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ORIGINAL ARTICLES

The effect of the transversus abdominis plane block on postoperative analgesia and patient comfort in patients having abdominal surgery with general anesthesia

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Abstract: *Background: This study aimed to investigate the effects of tranversus abdominis plane (TAP) block placed postoperatively using ultrasound guidance for patients with caesarean section, myomectomy, and hysterectomy under general anesthesia by eliminating additional pain caused by surgical incision.*

Methodology: The study has been planned to investigate the postoperative analgesia of 50 patients with TAP blocks applied and non-applied between the ages of 18-65, who will pass abdominal surgery. The study has been conducted in a prospective, randomized and controlled manner. Patients have been classified as those who have undergone TAP block (group: I) and those without block (group: II).

Results: Mean age of the patients in the TAP block group was 35.52 years, the mean age of the other group was 32 years and there was no statistically significant difference. The patients' visual analog scale (VAS) was evaluated at the 30th minute, 1st, 2nd, 6th, 12th, and 24th hours in the postoperative period. For patients with TAP blocks, the VAS score was found to be lower for all hours than patients without TAP blocks ($p<0.05$). Beginning at the 30th minute and 1st-hour analgesic needs of the block patients were compared with the other group ($p<0.05$).

Conclusion: TAP, that can be easily and safely placed provides effective analgesia and reduces the additional disruptions caused by the pain.

Keywords: *transversus abdominis plane block, postoperative pain, Bupivacaine, ultrasound-guided regional anesthesia*

INTRODUCTION

The transversus abdominis plane (TAP) block is a regional anesthesia technique described in recent years that provides analgesia for the anterior portion of the abdominal wall after abdominal surgery. With this method, local anesthetic injection of the area between the internal oblique and transversus abdominis muscles will block the afferent nerves of the abdominal wall.

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TAP is an attractive method of block simplicity and safety, and it has been shown to provide effective analgesia, reducing the response to postoperative stress and speeding up post-surgery improvement [1].

TAP block can be used in abdominal lower region operations such as hernia repair, appendectomy, abdominal hysterectomy. The most common operation where TAP is used is after cesarean operations. It is used for postoperative pain control in cesarean operations, reduction of analgesic drug consumption, reduction of side effects that may occur

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after the operation, and side effect profile due to analgesics used [2, 3].

The purpose of this study is to investigate the effects of the TAP block, which is performed with ultrasound after surgery, on patients with abdominal surgery such as cesarean, myomectomy, and hysterectomy under general anesthesia, on post-surgery pain and patient comfort.

MATERIALS AND METHODS

The study was conducted following the Helsinki Declaration Principles (rev.2013) and with the approval of the local ethical board. After the written and signed approval of the patients, it has been planned to investigate the postoperative analgesia and comfort of a total of 50 patients The study examined the postoperative pain levels after abdominal surgery with and without TAP block. Subjects were between the ages of 18-65 who will have abdominal surgery with transverse incision (cesarean section, hysterectomy (benign), myomectomy) and the American Society of Anesthesiologists Physical Status Classification System (ASA) I-II. Our study is planned to be prospective, randomized, and controlled. The individuals to be engaged were divided into two groups in a randomized form. Randomization was based on computer-generated code. In the first group, a total of 25 patients were admitted with 16 cesareans, 6 myomectomies, and 3 hysterectomies applied to the TAP block. In the second group, a total of 25 patients who did not undergo TAP block, no needle intervention, 18 cesareans, 5 myomectomies, and 2 hysterectomies were included as the control group. Those with skin infections, patients with organomegaly (hepatomegaly and splenomegaly), people who did not give consent to the method, and individuals with allergies to drugs to be used in the intervention area where Transversus abdominis plane is to be conducted were not included in the study.

0.9% NaCl solution at a rate of 2 ml/kg/hour was administered to the individuals whose oral intake was discontinued 8 hours before the surgery. The individuals to be included in the study were not given any sedative agent on the morning of their surgery. Before the procedure, 6-8 ml/kg volume of liquid replacement with crystalloid was applied to the individuals to be included in the study. 10 cm visual analog scale (VAS) for measuring the pain level was explained in detail to all patients before the procedure. All individuals to be included in the study were followed up with an anesthesia monitor, heart rate (CAH), electro-cardiography (ECG) (lead II), systolic blood pressure (SKB), and diastolic blood pressure (DBP) in the preoperative and preoperative period. After induction of anesthesia with 1 µg/kg fentanyl, 0.5 mg/kg rocuronium bromide, and 5 mg/kg thiopental sodium, 4-6% Desflurane and 50% N2O in Oxygen were used to maintain anesthesia following endotracheal intubation. Differently in general anesthesia management at cesarean operations, 5 mg/kg thiopental sodium and 0.5 mg/kg rocuronium bromide were administered in the induction and 4-6% Desflurane, (50% N2O+50% Oxygen) and 1 µg/kg fentanyl are added as inhalation anesthesia after umbilical cord clamping in maintenance. The maintenance dose of rocuronium bromide was 0.15 mg/kg for all cases. A necessary fluid replacement was performed during the operation. At the end of the operation, TAP blocks were placed on the 1st group of patients.

After the necessary sterilization conditions were established, the linear ultrasound probe was sterilely coated and placed in the middle of the iliac crest with the end limit of the ribs. Starting with skin, the layers in descending order, subcutaneous adipose tissue, external oblique muscle, internal oblique muscle, transversus abdominis muscle, and peritoneum were identified. As the tip of the 21Gx100 mm needle (visible cannula by ultrasound, with facet tip) passed through the muscular layers and fascia, a fascial click was felt and the needle was advanced with ultrasound in a controlled manner. After receiving the second click sensation (passage of the fascia of the internal oblique muscle), after a 0.5-1 ml test dose, the location of the needle was fixed and frequently aspirated and applied to the bilateral neurophysical plan so that 20 ml of 0.25% bupivacaine was applied to one side.

The first group of patients was awakened after TAP block treatment and reversal of muscle relaxant with atropine sulfate and neostigmine; the control group was awakened after reversal of muscle relaxant with atropine sulfate and neostigmine at the end of the operation. When VAS>3 in the postoperative period, 1g of paracetamol was administered as an intravenous infusion over 10 minutes in terms of the first analgesic requirement.

Systolic and diastolic arterial pressures, heart rates of all patients were monitored immediately before and postoperatively at 30th minute and 1st, 2nd, 4th, 6th, 12th, and 24th hours after block administration. The pain levels of the patients were measured at the 30th minute, 1st, 2nd, 4th, 6th, 12th, and 24th postoperative VAS values. The need for nausea, vomiting, and initial analgesia was recorded. In this study, none of the patients underwent any invasive procedures other than routine procedures.

When parametric test counts were fulfilled (Kolmogorov-Simirnov) by uploading the data obtained from our study to SPSS (ver:22.0) program, significance test of the difference between the two averages, variance analysis in repeated

measurements, Bonferroni test, Mann Whitney U test, Wilcoxon test, Freidman test, and Chi-square test were used when parametric test assumptions were not fulfilled. When α is taken as 0.05, β: 0.10, 1-β: 0.90, 25 individuals were included in each group and the strength of the test was p= 0.90388.

Our data were reported as the arithmetic mean, standard deviation, several individuals, and the level of error was taken as 0.05.

RESULTS

The age of the patients who underwent the TAP block was 35.52 ± 9.60 years; the age of the patients in the group without block was 32.00 ± 8.10 years. There was no difference in age compared to both groups (p>0.05). The duration of the case was 43.60 ± 11.41 minutes in the block group and 45.00 ± 12.24 minutes in the group without block. The difference between the groups in terms of case duration is insignificant (t: 0.41, p<0.678, p>0.05).

When the heart rate values of the groups were compared; the difference between the groups at 30th minute, 1st, 2nd, 4th, 6th, and 24th postoperative hours was found to be significant and the heart rate was lower in the block group compared to the other group (p<0.05) (Table 1).

Table 1: Comparison of groups in terms of heart rate (times/min)

Postop. time (hour)	**TAP group** (mean ± SD)	**Control group** (mean ± SD)	**Result**
0	80.50 ± 15.29	80.12 ± 13.85	t: 0.48 p: 0.96
½	86.84 ± 12.09	94.52 ± 14.42	t: 2.04 p: 0.047*
1	81.80 ± 9.30	92.72 ± 9.96	t: 4.00 p: 0.001*
2	80.44 ± 5.60	86.84 ± 6.74	t: 3.64 p: 0.001*
4	78.56 ± 6.31	86.48 ± 7.56	t: 4.01 p: 0.001*
6	77.0 ± 5.82	81.28 ± 5.19	t: 2.74 p: 0.009*
12	75.64 ± 7.40	78.44 ± 5.21	t: 1.54 p: 0.129
24	73.72 ± 4.71	76.56 ± 5.14	t: 2.03 p: 0.047*

**p<0.05 significant; SD – standard deviation*

When comparing the rest Visual Analogue Scale (VAS) values assessed at various times of patients in the two groups of study, the difference was significant (p<0.05). The resting VAS values measured at different periods of the individuals in the TAP block group were lower (Table 2).

Table 2: Comparison of resting values of groups

Postop. time (hour)	**TAP group** (mean ± SD)	**Control group** (mean ± SD)	**Result**
½	5.04 ± 1.59	8.88 ± 0.83	p: 0.001*
1	4.36 ± 0.86	8.12 ± 0.66	p: 0.001*
2	4.0 ± 0.95	7.40 ± 0.81	p: 0.001*
4	3.20 ± 0.95	6.92 ± 0.90	p: 0.001*
6	2.80 ± 0.76	5.64 ± 0.81	p: 0.001*
12	1.84 ± 0.74	4.0 ± 0.85	p: 0.001*
24	1.24 ± 0.43	3.44 ± 0.76	p: 0.001*

**p<0.05 significant; SD – standard deviation*

When the systolic blood pressure (SBP) values measured at different times were compared, the difference was found to be significant when the individuals in both groups were compared at the 1st hour and 4th hour postoperatively (p<0.05). SBP values of the individuals who received block at 1st and 4th hours are lower. A significant difference between the groups at 30th minute, 2nd, 6th, 12th, and 24th postoperative hours was not found (p>0.05) (Table 3).

Table 3: Comparison of groups in terms of systolic blood pressure (mm/Hg)

Postop. time (hour)	**TAP group** (mean ± SD)	**Control group** (mean ± SD)	**Result**
0	112.4 ± 10.9	111.24 ± 10.94	t: 0.48 p: 0.96
½	128.4 ± 15.18	137.2 ± 19.26	t: 1.79 p: 0.079
1	122.8 ± 10.21	132.8 ± 14.86	t: 2.77 p: 0.008*
2	119.6 ± 10.59	126.8 ± 14.92	t: 1.96 p: 0.055
4	115.6 ± 10.83	126.0 ± 12.24	t: 3.18 p: 0.003*
6	114.4 ± 11.93	113.24 ± 23.92	t: 0.21 p: 0.829
12	116.0 ± 9.57	110.8 ± 10.37	t: 1.84 p: 0.072
24	116.6 ± 7.57	112.8 ± 9.79	t: 1.45 p: 0.429

**p<0.05 significant; SD – standard deviation*

When comparing the diastolic blood pressure (DBP) values of the patients with and without TAP block, a statistically significant difference was found between the two groups at the 30th minute, 1st, 2nd, and 4th hour postoperatively (p<0.05). DBP values of the individuals who received block at these hours are lower. No difference between the two groups at the 6th, 12th, and 24th hours was found (p>0.05) (Table 4).

Table 4: Comparison of groups in terms of diastolic blood pressure (mm/Hg)

Postop. time (hour)	**TAP group** (mean ± SD)	**Control group** (mean ± SD)	**Result**
0	65.4 ± 8.1	67.8 ± 9.27	t: 0.77 p: 0.335
½	76.4 ± 8.6	83.8 ± 11.03	t: 2.77 p: 0.009*
1	77.2 ± 7.37	84.0 ± 10.0	t: 2.73 p: 0.009*
2	71.6 ± 6.87	80.0 ± 10.4	t: 3.36 p: 0.002*
4	70.8 ± 8.12	78.8 ± 11.66	t: 2.81 p: 0.007*
6	70.8 ± 7.59	72.8 ± 8.42	t: 0.88 p: 0.382
12	71.2 ± 8.32	71.6 ± 8.5	t: 0.16 p: 0.867
24	66.4 ± 8.10	68.8 ± 9.27	t: 0.77 p: 0.335

**p<0.05 significant; SD – standard deviation*

When comparing the need for analgesic drugs for the groups in the first 30 minutes, the difference was significant (p<0.05). Fewer patients in the TAP block group reported the need for analgesic drugs. When comparing the need for analgesic drugs for the groups at 1st hour, the difference was found to be significant (p<0.05). As can be seen, 8 patients in the TAP block group within the first postoperative hour and 25 patients in the control group within the first postoperative hour stated that they needed analgesics. Individuals without block application stated that they needed analgesics at the 30th minute and 1st hour, while two people in the block group needed analgesics at later hours (Table 5).

Table 5: Comparison of resting values of groups

Postop. time (hour)	**TAP group** (mean ± SD)	**Control group** (mean ± SD)	**Result**
½	8 patients (32%)	16 patients (64%)	p: 0.024*
1	0 patient (0%)	9 patients (100%)	p: 0.001*
12	2 patients (11.7%)		p: 0.49

**p<0.05 significant; SD – standard deviation*

When comparing postoperative nausea and vomiting (PONV) according to the groups, a statistically significant difference was found between the two groups at the 30th minute postoperatively ($p<0.05$). Nausea was never seen in the block group, whereas nausea was seen in 10 of the individuals who did not receive the block. No difference in nausea compared to both groups at the first hour was found ($p>0.05$). 4 patients (%16) in the non-block group indicated they had nausea. While 100% of the two groups did not have nausea at the 2nd hour, no difference was found between the two groups at the 4th hour ($p>0.05$). Nausea was observed in two individuals who did not receive block at the 4th hour. Individuals in both groups did not experience nausea at the 6th, 12th, and 24th hours.

When comparing the two groups in terms of vomiting, the difference at the 30th minute was significant ($p<0.05$). No vomiting was observed in the TAP block group, while vomiting was observed in 9 patients (36%) in the non-TAP group. No difference in vomiting compared to both groups at the first hour was found ($p>0.05$). Vomiting was observed in 4 patients (16%) in the non-block group, while no vomiting was observed in the other group. No vomiting was observed at the 2nd, 6th, 12th, and 24th hours. There was no difference between the groups at the 4th hour ($p>0.05$). Vomiting was observed in 2 patients (8%) without block application.

DISCUSSION

Today, pain is one of the frequent causes for doctor visits and is held responsible for a significant part of the loss of the labor force [4, 5]. Among the negative effects and complications; pain includes thromboembolic complications due to immobility and prolonged hospitalization time [4, 5].

It has been reported that with postoperative pain treatment using regional anesthesia methods, analgesic drug need is reduced and the recovery process of patients is faster [6]. The use of effective regional anesthesia methods in postoperative pain treatment also reduces the side effects of systemic analgesic drugs [7, 8].

TAP block is a regional anesthesia technique performed to provide analgesia after abdominal operations [9]. TAP block is used for retropubic prostatectomy [10], abdominal operations with bowel resection [11, 12], gynecological malignancy operations, total abdominal hysterectomy operations [13], cholecystectomy [14], and appendectomy operations [15] postoperative analgesia. Some of these studies were performed using the TAP block, a petite triangle, and a part of the study using the loss of resistance technique, followed by ultrasound. During the TAP block, the literature has been reported to damage the inner body of the abdomen, both in blind technical blocks and in blocks in the ultrasound guide [16]. Intraperitoneal injections, hematoma in the intestines, and temporary femoral nerve damage are among other complications [17]. It is important to remember the local anesthetic toxicity due to the increased local anesthetic volumes after bilateral TAP block placement. Therefore, careful aspiration is required to avoid intravascular local anesthetic injection [17]. Our study did not show any complications to the group where bilateral TAP block was applied.

Pain evaluations of the individuals included in the study were evaluated with VAS scoring at 1st, 2nd, 12th, and 24th hours. VAS score was found to be significantly lower in the TAP group compared to the control group at all evaluation times. With these results, very close results were obtained when compared to a study describing the petite triangle in TAP block [11]. In our study, unlike this study, the first analgesic needs of the patients were evaluated and it was determined that the TAP block group needed the first dose analgesic less frequently. Also, our study addressed additional complaints such as nausea and vomiting of patients.

The most commonly used local anesthetics in TAP block administration are Bupivacaine [10, 15, 18], Ropivacaine [13], and Levobupivacaine [9]. In our study, TAP block was applied to each site as 20 ml with 0.25% Bupivacaine, which we think has a longer duration of action. This application we made in our study complies with the current literature.

A study [12] included 40 patients who underwent colorectal surgery under general anesthesia, applied 0.25% Bupivacaine to the TAP group and SF to the control group as 20 ml bilaterally at the end of the surgery. A 65% decrease was observed in total morphine consumption for 24 hours compared to the control group in the TAP group. Although the need for initial analgesia was similar in both groups, subsequent doses were required longer in patients in the TAP group [12]. Another study [14] divided the patients including 54 patients that have undergone laparoscopic cholecystectomy as randomized 3 groups. The first group was the control group, the second group was the TAP group with 0.25% levobupivacaine and the third group was the TAP group with 0.5% levobupivacaine. The need for postoperative analgesia was found to be lower in the TAP groups. No significant difference was found between the 2nd and 3rd groups, and no complications related to TAP block were observed [14].

According to a study [15], 52 patients who underwent appendectomy under general anesthesia, divided the patients into two groups as randomized double-blind and

applied TAP block with Bupivacaine accompanied by ultrasound to the second group. Total morphine dose and VAS scores for the first 24 hours were found to be significantly lower in the TAP group and no complications occurred in the TAP group [15]. In contrast to these studies, a conducted research [13] on 13 patients who underwent gynecological cancer surgery in 2010; no difference was found between the groups with and without TAP block in terms of analgesic drug consumption and patient comfort. In our work, the TAP block was applied to individuals after the end of the operation.

In a meta-analysis examining the studies for postoperative pain control after cesarean section, 524 patients were evaluated in a total of 9 studies, and the main purpose of these individuals who underwent TAP block after spinal anesthesia (7 studies) and general anesthesia (2 studies) is to investigate pain control and analgesic consumption. It has been emphasized that after spinal anesthesia, TAP block application without intrathecal opioid is a significant contribution to the control of postoperative pain and that after spinal anesthetic using opioid, you need to work further, although unclear [19].

Some studies have compared TAP blocks to epidural analgesia. Recently, a group of researchers conducted a retrospective matched case-control study comparing continuous TAP block catheters (posterior and subcostal approaches; n = 15) to thoracic epidural analgesia (n = 15) [20]. Except for assessments in the post-anesthesia care unit, there was no appreciable difference in pain scores between the two groups over a 3-day follow-up period. While patient satisfaction was similar between groups, the TAP block group required a significantly higher amount of breakthrough fentanyl over the study period. The therapeutic failure rate was higher in the epidural group (patchy block in 4 patients) versus the TAP catheter group (unilateral block in 2 patients). Hypotension was reported in 2 patients from the epidural group [20].

Also, an increasing number of reports indicate that TAP blocks can be a safe alternative to neuraxial blockade in patients with coagulation disorders [21, 22].

In our study, postoperative patient-controlled analgesia was not studied as a dose and the first analgesic requirement was recorded as time; heart rate, systolic, and diastolic blood pressure were found to be lower in the patient group who underwent TAP block compared to the other group. No nausea-vomiting was observed in the TAP block group. Thus, we believe that the likelihood of nausea-vomiting complications is reduced.

CONCLUSION

In our study by applying TAP blocks, the need for the first postoperative supplemental analgesia was delayed in the TAP group, thus reducing any side effects that may develop due to these analgesics. Although in our study, in the patient group who underwent TAP block; we have achieved significant and positive results, such as less postoperative pain, less initial analgesic need and additional convergence, more stable vital signs, more comprehensive investigations are necessary to routinely implement this practice.

Tap blocks are relatively easy to place and appear to be associated with little risk when placed with ultrasound guidance by trained practitioners. This kind of block provides effective analgesia and reduces the additional disruptions caused by the pain.

Contribution of authors

Study Design: Nagihan Yuksek, Ahmet Cemil Isbir; Data Collection: Nagihan Yuksek; Statistical Analysis: Iclal Ozdemir Kol; Data Interpretation: Ahmet Cemil Isbir; Manuscript Preparation: Onur Avci, Ahmet Cemil Isbir; Literature Search: Kenan Kaygusuz, Sinan Gursoy

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