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Ultrasound-guided transversus abdominis block vs wound infiltration in patients undergoing open appendectomies

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Abstract
The aim of this study was to compare USG-guided Transversus Abdominis Plan Block (TAP) and wound infiltration in terms of intraoperative parameters, postoperative complications, VAS scores, analgesic requirement time in the patients undergoing open appendectomy. A total of forty patients, aged 18-65 years, ASA physical status I or II scheduled to undergo open appendectomy, were enrolled in this retrospective study and allocated to two groups. We reviewed the procedures that was experienced in 2014 retrospectively. Patients were allocated into two equal groups: Transversus Abdominis Plan Block (TAP group) (n=20) group and wound infiltration (WD group) (n=20) group. The patients demographic datas such as intraoperative hearth rate (HR), noninvasive blood pressure (NBP), duration of anesthesia, postoperative Visuel Analog Scala (VAS) values, complications (nausea, vomiting, somnolence, wound infection, ichting), duration of analgesic requirement were recorded retrospectively. The data were compared using t-test and chi-square test within the groups, p values < 0.05 were considered significant. Demographic datas such age, sex, weight, lenght and ASA status were similar in both groups. The duration of anesthesia (min) was significantly higher in Group TAP (49 ± 12,2 min) compared with Group WD (32,75 ± 10,06 min) (p=0.001). Intraoperative opioid consumption (mcg) was significantly shorter in Group TAP group. There was statistically significant difference between the two groups as regards the first time of analgesic requirement (Group TAP 24,74 ± 7,77 h, Group WD 3,5 ± 3,52 h). HR values were compared between the groups, it was no significiant difference found expect HR-20, HR-25 and HR-30. it was lower in Group TAP. We didn't find significant difference between groups at all hours for postoperative complications. VAS pain scores were lower in Group at rest and on couching at PACU, postoperative first, second and third hours (p<0.05). Wound infiltration and TAP block can perform as a part of the multimodal analgesia of the patients who undergoing open appendectomy. TAP block application prolongs the duration of anesthesia as well as reduces intraoperative analgesic requirement and initial postoperative analgesic requirement period. The fact that VAS scores were lower in the TAP block group showed that the multimodal analgesia regimen could be applied as an effective component.

Keywords: Appendectomy, transversus abdominis block, wound infiltration

Introduction

Acute appendicitis is the most common lower abdominal surgery in patients who apply to the hospital with abdominal pain. The main treatment is appendectomy. Open surgical appendectomy technique is easier than laparoscopic technique which is used more than a century because it is easier to use and reliable technique that doesn't require technical skills and has more efficacy in complicated cases [1].

TAP (Transversus abdominis plan) block is a regional anesthetic technique which targets the anterolateral region of the abdominal field by lokal anesthetic between internal oblique muscules and transvers muscules [2]. İt was defined for the first time by Rafi using 'Petit triangle' with blind technique in 2001 [3]. Herb and coll. emphasized that using usg to showing the section called TAP and application of local anesthetic is more efficacy and safetly.

It is preferred in many surgical operations today, because complication rate is less than blind technique and the needle and the region can be seen where the local anesthetic agent is dispered when the technique is applied [4]. It is often used for the purpose of reducing postoperative pain, using analgesic and side effects in surgical interventions that concern the lower abdominal region such as ; cesarean, appendectomy, repairing of hernia, abdominal hysterectomy, laparoscopic surgery, piloromyotomi, major abdominal wall surgeon, opening colostomy and closing colostomy and prostatectomy [5-9].

Surgical wound infiltration is a simple and effective procedure for the purpose of analgesia that provides continous infusion analgesia through the catheter or injection of a single dose agent. at the beginning or at the end of the operation [10]. In abdominal surgeons, the most distruptive factor of postoperative patient comfort is incisional pain [11,12]. There are two sources

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of postoperative pain in postoperative appendectomy with open surgical technique; associated with inflammation and infection of somotosensory pain and appendicitis associated with the incision of the wall of abdomen visseroperitoneal pain [13]. Inadequate postoperative pain affected that healing of the patient adversely and lead to many complications that delay the discharge [14,15].

In this study we aimed to compare retrospectively the examination of TAP block and who underwent appendectomy with open surgical technique in our clinic.

Material and Methods

This retrospective comparative study was conducted in the Department of General Surgery and Department of Anesthesiology after obtaining approval from the regional Ethics Committee. We retrospectively evaluated data files of 40 American Society of Anaesthesiologists (ASA) physical status I–III patients who had opened appendectomy in general anesthesia due to acute appendicitis in general surgery department. The patients who, were performed TAP block or wound infiltration for postoperative analgesia, were enrolled the study. We excluded the patients who weren't recorded adequately preoperative evaluation form, intraoperative and postoperative anesthesia observation form. The demographic variables were obtained from preoperative evaluation form: age, gender, ASA physical status, indications, contagious disease, physical examination results, laboratory results, consultation proposal and properity anesthetic plan. The induction and maintenance of anesthesic agents, vital signs; heart rate (HR), five-minute interval noninvasive blood pressure measurements from blood pressure cuff device (NBP), peripheral oxygen saturation (SpO2), analgesic consumption, extra-used drugs for pathological conditions, duration of operation, duration of anesthesia, duration of recovery, duration of discharge, invasive monitoring if used, early postoperative evaluations were recorded.

The patients with a standardized general anesthesia induction (rocuronium 0.8 mg/kg, remifentanil 0.2-0.5 mg/kg/minute and propofol 1-2 mg/kg) and maintenance (sevoflurane and remifentanil combination) were included in this study. In our routine application TAP block is applied under USG-guidance after induction of general anesthesia and before the begining of surgical procedure. Wound infiltration is applied in the surgical wound after closure of the peritoneum. The block is advanced using in-plane USG visualization until the needle tip is confirmed between the transverses abdominis and internal oblique muscules. We receive TAP block with 20 mL of 0,25% bupivacaine and wound infiltration with 20 mL of 0,25% bupivacaine.

Intraoperative and postoperative drug consumption doses, Visuel Analog Scala (VAS) values for used the assessment of pain were recorded on the following times: postanaesthetic care unit (PACU), postoperative 1, 2, 3, 6, 12, 18, 24. hours. Nause-vomiting, itching, somnolence, wound infection and the other complications were also recorded.

Statistical Analysis

In this study, statistical analyses were performed using the statistical software package SPSS for Window Version 11 (SPSS Inc., Chicago, IL, USA) to analyze the data. Datas are presented as mean ± standard deviation (SD) and the patients (n). The data were compared using t-test and chi-square test within the groups, p values < 0.05 were considered significant.

Results

A total of 40 patients were included in our study. Demographic variables of patients such as age, sex, weight, length and ASA status were similar in both groups (Table 1) (p>0.05).

Table 1. Basic variables of patients in both groups

	TAP Group (n=20)	WD Group (n=20)	P-value
Age (years)	29,95 ± 8,93	26,4 ± 8,79	0,21
Length (cm)	170±7,38	173± 7,94	0,21
Weight (kg)	68±10,7	69±11,49	0,38

There was statistically significant difference between the two groups as regards the first time of analgesic requirement (Group TAP 24,74 ± 7,77 h, Group WD 3,5 ± 3,52 h)(P value < 0.05). The duration of anesthesia (min) was significantly higher in Group TAP (49 ± 12,2 min) compared with Group WD (32,75 ± 10,06 min). Intraoperative opioid consumption (mcg) was significantly shorter in Group TAP (50 mcg) compared with (72,5 ± 29,13 mcg) in Group WD (Table 2).

Table 2. Anesthesia Duration (min), İntraoperative opioid consumption (mcg), Postoperative first analgesic requirement time (h). Data are mean ± SD, or numbers. P value >0.05 was considered statistically not significant. P value <0.05 was considered statistically significant

	TAP Group (n=20)	WD Group (n=20)	P-value
Anesthesia Duration (min)	49 ± 12,2	32,75 ± 10,06	0,001*
Intraoperative opioid consumption (mcg)	50	72,5 ± 29,13	0,001*
Postoperative first analgesic requirement time (h)	24,74 ± 7,77	3,5 ± 3,52	0,001*

After the operation, all patients were instructed in the use of an ungraded 10-cm VAS with 0 " no pain and 10 " worst pain imaginable. Patients were interviewed at PACU, 1, 2, 3, 6, 12, 18 and 24 hours after operation by the investigators either in person or by telephone after discharge. VAS pain scores were statistically significantly lower in Group TAP compared with Group WD while at rest and on couching at PACU, postoperative first, second and third hours (p<0.05) (Table 3). We didn't find significant difference between groups at the other hours for VAS pain scores.

NBP values were compared between the groups, it was no significiant difference found expect NBP-35 (Table 4).

HR values were compared between the groups, it was no significiant difference found expect HR-20, HR-25 and HR-30. İn that times it was statistically significantly lower in Group TAP when compared with Group WD (Table 5)

We didn't find significant difference between groups at all hours for postoperative complications (nause p= 0,311; vomiting p= 0,48; somnolence p= 1; wound infection p=0,34; ichting p= 0,6).

Table 3. VAS pain scores of groups at the rest and on couching (mean ± SD)

		PACU	T1	T2	T3	T6	T12	T18	T24
TAP	**Rest VAS**	2,2 ± 1,1*	2 ± 1,1*	2 ± 0,8*	2 ± 0,76*	1 ± 1	0,5± 1	0 ± 0,88	0,5± 0,7*
	Couching VAS	3 ± 1,16 *	3 ± 1,14*	2,5 ± 1*	2 ± 0,8*	2,5 ± 1,5	2 ± 1,4	2 ± 0,9	2 ± 1,06
INF	**Rest VAS**	3,4 ± 3*	4 ± 3,3*	3± 1,06*	2 ± 1,23*	2 ± 1,46	1 ± 1,4	0 ± 0,87	0,0± 0,4*
	Couching VAS	4 ± 1,4*	4,5 ± 1,4*	4 ± 1,2*	3 ± 1,3*	3 ± 1,68	2 ± 1,6	2 ± 0,85	2 ± 0,74

*p<0.05
PACU: post anesthetic care unit, T1: postoperative 1.hour, T2: postoperative 2.hour, T3: postoperative 3.hour, T6: postoperative 6.hour, T12: postoperative 12.hour, T18: postoperative 18.hour, T24: postoperative 24.hour

Table 4. Noninvasive blood pressure (NBP) (mmHg) between the groups

	TAP Group	WD Group	P- values
NBP – 0	82,10 ± 15,52	90,05 ± 13,24	0,090
NBP – 5	96,20 ± 18,40	89,80 ± 13	0,212
NBP – 10	85,55 ± 13,55	92,05 ± 15,78	0,207
NBP – 15	83,35 ± 12,33	88,45 ± 13,79	0,225
NBP – 20	88,75 ± 16,80	86,45 ± 15,03	0,651
NBP – 25	86,15 ± 16,96	87,15 ± 12,39	0,833
NBP – 30	84,25 ± 15,09	90,25 ± 14,17	0,203
NBP – 35	83,95 ± 11,23	91,45 ± 11,72	0,046*
NBP – 40	86,75 ± 13,09	92,35 ± 11,17	0,154
NBP – 45	91,65 ± 12,81	94,55 ± 12, 99	0,481

*p<0.05
NBP-0: Preoperative NBP, **NBP-5**: 5. minute NBP, **NBP-10:** 10. minute NBP, **NBP-15:** 15. minute NBP, **NBP-20:** 20. minute NBP, **NBP-25:** 25. minute NBP, **NBP-30:** 30. minute NBP, **NBP-35:** 35. minute NBP, **NBP-40:** 40. minute NBP, **NBP-45**: 45. minute NBP

Table 5. Hearth rate (HR) between the groups

	TAP Group	WD Group	P- values
HR – 0	90,20 ± 14,46	93,45 ± 13,49	0,467
HR – 5	98,55 ± 17,78	93,55 ± 12,43	0,309
HR – 10	83,80 ± 11,94	87,95 ± 15,46	0,348
HR – 15	77,15 ± 13,32	84,30 ± 12,33	0,086
HR – 20	74,40 ± 11,13	81,85 ± 11,20	0,041*
HR – 25	73,30 ± 9,63	82,95 ± 14,12	0,048*
HR – 30	74,95 ± 9,17	85,90 ± 13,84	0,040*
HR – 35	78,50 ± 10,04	85,90 ± 13,84	0,060
HR – 40	81,75 ± 10,20	86,90 ± 12,02	0,152
HR – 45	84,60 ± 10,71	88,25 ± 11,15	0,298

*p<0.05
HR-0: Preoperative HR **HR-5:** 5. minute HR, HR-10: 10. minute HR, **HR-15:** 15. minute HR, **HR-20:** 20. minute HR, **HR-25:** 25. minute HR, **HR-30:** 30. minute HR, **HR-35:** 35. minute HR, **HR-40:** 40. minute HR, **HR-45:** 45. minute HR

Discussion

Pain is an uncomfortable condition that affects quality of life and personal performance considerably. Despite scientific advances today, doctors are still struggle with pain. Studies conducted since 2000 have shown that 25-67% of patients feel postoperative pain and 12% of these patients have severe pain [16]. İt is known that the pain and its negative effects of psychological trauma affect adversely the recovery and lead to complications that prevent discharge 17]. Providing adequate analgesia is the basic building block of anesthesia. This can be done with many different medications or methods. The effectiveness of the method, its application and its complications are self-inflicted.

Over the last decade, the effectiveness of TAP block for post-operative pain control complementary to the general anesthesia has been demonstrated in many studies [18,19]. We compared TAP block and Wound infiltration for postoperative analgesia after open appendectomy. TAP block application prolongs the duration of anesthesia as well as reduces the intraoperative analgesic requirement and the initial postoperative analgesic requirement period. The fact that the VAS scores were lower in the TAP block group showed that the multimodal analgesia regimen could be applied as an effective component.

The common use of nerve blocks in USG guiding has increased the effectiveness and has become more preferred. Tap block has begun to be used in lower abdominal region surgeons and appendectomy has become one of the common indication [5]. The literature has been particularly pioneering in the search for answers to main

questions such as pain control, total analgesic consumption, dose comparison and patient comfort.

Tap block blocks somatic pain but can't block visceral pain, so it can be only part of the multimodal analgesia in pain management. Studies have shown that Tap block reduces % 70 morphine consumption and % 50 nause-vomiting in the first 24 hours [(8].

Tap block has performed with ropivacain (2,5 mg kg-1/ 0,3 mL kg-1/ % 0,75) for 19 pediatric patients which is underwent appendectomy in a randomized controlled trial. In control group Tap block has performed with % 0,9 SF for 21 patients and a total of 40 patients have compared with each other. In the ropivacain group, they have shown that the first morphine requirement has prolonged, the morphine consumption in the first 48 hours decreased and the analgesia has as effective as the multimodal analgesia regimen. They have reported that nausea-vomiting and sedation scores were not different [6].

Şahin and colleagues have assessed time to first analgesic, cumulative number of doses of analgesic, pain scores and advers effects over the 24 hours. Fifty-seven children between 2 and 8 years of age undergoing unilateral inguinal hernia repair have randomized to TAP block (group T, n=29) or to wound infiltration (group C, n=28). A TAP block using USG-guidance with 0,25% levobupivacaine 0,5 mL kg-1 or wound infiltration with 0,25% levobupivacaine 0,2 mL kg-1was performed on the same side. Group T provides prolonged postoperative analgesia and reduced analgesic use without any clinical side-effects [20].

In a similar study as methodology [21] TAP block and wound infiltration have compared the analgesic efficacy of the patients during the first postoperative 24 hours. The frequency of additional analgesic use in home and the total analgesic used have higher in İNF group and the side effects were lower in the TAP group. In our study postoperative first analgesic requirement time (h) was long in TAP group. We didn't find significant difference between groups at all hours for postoperative complications and side effects.

Peterson and colleagues have evaluated TAP block versus placebo and versus an active comparator (ilioinguinal block and wound infiltration). Pain scores has measured while couching and at rest as area under the curve for the first 24 h (AUC24h). VAS scores at 6h (AUC6h) have significantly lower in group infiltration than group TAP and than in group placebo. Median morphine consumption has lower in group infiltration [22]. In conclusion they have reported that TAP block didn't reduce postoperative pain after inguinal hernia repair. We think that the result of this; they used %0.75 25 ml ropivacain in the TAP group as well as used 40 ml ropivacain in ilioinguinal block and wound infiltration group.

TAP block is also preferred in laparoscopic surgeons and there are many various studies about comparing TAP block and wound infiltration. The patients who have 71 ASA I-II , aged 18 to 65 years, were randomized to port site infiltration (control, 36) and TAP block group. Postoperative patients controlled analgesia fentanyl has provided for 6 hours; pain has assessed using VAS. İntraoperative fentanyl consumption has significantly higher in control group than TAP group and VAS has lower at rest and on deep breathing in TAP group. Conclusion, TAP block reduced postoperative pain up to 24 hours after laparoscopic hernia repair [23].

Fredricson and colleagues have compared USG-guided TAP block (n=20) and ilioinguinal block (n=21) after pediatric inguinal surgery. İn the day-stay unit, pain has more frequent and ibuprofen use has higher in TAP group. Recover room pain, morphine consumption and postdischarge ibufen use, comfort and satisfaction scores have similar between groups. Ultrasound image quality has poorer and needle time under the skin has longer for the ilioinguinal group. They have demonstrated that ilioinguinal block provides more effective analgesia than TAP block [24].

It is shown that preoperative applying of TAP block decreases opioid requirement significantly [10,25]. TAP block is applied after induction and before the surgical incision to achieve effective preoperative analgesia. Because of we preferred to apply the block after induction. Consequently, intraoperative analgesic requirement is lower (50 mcg) significantly in TAP group (50 mcg) than WD group (72,5 ± 29,13 mcg) ($p<0,001$).

It has assessed that the efficacy of TAP block following Cesarean delivery (CD) and reported on postoperative pain scores and opioid consumption after cesarean delivery in a randomized controlled trials. Studies have combined according to the use or non-use of intrathecal morphine (ITM). Nine studies have included (n=524) (Spinal anesthesia 7, General anesthesia 2). When have compared with ITM, pain scores on movement and opioid consumption at 24 hours have lower and time to first rescue analgesic was longer with ITM, although opioid-related side effects have more common. In conclusion, TAP block significiantly improved postoperative analgesia in women undergoing CD who haven't receive ITM but showed no improvement in those who have received ITM (26).

In this study we compared USG-guided TAP block vs wound infiltration in patients undergoing open appendectomy. There are a number of limitations to this study. First limitation factor, it can't be planned prospectively and the second the number of the cases is limited. We learn a lot of information about the most effective analgesia method in open appendectomies when can be planned prospectively and included more cases. The aim of the study to contribute to the wide range of studies of analgesic methods with less complication, more stable and more comfortable in the future. Future trials will have to address these questions.

Conclusion

Wound infiltration and TAP block can perform as a part of the multimodal analgesia of the patients who undergoing open appendectomy. TAP block application prolongs the duration of anesthesia as well as reduces intraoperative analgesic requirement and initial postoperative analgesic requirement period. The fact that VAS scores were lower in the TAP block group showed that the multimodal analgesia regimen could be applied as an effective component and further studies are required comparing TAP block with other methods of postoperative analgesia and as an analgesia adjunct to usual care.

Competing interests
The authors declare that they have no competing interest.

Financial Disclosure
There are no financial supports.

Ethical approval
This work has been approved by the Institutional Review Board.

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