analgesic efficacy of ultrasound-assisted transversus abdominis plane (TAP) block and wound infiltration during the first postoperative 24 hours.

Design: A prospective, observer-blinded, randomized, and controlled study

Setting: Operating room of a university hospital.

Patients: Forty patients received a TAP block (TAP group) and 40 patients received wound infiltration (INF group) at the end of the surgery.

Interventions: Patients were randomized to receive a TAP block or wound infiltration. Postoperative analgesics were administered on request and selected based on pain severity.

Measurements: Pain scores, analgesic drug requirement, and side effects were observed for 24 hours.

Main Results: Postoperative pain scores were lower in TAP group compared to INF group ($P < .001$). Analgesic consumption was significantly higher at the 5th minute and 1st, 6th, and 12th hours in the INF group ($P < .001$). The frequency of additional analgesic use in home and the total analgesic used during the postoperative 24 hours were significantly higher in INF group ($P < .001$). Side effects were lower in the TAP group. Parent's satisfaction scores were higher in TAP group.

Conclusion: Transversus abdominis plane block is effective method with convenient technique, drug dosage, and volume in pediatric patients undergoing inguinal hernia surgery.

☆ Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the ethics committee of Istanbul University Cerrahpasa Faculty of Medicine and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

☆☆ Informed consent: Informed consent was obtained from all individual participants included in the study.

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1. Introduction

Inguinal hernia is one of the most common reasons of outpatient pediatric surgery with a rate of 3% and increases up to 10% in premature infants [1]. Effective and safe pain management causes fewer side effects and enables faster hospital discharge. It is also important in overcoming chronic pain in the late postoperative period [2]. The chronic pain which generally seen in postoperative hernia surgery is important problem. An inadequate pain management in early postoperative period and pain intensity may be the reasons of chronic pain. Different methods of analgesia may be used for the treatment of postoperative pain, but use of systemic analgesics may be responsible for the problems as increased rate of side effects and the unpredictable bioavailability of the oral drugs. Wound infiltration is common practice during inguinal area surgery.

Transversus abdominis plane (TAP) block which is one of the abdominal wall blocks is another alternative to reduce the pain. It was described by Rafi [3] in 2001 with blind technique in adult patients; the procedure provides analgesia blocking the anterior branches of the spinal nerves innerving anterior abdominal wall between thoracic 7 and 12 and lumbar 1 levels. Practice of TAP block with blind technique in pediatric patients is not safe because the fascias are weak in children and transition cannot be felt. First intervention with ultrasound in adult patients was practiced by Hebbard et al in 2007 and by Frederickson et al in 2008 in pediatrics [4,5]. After 3 layers of muscles in anterolateral abdominal wall was visualized with the ultrasound, local anesthetic solution was injected to the neurofascial space between internal oblique and transversus abdominis muscles, and validation was achieved with observing separation of the 2 muscle layers. Hebbard et al [4] first described the technique where needle is inserted through the midaxillary line with medial approach; then they have also described subcostal approach technique. Suresh and Chan [6] described a technique in children where they suggested that, first, rectus muscle must be identified in the lateral of the umbilicus, and then by sliding the probe to the lateral, the TAP area (of the 3 muscles) can be seen easily.

Transversus abdominis plane block was started to be practiced in surgeries in various age groups even infants, but studies on its efficacy are few and the results are different in children [6,7].

The aim of this study is to compare the analgesic efficacy of ultrasound-guided TAP block and wound infiltration during the first postoperative 24 hours.

2. Materials and methods

After getting ethical committee approval (83045809/18227) and parent consent, the prospective, observer-blinded clinical study was completed in the pediatric surgery operation theater of I.U. Cerrahpasa Medical School, Anesthesiology and Reanimation Department. Eighty-six American Society of Anesthesiologists (ASA) physical status I to II patients between 6 and 8 years old who planned to undergo unilateral inguinal surgery were included to the study. Patients with history of allergy, preoperative chronic pain treatment, hepatic and renal failure, previous inguinal surgery, or not being able to evaluate the pain score were excluded from the study. Randomization was achieved with closed envelope technique, and either TAP block or wound infiltration was applied to all patients (Fig. 1).

All patients received standard anesthesia. Before being taken to operation room, premedication with midazolam was applied. After routine monitoring, 1 to 3 mg/kg propofol and 0.6 mg/kg rocuronium were given for induction. Anesthesia was managed with sevoflurane in oxygen/air mixture and remifentanyl infusion.

2.1. Technique

After the randomization of the patients, TAP block (TAP group) was done at the end of the surgery, before extubation by an experienced anesthesiologist. For the TAP block, high-frequency ultrasound (EsaoteMyLab5-LA523E prob), 6- to 13-MHz linear probe, and 50- to 100-mm needle (Stimuplex A; B.Braun, Melsungen,Germany) were used.

Skin was cleansed with 2% chlorhexidine, and probe was covered with a sterile sheath. Initially, probe was placed transversally to the lateral of umbilicus; after 3 muscle layers (external oblique, internal oblique, and transversus abdominus) on the anterolateral abdominal wall were seen, probe was slid between iliac crest and arcus costa; and within plane approach (needle along the axis of the ultrasound probe), needle was inserted from the front axillary line anteroposteriorly. When it was between internal oblique and transversus abdominis muscles, first, a 0.2- to 0.4-mL normal saline was given to confirm the space with hypoechoic fusiform image. After negative aspiration was done, 2 mg/kg 0.25% bupivacaine was given with a maximum volume of 30 mL.

In infiltration group (INF group), after the end of the operation, an experienced surgeon infiltrated the space between fascia and incision with 2 mg/kg 0.5% bupivacaine subcutaneously. Anesthesiologist who performed the block and the surgeon who did the infiltration were not present during the pain evaluation and collecting of the data. The parents were not informed about which group they were included in the study.

The pain evaluation was done using visual analog scale (VAS) (0, no pain; 10, severe pain). Visual analog scale scores, additional analgesic drug requirement, and side effects (nausea, vomiting, etc) were observed for 24 hours. In the postoperative care unit, VAS scores were recorded by a blind anesthesiologist for 3 hours (postoperative fifth minute and first, second, and third hours). When VAS score