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Efficacy of preoperative transversus abdominis plane block in acute appendicitis pain and its success in postoperative pain: a retrospective study

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Abstract. – OBJECTIVE: The aim of this study is to determine the analgesic efficacy of Transversus Abdominis Plane (TAP) block applied before anesthesia on preoperative abdominal pain and postoperative surgical pain in acute appendicitis.

PATIENTS AND METHODS: Among the patients aged 18 years and older who underwent open appendectomy with the diagnosis of acute appendicitis, patients who underwent TAP block were identified retrospectively. To the aim of this study, demographic data of the patients, preoperative change in pain scores at rest and with coughing, postoperative pain scores, need for postoperative analgesics were evaluated.

RESULTS: Twenty-two patients who underwent preanesthetic lateral TAP block were accepted as the sample of the study. Preoperative 0th minute resting and rebound pain scores due to appendicitis before TAP block were 4.63 and 7.63, respectively. Resting and rebound pain scores at the 1st, 3rd, 5th, 10th, 15th, and 20th minutes after TAP block were respectively 2.95, 2.04, 1.27, 0.68, 0.50, 0.45 and 5.59, 4.68, 3.72, 2.77, 2.22, 1.86. Both resting and rebound pain scores decreased from the 1st minute to the 15th minute, with a statistically significant difference ($p<0.05$). The mean pain scores at the 1st, 2nd, 6th, 12th and 24th hours postoperatively were 3.72, 2.81, 2.13, 1.86, and 1.5, respectively. Six patients did not need analgesics in the first 24 hours. Opioid was administered to only one patient postoperatively.

CONCLUSIONS: TAP block provides effective analgesia in the preoperative abdominal pain treatment of acute appendicitis cases. It also shows that effective postoperative analgesia can be achieved even when applied preoperatively.

Key Words:
Abdominal pain, Analgesia, Appendicitis, Nerve block, Postoperative pain.

Introduction

Abdominal pain complaints constitute 5-10% of emergency service admissions. Innervation of intra-abdominal organs is very important in determining the etiology of abdominal pain. Innervation of intra-abdominal structures is provided by visceral and somatic nerve fibers. Visceral nerve fibers innervate the abdominal organs, somatic nerve fibers innervate the peritoneum[1]. In case of stimulation of visceral nerve fibers, pain that cannot be fully localized, aching or blunt (dull-pain) pain occurs. However, sharp and well-localized pain occurs with the stimulation of somatic nerve fibers[2]. Acute appendicitis cases mainly apply with the complaint of abdominal pain. Acute appendicitis is an urgent abdominal pathology that is observed 1.4 times more frequently in men and at any age[3]. Abdominal pain from appendicitis begins between 12 and 23 hours. In appendicitis, abdominal pain starts from the periumbilical region and is localized to the right lower quadrant in a very specific and sensitive way. Pain due to rebound is an indicator of peritoneal irritation. In cases of appendicitis, rebound pain caused by coughing or pressing on the right quadrant is usually more severe and more disturbing than pain at rest[2].

Transversus Abdominis Plane (TAP) block is one of the nerve block methods that is almost always used for postoperative analgesia in abdominal surgeries. It was first performed by Rafi[4] in 2001 with the Double Pop technique using anatomical marking points. Peripheral nerves (T7-T12, L1) which provide the sensory innervation of the abdominal wall and parietal peritoneum travel between the Transversus Abdominis Muscle and Internal Oblique Muscle fascia in the abdominal wall. TAP block is based on the principle of blocking the peripheral nerves in this potential space by injecting local anesthetic between these two muscle fascia. TAP block creates an analgesic effect by blocking both sensory skin dermatomes and viscero somatic conduction[5]. Ultrasound-guided TAP block was first performed by Hebbard

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et al[6], and the use of USG made the procedure faster and safer. TAP block has been successfully applied for analgesia in procedures such as cholecystectomy, inguinal hernia repair, abdominal hysterectomy, prostatectomy and appendectomy. According to the surgical incision to be applied, TAP block is performed from different anatomical regions[7-14]. In addition, it is applied for pain palliation in intra-abdominal etiologies or rarely for anesthesia in surgical procedures[5,13,15-18]. The aim of this study is to determine the analgesic efficacy of TAP block in abdominal pain caused by acute appendicitis and the postoperative analgesic efficacy of preanesthetic TAP block in appendectomy.

Patients and Methods

A retrospective study was conducted with the decision of the Hitit University Faculty of Medicine Clinical Research Ethics Committee dated 19/08/2020 and numbered 223. Between 01.01.2017 and 24.07.2020, patients aged 18 years and older who underwent TAP block in the preanesthetic period and underwent open appendectomy with the diagnosis of acute appendicitis were identified. Data were collected from Preoperative Regional Anesthesia Application Forms and Postoperative Pain Evaluation Forms. The analgesic efficacy of preoperative TAP block on acute appendicitis pain and postoperative acute pain was determined through these forms. The data of patients who underwent laparoscopic appendectomy or additional surgical procedure other than appendectomy (right hemicolectomy, etc.), who were diagnosed other than acute appendicitis after the surgical procedure (diverticulitis, tumor, etc.) and who underwent TAP block under general anesthesia were excluded from the study. Demographic data of patients (age, gender, height, weight, BMI, ASA scores), surgical incision site, time between block application and anesthesia induction, anesthesia and surgery start-end time (general anesthesia and surgical procedure times), block application site /method (USG accompanied or Anatomical signs), USG probe type/method (linear or convex, in plane or out of plane), variation of Verbal Numerical Pain Scale (VNRS) values at rest and coughing over time which was applied to evaluate the success and effectiveness of the procedure after TAP block, amount/type/concentration of local anesthetic applied, analgesics applied in the intraoperative period for postoperative analgesia, postoperative pain scores, type/amount/time of postoperative analgesics, duration of first analgesic requirement and amount of analgesic administered in postoperative 24 hours were statistically evaluated.

Statistical Analysis

In this study, statistical analyzes were performed using the SPSS (version 24.0, SPSS Inc., Chicago, Armonk, NY, USA) package program. Descriptive statistics were presented as mean ± standard deviation for normally distributed continuous data, median (min-max) for non-normally distributed continuous data and variables with ordinal data, and numbers and percentages for categorical data. The normality distribution was analyzed using the Shapiro-Wilk test. The Wilcoxon test was used for data that did not show normal distribution in the two-sample mean comparisons for continuous variables. Chi-square test or Fisher test was applied in accordance with the data numbers in the crosstab cells for ratio comparisons or correlation analysis between nominal variables. For statistical significance level, $p < 0.05$ was accepted. In case of insufficient data to obtain statistically significant results; it was stated that statistically significant results could not be obtained because there was not enough data and numerical information was shared.

Results

The number of patients who underwent TAP block and appendectomy between 01.01.2017 and 24.07.2020 was determined as 25. Three patients who underwent TAP block under general anesthesia were excluded from the study. Twenty-two patients who underwent TAP block only in the preanesthetic period were included in the study (Figure 1). One of these three patients who underwent TAP block under general anesthesia was administered prilocaine 30 cc (1%) with ultrasonography-guided subcostal TAP block method, and lateral TAP block with bupivacaine 20 cc (0.25%) was applied to two patients under USG guidance. 20 cc (0.25%) bupivacaine was used with the lateral TAP block method in all 22 patients who were accepted as the universe of the study and underwent TAP block in the preanesthetic period[19]. Opioid or analgesic-containing drugs were not administered to all of these 22 patients before TAP block. Blocking was performed with a linear 6-12 Hz ultrasound probe and

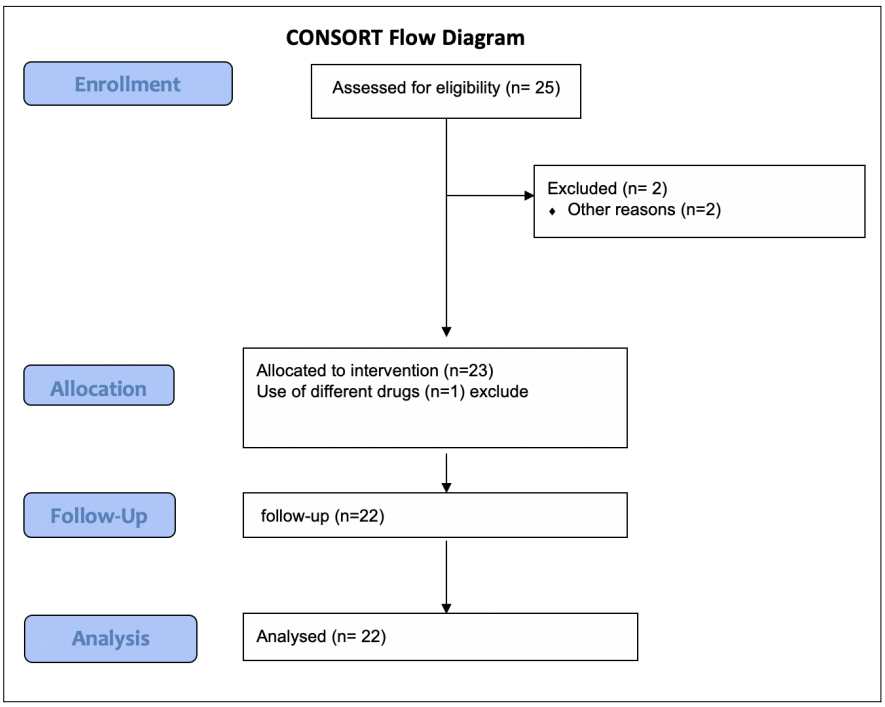

Figure 1. Flow chart of the study.

(GE LOGIQ V2; GE Medical Systems; Jiangsu China) peripheral block needle (Pajunk; SonoTAP®; Germany) in-plane. For local anesthesia, 2-3 ml of 2% lidocaine was applied subcutaneously. For general anesthesia, 2 mg midazolam, 2 mg/kg propofol, 0.6 mg/kg rocuronium, 1 mg/kg fentanyl, a mixture of sevoflurane and 2 lt/min nitrous oxide 2 lt/min oxygen with a MAC value of 1.3, 1 g paracetamol, 2 mg/kg tramadol, 4 mg ondansetron and 2 mg/kg sugammadex were used. Seven (31.8%) of the patients were female, 15 (68.2%) were male, 13 were ASA I (59.1%), and 9 were ASA II (40.9). In addition, the mean age of the patients was 36.9 (min=20, max=64), the mean weight was 67.6 (min = 52, max 83), the mean height was 169 cm (min=153, max=183), the mean BMI was 24.2 (min 19.4, max 32.4). The mean time between TAP block application and anesthesia induction was 27.95 minutes (std deviation 8.03 and this time was not less than 20 minutes in any patient), anesthesia time was 53.95 minutes (std deviation 16.06), surgery time was 40.54 minutes (std deviation 13.25). Patients' preoperative resting and rebound (with coughing) VRNS means were determined. Before TAP block application, the patients' mean 0-minute baseline resting VRNS and rebound VRNS were 4.63 and 7.63, respectively. The 1st, 3rd, 5th, 10th, 15th, and 20th minutes of resting VRNS values after the TAP block were determined as 2.95, 2.04, 1.27, 0.68, 0.50, and 0.45, respectively (Figure 2). In addition, rebound (with coughing) VRNS values at the 1st, 3rd, 5th, 10th, 15th, and 20th minutes after TAP block was applied were found to be 5.59, 4.68, 3.72, 2.77, 2.22, and 1.86, respectively (Figure 3). According to these results, the resting VRNS values decreased from the 1st minute to the 15th minute, with a statistically significant difference (p<0.001), but no significant difference was found between the 15th and 20th minute in terms of resting VRNS scores. When the rebound VRNS scores were evaluated, there was a statistically significant difference (p<0.001) as in the resting

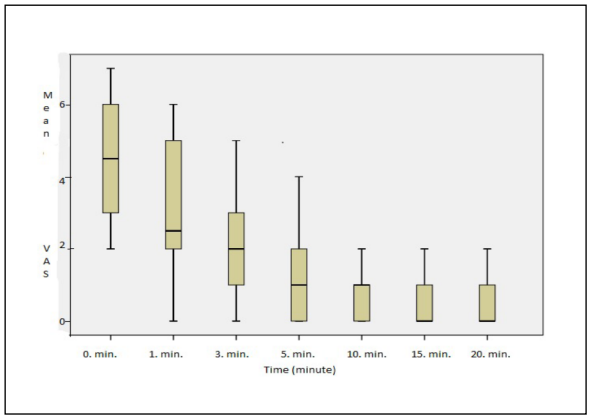

Figure 2. Scatter graph of the mean resting VRNS.

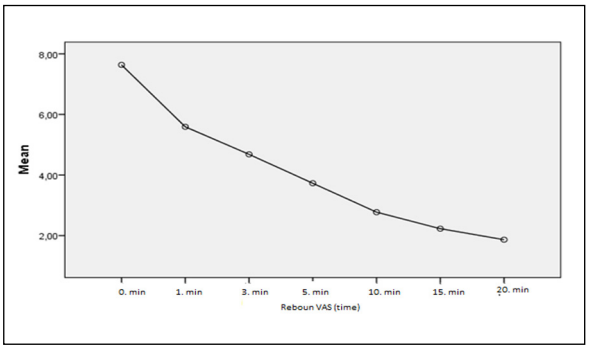

Figure 3. Rebound VRNS mean distribution.

VRNS scores. Rebound VRNS scores decreased from the 1st minute to the 15th minute, but there was no significant difference between the 15th and 20th minute in terms of rebound VRNS scores.

The mean VRNS at the 1st, 2nd, 6th, 12th, and 24th hours postoperatively were found to be 3.72, 2.81, 2.13, 1.86, and 1.5, respectively. The pain scores of the patients and the analgesic drugs administered and the application times of these drugs were compared (Figure 4). Six of the patients did not need analgesics in the first 24 hours. However, paracetamol was preferred in 3 patients, diclofenac in 12 patients, and tramadol in 1 patient, who were administered analgesics within the first 24 hours. In 16 patients who needed analgesics in the first 24 hours, the average time of first analgesic administration was 100 minutes. It was observed that the first postoperative analgesic administration time was a minimum of 30 minutes and a maximum of 600 minutes. It was determined that stepwise analgesic administration method was preferred in analgesic preference and opioid (tramadol) was used in a patient with a high pain score. In addition, none of the patients had complain of nausea and vomiting in the postoperative period.

Discussion

TAP block is used for postoperative analgesia, especially in surgical procedures. However, we see in the literature that TAP block has recently

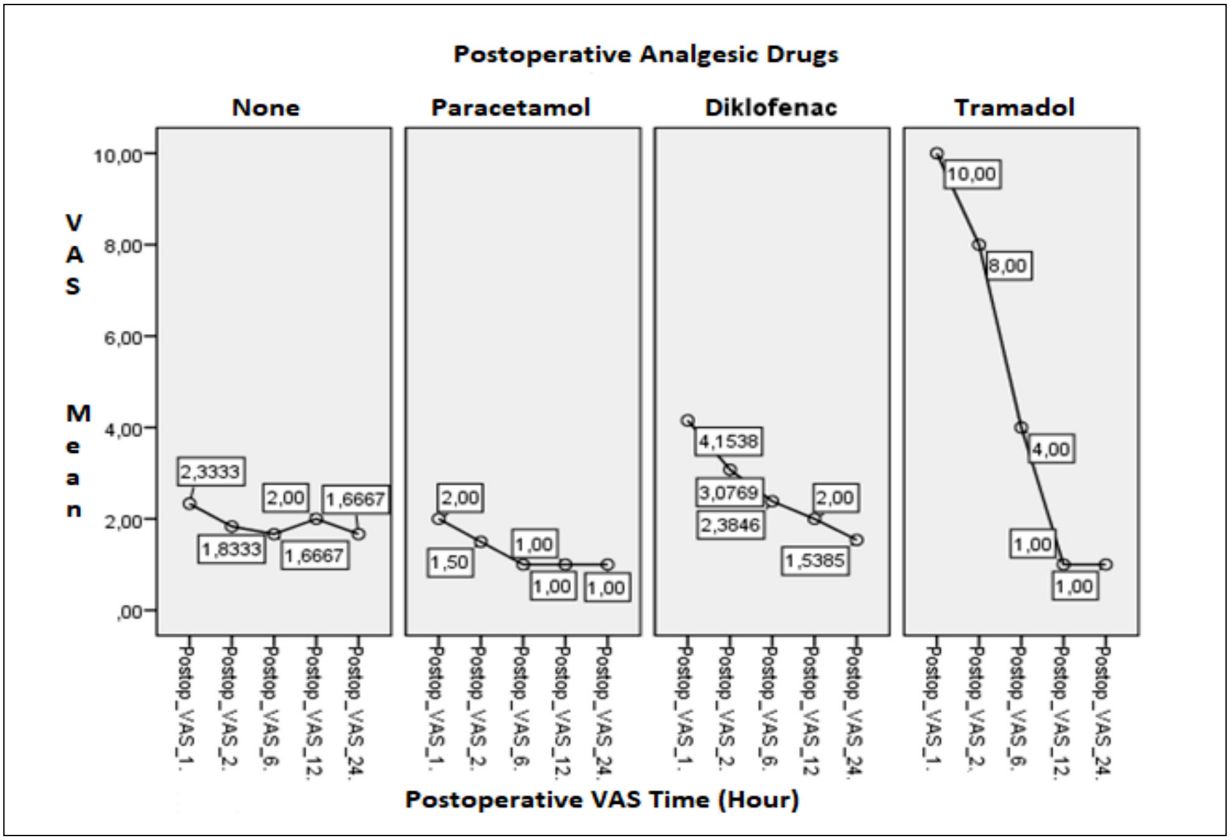

Figure 4. Postoperative pain scores and applied analgesics.

been used in a few cases for the purpose of anesthesia and analgesia in intra-abdominal pathologies. We also evaluated the analgesic efficacy of preoperative TAP block in abdominal pain caused by acute appendicitis and its success in postoperative pain. We found that the right unilateral TAP block provides effective analgesia, which starts at the 1st minute and reaches its peak at the 15th minute, in the treatment of acute appendicitis-related abdominal pain. We also observed that preoperative TAP block was effective in postoperative analgesia as a secondary gain.

In two separate studies, Carney et al[20] and Ghimire et al[21] applied ipsilateral TAP block before surgical incision for postoperative analgesia in open appendectomy cases under general anesthesia and showed that right unilateral TAP block provided effective analgesia. Similarly, we achieved both preoperative and postoperative effective analgesia with the right unilateral TAP block applied preoperatively. Our study supports these two studies and shows that an ipsilateral TAP block will provide effective analgesia, especially in unilateral intra-abdominal pathologies. In addition, these three studies can be considered as proof that a unilateral TAP block is sufficient for analgesia in appendicitis and there is no need for bilateral injection.

The use of the Transversus Abdominis Plane Block as an anesthetic method in open appendectomy has been demonstrated separately with two case reports. In these two studies, 30 ml of 0.5% bupivacaine was used right unilaterally and the patients were sedated. In both studies, it was determined that the required level of analgesia for the surgical procedure was gathered 15 minutes after the TAP block was applied[15,18]. In our study, the extent of block spread in the skin region was not detected. However, using less local anesthetics, a statistically significant decrease was achieved in pain scores at rest and with coughing in the preoperative period, and this analgesic effect reached the highest level at the 15th minute, as in the other two studies. Our study supports these two case reports and shows that TAP block should be applied at least 15 minutes before surgical incision for preemptive analgesia in appendicitis cases.

Smith et al[5] applied right unilateral TAP block for analgesia to two patients who applied to the emergency department with the complaint of abdominal pain due to chronic pancreatitis (30 ml 0.25% bupivacaine + 150 mcg epinephrine and 20 ml 0.25% bupivacaine + 40 mg depomedrol, respectively). The analgesic effect of TAP block started at the 10th minute in the first patient and at the 5th minute in the second patient. In addition, it was determined that the analgesic efficacy lasted for 7 days in both patients. These two cases were indicative of the viscero-somatic activity of TAP block[5]. In our study, the viscero-somatic efficiency of the TAP block applied for analgesia in abdominal pain due to appendicitis starts at the 1st minute and reaches the highest level at the 15th minute.

Mishra et al[17] applied bilateral TAP block for anesthesia in a patient with ASA IV ileal perforation. 30 minutes after TAP Block, the patient's abdominal pain completely disappeared. Thirty minutes later, they started the surgical procedure and the patient did not experience any pain due to the incision. The ileal perforation of the patient was closed with the omentum by applying dexmedetomidine infusion. These three cases and our study indicate that TAP block is a good analgesic method in pathologies, such as pancreatitis, ileal perforation and appendicitis, and abdominal pain of different etiologies.

Niraj et al[22] showed that TAP block decreased postoperative opioid consumption and decreased pain scores in open appendectomy. In our study, opioid was used in only one case in the postoperative period and no analgesics were used in six patients. We found that this patient in need of postoperative opioids was one of two patients with a preoperative rebound VRNS score of 10. However, we observed that the rebound VRNS score decreased to 2 at the 15th minute after TAP block. This effective analgesia shows us that there was no block failure in this patient. The high postoperative pain scores in this patient suggest that there may be individual differences in the effectiveness of TAP block.

Limitations and Suggestions

This article reviews the effectiveness of TAP block for abdominal pain caused by preoperative appendicitis. In addition, patients who were diagnosed with preoperative acute appendicitis and had appendectomy were included in the study. In this study, clinically, postoperative pain scores and analgesic consumption decreased in appendectomy patients who underwent preoperative TAP block. In order to evaluate the postoperative analgesia effectiveness of TAP block applied preoperatively in appendectomy, a randomized study with a control group without block is required.

Especially in various etiologies of abdominal pain for which surgery is planned (cholecystectomy, pancreatitis, perforation, vascular pathologies, cancer pain, etc.), the analgesic efficacy of TAP block, unilateral TAP block with its etiology, and the analgesic efficacy of bilateral TAP block, where the etiology and drug are used, should be investigated.

Conclusions

Right lateral TAP block provides effective analgesia in the treatment of preoperative abdominal pain in acute appendicitis cases.

Conflict of Interest

The Authors declare that they have no conflict of interests.

Acknowledgements

All procedures involving human participants were performed in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. There is no conflict of interest between the authors. Our article is a previously unpublished original work. The article will be evaluated by you first. There is not any funding for this study

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