JoCASS
Çukurova Anestezi ve Cerrahi Bilimler Dergisi
2018 Adana

EVALUATION OF THE EFFECTS OF ULTRASOUND-GUIDED TRANSVERSUS ABDOMINAL PLANE BLOCK FOR POSTOPERATIVE ANALGESIA ON RECOVERY AND POSTOPERATIVE HEMODYNAMIC PARAMETERS IN LAPAROSCOPIC CHOLECYSTECTOMY

POSTOPERATİF ANALJEZİ İÇİN ULTRASON KILAVUZLUĞUNDA TRANSVERSUS ABDOMİNAL PLAN BLOĞUNUN LAPAROSKOPİK KOLESİSTEKTOMİDE DERLENME VE POSTOPERATİF HEMODİNAMİK PARAMETRELER ÜZERİNE ETKİLERİNİN DEĞERLENDİRİLMESİ

Öztürk Taşkın[1], Ayşe Yılmaz[2], Ufuk Demir[1]

1 *Kastamonu University Medicine Faculty Anesthesiology and Reanimation, Kastamonu, Türkiye*
2 *Kastamonu Training and Research Hospital Anesthesiology and Reanimation, Kastamonu, Türkiye*

Sorumlu Yazar/Corresponding Author: Öztürk Taşkın E-mail: drozturk275@hotmail.com
Geliş Tarihi/Received: 07.05.2022 Kabul Tarihi-Accepted: 12.08.2022 Available Online Date/Çevrimiçi Yayın Tarihi: 31.08.2022
Cite this article as: Taskın Ö, Yılmaz A, Demir U. Evaluation of the Effects of Ultrasound-Guided Transversus Abdominal Plane Block for Postoperative Analgesia on Recovery and Postoperative Hemodynamic Parameters in Laparoscopic Cholecystectomy. J Cukurova Anesth Surg. 2022;5(2):213-221.
Doi: 10.36516/jocass.1113668

Abstract
Aim: Laparoscopic cholecystectomy has become quite common all over the world. Severe pain may also develop after laparoscopic procedures. Postoperative pain can cause changes in many systems and increase the risk of complications. In this study, we aimed to evaluate the effect of ultrasound-guided Transversus Abdominis plane block on recovery and postoperative hemodynamic parameters in laparoscopic cholecystectomy.
Methods: The patients were divided into 2 groups as those who received paracetamol for postoperative analgesia and those who received paracetamol and TAP block. Postoperative hemodynamic parameters, peripheral oxygen saturations, VAS scores and Aldrete Scores of the patients were recorded from the patient files and compared.
Results: VAS scores and systolic-diastolic arterial pressures were statistically significantly lower and Modified Aldrete scores and oxygen saturations were statistically significantly higher in patients with TAP block.
Conclusions: We showed that in addition to conventional analgesia methods in patients who underwent laparoscopic cholecystectomy, TAP block applied with USG facilitates postoperative pain control, provides a more stable hemodynamics and both better and earlier recovery. It will provide an advantage in terms of both recovery and complication risk, especially in patients with cardiovascular system disorders.

Keywords: TAP Block, Regional anesthesia, Transversus Abdominis Plan Block, Laparoscopic cholecystectomy, Postoperative analgesia

Öz
Amaç: Laparoskopik kolesistektomi tüm dünyada oldukça yaygın hale gelmiştir. Laparoskopik işlemlerden sonra da şiddetli ağrı gelişebilir. Ameliyat sonrası ağrı birçok sistemde değişikliğe neden olabilir ve komplikasyon riskini artırabilir. Bu çalışmada, laparoskopik kolesistektomide ultrason eşliğinde yapılan Transversus Abdominis plan bloğunun derlenme ve postoperatif hemodinamik parametrelere etkisini değerlendirmeyi amaçladık.
Yöntemler: Hastalar postoperatif analjezi için parasetamol alanlar ve parasetamol ve TAP blok alanlar olarak 2 gruba ayrıldı. Hastaların postoperatif hemodinamik parametreleri, periferik oksijen satürasyonları, VAS skorları ve Aldrete Skorları hasta dosyalarından kaydedilerek karşılaştırıldı.
Bulgular: TAP bloklu hastalarda VAS skorları ve sistolik-diyastolik arter basınçları istatistiksel olarak anlamlı düşüktü ve Modifiye Aldrete skorları ve oksijen satürasyonları istatistiksel olarak anlamlı derecede yüksekti.
Sonuç: Laparoskopik kolesistektomi yapılan hastalarda konvansiyonel analjezi yöntemlerine ek olarak USG ile uygulanan TAP bloğun postoperatif ağrı kontrolünü kolaylaştırdığını, daha stabil bir hemodinami sağladığını ve hem daha iyi hem de daha erken derlenme sağladığını gösterdik. Özellikle kardiyovasküler sistem bozukluğu olan hastalarda hem iyileşme hem de komplikasyon riski açısından avantaj sağlayacaktır.

Anahtar Kelimeler: TAP blok, rejyonel anestezi, transversus abdominis plan bloğu, laparoskopik kolesistektomi, postoperatif analjezi

Introduction

Laparoscopic cholecystectomy has become very common all over the world and has become the first preferred method in the treatment of cholelithiasis by both physicians and patients. Despite the decrease in postoperative pain, which is one of the biggest advantages compared to laparotomy, most of the patients can still talk about severe pain after laparoscopic cholecystectomy[1].
Postoperative pain is acute pain that begins with surgical incision and ends with wound healing. Post-operative pain can cause changes in many systems. It may cause hypoxemia, atelectasis and pneumonia in the respiratory system[2-4]. In the cardiovascular system, it can cause hypertension, tachycardia, arrhythmia, increased stroke volume, and increased myocardial oxygen consumption. It may increase the risk of myocardial ischemia and infarction[5,6]. Consequently, the risk of postoperative morbidity and mortality increases. With an effective analgesia, both the development of complications can be prevented and the cost of hospital stay can be shortened.
Alternatively, the transverse abdominis plane block (TAP block), first described by Rafi, can also be used for analgesia. In TAP block, a local anesthetic is injected into the neurofascial plane of the abdominal muscle, thereby blocking the sensory nerves and providing pain control[7]. TAP block is performed by advancing the needle in the so-called "Petit triangle", which is bounded by the lattisimus dorsi muscle posteriorly, the external oblique muscle (EOM) anteriorly, and the iliac crest below[8]. Considering the risk of complications during the procedure, ultrasound-guided application is generally preferred instead of the blind technique.
In this study, we aimed to investigate the effects of ultrasound-guided TAP block for postoperative analgesia on recovery and postoperative hemodynamics in patients who underwent laparoscopic cholecystectomy.

Materials and Methods

In our study, 825 patients who underwent laparoscopic cholecystectomy were selected from 7868 patients who were operated for various reasons in Kastamonu Training and Research Hospital between January 2019 and 2020, and their files were reviewed retrospectively.

As inclusion criteria;

- To be operated under general anesthesia (propofol, fentanyl, rocuronium bromide)
- >18 years old, ≤65 years old
- American Society of Anesthesia (ASA) 1-2
- Premedication has been applied
- Staying in the post anesthesia care unit (PACU) for at least 30 minutes
- Systolic arterial pressure <150 mmHg, diastolic arterial pressure <90 mmHg
- TAP block with paracetamol or paracetamol for postoperative analgesia
- Heart rate <100/minute, >60/minute

Also, as exclusion criteria;

- History of cardiovascular diseases (hypertension, arrhythmia, heart failure, etc.)
- Having additional diseases such as malignancies, stroke, visual and hearing impairment
- Conversion from laparoscopic surgery to open
- Having developed postoperative nausea and vomiting (due to the possibility of affecting hemodynamics)
- Having applied additional postoperative analgesia
- Performing more than one surgical procedure or developing surgical or hemodynamic complications (cholecystectomy and umbilical hernia repair, etc.)
- Pregnancy status

- *Recording Data Section*

Age, gender, comorbidity, ASA scores, preoperative, post-extubation, 5th, 10th, 15th, 20th and 30th minute heart rates, systolic and diastolic blood pressures, mean arterial pressures, and saturation values were scanned in patient files was recorded. 5th minute, 10th minute, 15th minute, 20th minute and 30th minute modified aldrete scores and visual analog scale (VAS) scores were recorded in the PACU from the patient files[9].

- *Statistical Analysis*

Statistical analyzes were performed using the SPSS 26.0 software program (SPSS Inc., Chicago, IL, USA). After Kolmogorov - Smirnov test was applied to all data, Student t test was used for data with normal distribution in the evaluation between groups, and Mann Whitney U test was used for data with skewed distribution. Chi-square test was used for comparison of nominal values between groups. $p<0.05$ was considered significant.

Results

The study included 110 patients who met the criteria. Patients who underwent bilateral TAP block with ultrasound after the end of the surgical procedure with paracetamol for postoperative analgesia were divided into Group I (n=49), and patients who received only paracetamol were divided into Group II (n=61).
No statistically significant difference was observed between the two groups included in the study in terms of demographic data. Demographic data are presented in table 1.
There was no additional disease in 37 patients in group I and 48 patients in group 2. The most common comorbid disease in both groups was diabetes mellitus (DM). The ASA classification of 38 patients in group 1 was ASA 1, and the ASA classification of 48 patients in group 2 was ASA 1.

Table 1. Demographic characteristics of patients

		Group I (n=49)	Group II (n=61)	P
Age		48,84±12,77	46,97±11,82	,420
Gender	Female	10	18	,273
	Male	39	43	
Comorbidities	None	37	48	,216
	Diabetes Mellitus	10	12	
	Respiratory system	0	1	
	Neurological	2	0	
ASA	I	38	48	,886
	II	11	13	

ASA; American Soceity of Anesthesia

Table 2. Hemodynamic parameters and $Sp0_2$ values of the patients

		preop Mean ±SD	0.minute Mean ±SD	5. minute Mean ±SD	10. minute Mean±SD	15. minute Mean±SD	20. minute Mean±SD	30. minute Mean±SD
Heart Rate	Group 1	84,41±13,17	87,04±14,06	73,51±12,15	68,04±11,15	67,88±11,36	66,59±10,75	67,86±10,67
	Group 2	81,90±10,87	107,82±10,53	104,31±18,81	104,54±15,42	102,89±15,39	102,28±14,55	100,79±13,73
	P	,277	,000	,000	,000	,000	,000	,000
Systolic Arterial Pressure	Group 1	133,57±14,74	133,37 ±18,62	132,59±20,08	131,27±20,38	130,55±20,15	132,65±20,34	131,82±19,10
	Group 2	132,28 ±15,11	163,54±16,64	160,02±25,11	159,89±17,45	158,18±14,79	156,18±17,92	154,89±16,60
	P	,653	,000	,000	,000	,000	,000	,000
Diastolic Arteial Pressure	Group 1	77,02±10,62	81,24±11,55	77,02±12,75	76,22±13,10	76,18±11,66	76,80±12,12	77,27±10,10
	Group 2	79,64±9,28	95,46±11,77	93,36±13,69	94,26±14,52	93,90±13,03	91,41±12,19	91,99±11,05
	P	,171	,000	,000	,000	,000	,000	,000
Mean Arterial Pressure	Group 1	96,69±17,70	99,04±13,93	93,90±12,95	92,37±12,67	92,22±11,47	92,20±13,20	92,31±13,72
	Group 2	100,80±13,45	117,66±14,85	113,13±15,29	115,43±15,90	113,77±15,25	109,82±19,74	110,85±13,83
	P	,169	,000	,000	,000	,000	,000	,000
Saturation	Group 1	97,84±2,65	98,35±1,60	97,86±2,29	98,00±1,86	98,20±1,93	98,31±1,79	98,31±1,66
	Group2	98,59±1,33	93,44±1,85	93,48±1,58	94,16±1,25	94,92±1,23	95,59±1,11	95,92±0,98
	P	,075	,000	,000	,000	,000	,000	,000

preop; preoperative, SD; standard deviation.

Table 3. Comparison of Modified Aldrete Score and Visual Analogue Scale

		5. minute Mean ±SD	10. minute Mean±SD	15. minute Mean±SD	20. minute Mean±SD	30. minute Mean±SD
Modified Aldrete Score	Group 1	10,14±1,06	10,78±0,94	11,02±0 ,87	11,37±0,75	11,43±0,67
	Group 2	7,46±0,84	7,92±0,73	8,26±0,68	8,64±0,68	9,07±0,25
	P	,000	,000	,000	,000	,000
Visual Analogue Scale	Group 1	2,16±1,90	1,96±1,70	2,12±1,70	2,16±1,72	2,04±1,49
	Group 2	7,80±1,66	7,64±1,61	7,64±1,61	7,64±1,61	7,64±1,61
	P	,000	,000	,000	,000	,000

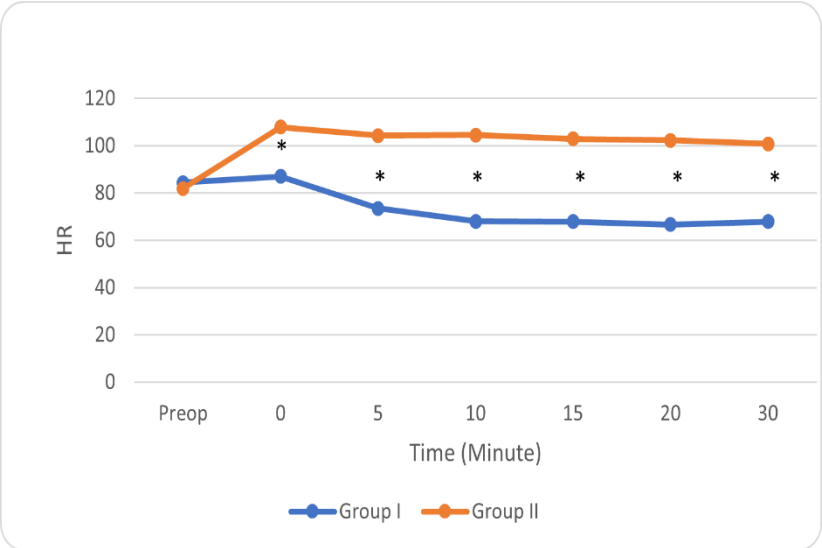
SD; standard deviation.

When the preoperative period heart rates of the groups were compared, no statistically significant difference was found. When the 0 (post-extubation), 5th, 10th, 15th, 20th and 30th minutes values were compared, it was found to be statistically significantly higher in Group II ($p<0.05$, table 2, graph 1). When the systolic arterial pressures were compared, there was no statistically significant difference between the two groups for the preoperative period, while the 0th, 5th, 10th, 15th, 20th and 30th minute values were found to be statistically significantly higher in Group II ($p< 0.05$, Table 2, Graph 2).

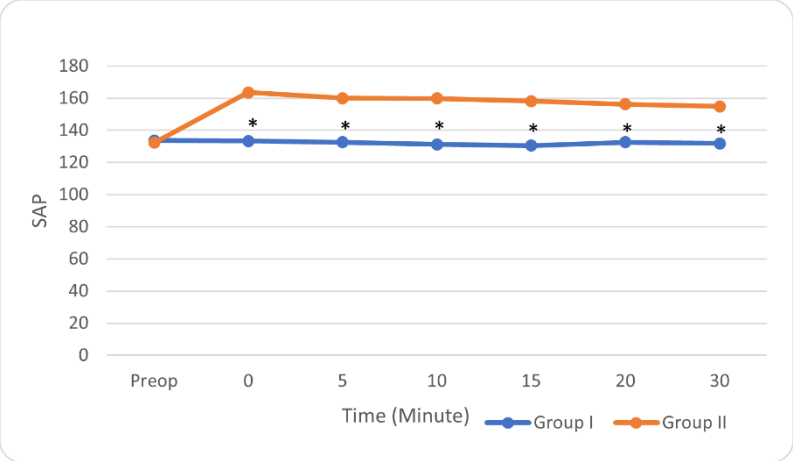
When the diastolic arterial pressures were compared, there was no statistically significant difference between the two groups for the preoperative period, while the 0th, 5th, 10th, 15th, 20th and 30th minute values were found to be statistically significantly higher in Group II ($p< 0.05$, Table 2, Graph 3).

Graphic 1. Heart rate (HR) changes between groups.

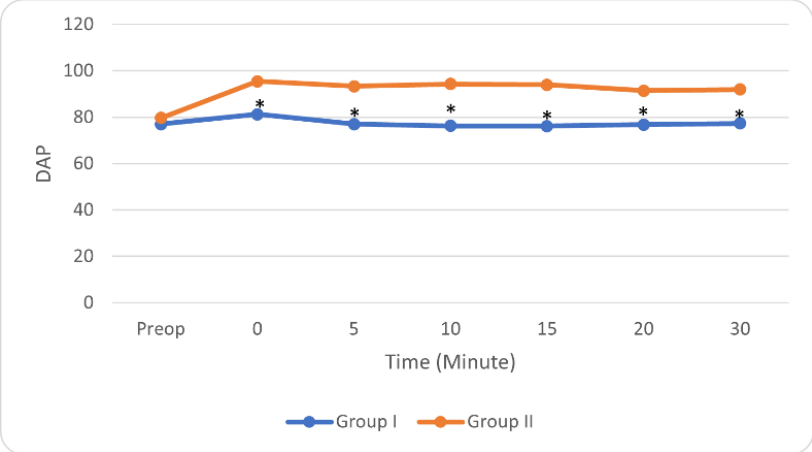
* Stastically significant change according to former value in the group. ($p<0.05$), HR: Heart rate)



Graphic 2. Sistolic arter pressure changes between groups.
* Stastically significant change according former value in the group. (p<0.05), SAP: Systolic arterial pressure.



Graphic 3. Diastolic arter pressure changes between groups.
* Stastically significant change according former value in the group. (p<0.05), DAP: Diastolic arterial pressure.



When the mean arterial pressures were compared, no statistical difference was found for the preoperative period, while the 0th, 5th, 10th, 15th, 20th and 30th minute values were statistically significantly higher in Group II (p<0.05, Table 2). There was no difference between the preoperative period saturation values of the groups. 0., 5., 10., 15., 20. and 30. minutes values were found to be statistically significantly higher in Group I (p<0.05, Table 2).
When the visual analog scale values of the groups were compared, the 5th, 10th, 15th, 20th and 30th minute values were found to be statistically significantly lower in Group I (p<0.05, table 3). When the scores of the groups were compared according to the Modified Aldrete Scoring system, the 5th, 10th, 15th, 20th and 30th minute values were statistically significantly higher in Group I (p<0.05, table 3).

Discussion

As a result of this study, heart rate and systolic-diastolic arterial pressures were more stable, saturation values were higher, visual analog scale scores were lower in patients who received TAP block in addition to the analgesic agent. The modified alderete score was found to be higher in patients who received TAP block in addition to the analgesic agent compared to the patients who received a single analgesic agent. It is seen that TAP block applied in addition to the analgesic agent for postoperative pain has positive effects on postoperative hemodynamics and respiration, as well as providing early and better recovery.
With laparoscopic surgery, the sympathetic system is stimulated, resulting in a metabolic and endocrine response. There are studies reporting that surgical trauma and stress response are directly proportional[10]. Pain is the result of many factors such as tissue trauma, abdominal distension, trauma secondary to gallbladder removal, chemical irritation of the peritoneum, and pneumoperitoneum[11-14]. Visceral, parietal, and shoulder pain components should be effectively reduced for postoperative analgesia after laparoscopic cholecystectomy[13]. For pain control after laparoscopic cholecystectomy, intravenous patient-controlled analgesia, pa-

tient-controlled thoracic epidural analgesia, intraperitoneal local anesthetic injection, low-pressure pneumoperitoneum and heated air supply were used[15,16]. Alternatively, the transverse abdominis plane block (TAP block), first described by Rafi, can also be used for analgesia.

Cholecystectomy, laparoscopic procedures, cesarean section, and retropubic prostatectomy have proven effective for postoperative analgesia[17-19]. It has been reported that pain increases myocardial workload, oxygen demand and, consequently, the risk of coronary vasoconstriction and myocardial ischemia and infarction[5,6]. Alsadek et al., in their study called ultrasound-guided TAP block for the relief of pain in children who had undergone lower abdominal surgery, stated that the heart rate and mean arterial pressure were lower in patients who applied TAP block for postoperative analgesia, although not statistically significant, and that hemodynamics was more stable compared to the patients who did not undergo the block[20]. In our study, no difference was found for preoperative heart rate, systolic arterial pressure, diastolic arterial pressure and mean arterial pressure, while heart rate, systolic-diastolic and mean arterial pressures in all other measurements were significantly higher in the non-blocked patient group. It was seen that TAP block provided a more stable hemodynamics for the patients.

In their study, Jain et al. proved that TAP and caudal block provide additional benefits to multimodal analgesia in children undergoing lower abdominal surgery, require a low rate of additional postoperative analgesia, and provide lower pain scores[20]. Similarly, in our study, we observed that the VAS score was lower in all measurements in patients who underwent TAP block for multimodal analgesia.

Pulmonary dysfunction is one of the most important causes of mortality and morbidity after surgery and anesthesia. This situation can be prevented by providing postoperative analgesia[21]. Conacher reported in a study that an effective analgesia can prevent the decrease in pulmonary functions that cause hypoxemia and hypercarbia[22]. In our study, peripheral oxygen saturations were significantly higher in patients who underwent TAP block.

Perioperative and postoperative pain management is an important factor in postoperative recovery. In this way, autonomic, somatic and endocrine reflexes are suppressed, thereby reducing perioperative morbidity[23]. Aytaç et al. reported the effect of pain management on recovery parameters in laparoscopic cholecystectomy in their study, and it was emphasized that Aldrete scores were low in patients who did not receive intraoperative analgesia[24]. In our study, Modified Aldrete was also used in patients who underwent TAP block. We observed that their scores were higher in all measures and recovery was earlier.

There are some limitations in our study. These are the number of patients included in the study, the anesthetic agents used in TAP block application and their volumes may be different, the max values of inhaler anesthetics are not known, and the duration of the surgical operation is different.

We know that the intraoperative analgesia approach is important in the development of postoperative pain and complications in patients who underwent laparoscopic cholecystectomy. In this study, we showed that in addition to traditional analgesia methods, TAP block with USG facilitates postoperative pain control, provides more stable hemodynamics, and provides both better and earlier recovery in patients who underwent laparoscopic cholecystectomy. It will provide an advantage in terms of both recovery and complication risk, especially in patients with cardiovascular system disorders. Since it is a simple method under USG guidance and the risk of complications is low, it can be easily applied in clinics.

Author contributions

All authors contributed to the study conception and design. All authors read and approved the final manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

Funding

Authors declared no financial support.

Ethical approval

The ethics committee of Kastamonu Training and Research Hospital approved this study, which was written according to the principles of the Declaration of Helsinki. (1964) (ethical consent: 12.01.2022, 2020-KAEK-143-147).

References

1. Kaloo P, Armstrong S, Kaloo C, et al. Interventions to reduce shoulder pain following gynaecological laparoscopic procedures. Cochrane Database Syst Rev. 2019;1(1): CD011101. doi:10.1002/14651858.CD011101.pub2
2. Reisli R, Akkaya ÖT, Arıcan Ş, et al. Akut postoperatif ağrının farmakolojik tedavisi: Türk Algoloji-Ağrı Derneği klinik uygulama kılavuzu Agri. 2021;33(Suppl 1):1-51. doi: 10.14744/agri.2021.60243
3. Ferguson MK. Preoperative assessment of pulmonary risk. Chest. 1999;115(5 Suppl):58S-63S. doi: 10.1378/chest.115.suppl_2.58s
4. Hall JC, Tarala R, Harris J, et al. Incentive spirometry versus routine chest physiotherapy for prevention of pulmonary complications after abdominal surgery. Lancet. 1991;337(8747):953-6. doi:10.1016/0140-6736(91)91580-n
5. Kehlet H, Rung GW, Callesen T. Postoperative opioid analgesia: time for a reconsideration?. J Clin Anesth. 1996;8(6):441-5. doi:10.1016/0952-8180(96)00131-6
6. Beattie WS, Badner NH, Choi P. Epidural analgesia reduces postoperative myocardial infarction: a meta-analysis. Anesth Analg. 2001;93(4):853-8. doi:10.1097/00000539-200110000-00010
7. Akyol Beyoğlu Ç, Özdilek A, Erbabacan E, et al. Evaluation of the effects of subcostal transversus abdominis plane block on acute and subacute pain development following inguinal herniography: Randomized clinical study. Agri. 2018;30(3):123-9. doi:10.5505/agri.2018.49344
8. Netter FH. Abdomen Posterolateral Abdominal Wall. In: Netter FH, Editor. Atlas Of Human Anatomy Summit. New Jersey: The Ciba-Geigy Corporation; 1989. Pp. 231–40.
9. Aldrete JA. The post-anesthesia recovery score revisited. J Clin Anesth. 1995;7(1):89-91. doi:10.1016/0952-8180(94)00001-k
10. Foster MA, Taylor AE, Hill NE, et al. Mapping the Steroid Response to Major Trauma from Injury to Recovery: A Prospective Cohort Study. J Clin Endocrinol Metab. 2020;105(3):925-37. doi:10.1210/clinem/dgz302
11. Kim HY, Choi JB, Min SK, et al. A randomized clinical trial on the effect of a lidocaine patch on shoulder pain relief in laparoscopic cholecystectomy. Sci Rep. 2021;11(1):1052. doi:10.1038/s41598-020-80289-y
12. Chung JW, Kang KS, Park SH, et al. İntraperitonal CO etkisi 2 laparoskopik kolesistektomide ameliyat sonrası ağrı ile ilgili konsantrasyon. Ann Surg Tedavi Arş. 2017;93(4):181-5. doi:10.4174/astr.2017.93.4.181
13. Altıparmak B, Korkmaz Toker M, Uysal AI, et al. Ultrasound-guided erector spinae plane block versus oblique subcostal transversus abdominis plane block for postoperative analgesia of adult patients undergoing laparoscopic cholecystectomy: Randomized, controlled trial. J Clin Anesth. 2019;57:31-6. doi:10.1016/j.jclinane.2019.03.012
14. Barazanchi AWH, MacFater WS, Rahiri JL, et al. Evidence-based management of pain after laparoscopic cholecystectomy: a PROSPECT review update. Br J Anaesth. 2018;121(4):787-803. doi:10.1016/j.bja.2018.06.023
15. Barczyński M, Herman RM. A prospective randomized trial on comparison of low-pressure (LP) and standard-pressure (SP) pneumoperitoneum for laparoscopic cholecystectomy. Surg Endosc. 2003;17(4):533-8. doi:10.1007/s00464-002-9121-2
16. Mouton WG, Bessell JR, Millard SH, et al. A randomized controlled trial assessing the benefit of humidified insufflation gas during laparoscopic surgery. Surg Endosc. 1999;13(2):106-8. doi:10.1007/s004649900915
17. Faiz SHR, Alebouyeh MR, Derakhshan P, et al. Comparison of ultrasound-guided posterior transversus abdominis plane block and lateral transversus abdominis plane block for postoperative pain management in patients undergoing cesarean section: a randomized double-blind clinical trial study. J Pain Res. 2017;11:5-9. Published 2017 Dec 19. doi:10.2147/JPR.S146970
18. Khan KK, Khan RI. Analgesic Effect of Bilateral Subcostal Tap Block After Laparoscopic Cholecystectomy. J Ayub Med Coll Abbottabad. 2018;30(1):12-5.
19. Shahait M, Lee DI. Application of TAP Block in Laparoscopic Urological Surgery: Current Status and Future Directions. Curr Urol Rep. 2019;20(5):20. doi:10.1007/s11934-019-0883-7
20. Alsadek WM, Al-Gohari MM, Elsonbaty MI, et al. Ultrasound guided TAP block versus ultra-

sound guided caudal block for pain relief in children undergoing lower abdominal surgeries. Egyptian Journal of Anaesthesia. 2015;31(2): 155-60.
doi: 10.1016/j.egja.2015.03.001
21. Jain S, Kalra S, Sharma B, et al. Evaluation of Ultrasound-Guided Transversus Abdominis Plane Block for Postoperative Analgesia in Patients Undergoing Intraperitoneal Onlay Mesh Repair. Anesth Essays Res. 2019;13(1):126-31.
doi:10.4103/aer.AER_176_18
22. Conacher ID. Pain relief after thoracotomy. Br J Anaesth. 1990;65(6):806-12.
doi:10.1093/bja/65.6.806
23. Kara H, Sahin N, Ulusan V, et al. Magnesium infusion reduces perioperative pain. Eur J Anaesthesiol. 2002;19(1):52-6.
doi:10.1017/s026502150200008x
24. Güven Aytac B, Aytaç İ, Lafçı A, et al. The effect of pain management in laparoscopic cholecystectomy on recovery parameters. TJCL. 2018; 9(3): 216-20.
doi: 10.18663/tjcl.445926