Original Research Article

Analgesic Efficacy of Right Subcostal Transversus Abdominis (STA) Block Supplemented by Bilateral Rectus Sheath Block (RSB) under USG Guidance and Its Comparison with Port Site Infiltration of Local Anaesthetic in Laparoscopic Cholecystectomy

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Abstract

Background and Aims: Pain after Laparoscopic Cholecystectomy is multifactorial, pain is most intense on the day of surgery with the incisional pain predominating over the visceral pain. Subcostal transversus abdominis (STA) block and Rectus sheath block (RSB) has been proven to reduce the pain from midline abdominal incision in laparoscopic surgery. This study aimed to compare the analgesic efficacy of USG guided subcostal transversus abdominis (STA) Block and rectus sheath block vs port site infiltration of local anesthetic in terms of quality of intraoperative and post-operative pain relief (NRS), need of rescue analgesics, hemodynamic stability and 24 hr postoperative patient satisfaction score.**Methods:** Sixty patients scheduled for laparoscopic cholecystectomy were randomly allocated to two groups either to receive USG guided right STA and bilateral RSB (n = 30, Group A) or port site infiltration of local anesthetic (n = 30, Group B group). Intraoperative and postoperative hemodynamics, pain score and need of rescue analgesics were monitored.**Results:** The study group (Group A) had significantly reduced NRS score and tramadol consumption over 24 hr. Total tramadol consumption in patients receiving port site local anaesthetic infiltrations (Group B group) was approximately twice (200 ± 100 mg) as compared to patients in block group (Group A) (100 ± 50 mg) ($P < 0.0001$). **Conclusion:** It is concluded that ultrasound-guided STA and RSB produce effective post-operative analgesia for the incisional pain in laparoscopic cholecystectomy surgeries and act as a supplementary method in multimodal analgesia.

Keywords: Laparoscopic cholecystectomy, post-operative analgesia, rectus sheath block, subcostal transversus abdominis block.

Introduction

Despite advances in surgical techniques and anaesthesia management, postoperative pain remains an important issue. Postoperative pain is a limiting factor in the recovery of the patient and may lead to following effects such as hemodynamic instability, decreased functional residual capacity and increased work of breathing, atelectasis, hypoxemia, sepsis, poor wound healing and wound gaping, poor healing of anastomosis site, opioid consumption and its adverse effects, postoperative paralytic ileus, prolonged hospital stay, and increased morbidity. Hence, an effective analgesia is must in post-operative management[1].

Post-laparoscopy surgeries pain relief could not be achieved by a single technique as the pain could be incisional, visceral, or referred; hence, a multimodal approach to analgesia would be adopted. Together with the increasing use of ultrasound (US), various truncal blocks are performed under US guidance to eliminate postoperative pain and reduce the need for opioids in patients undergoing laparoscopic cholecystectomy.

Transversus abdominis plane block (TAP) is one of the preferred analgesia methods in abdominal anterolateral wall surgeries[2,3].The TAP block is administered between the internal oblique muscle and the transversus abdominis muscle. It provides adequate analgesia in the anterior abdominal wall through the ventral branches of the nerve roots, which is divided into the ventral and dorsal rami after originating from the medulla spinalis[4]The ultrasound-guided subcostal transversus abdominis (STA) block is a variation of transverse abdominis plane (TAP) block which produces effective analgesia for supraumbilical incisional pain limited to lateral border of rectus sheath[5,6].Several studies demonstrated that the STA block decreased the pain scores and the analgesic consumption and improved patient satisfaction in the postoperative period. However, the spread of local anaesthetic injected into these planes is limited by the lateral border of the rectus sheath, limiting their analgesic effects in midline, and require modification of port siteAddition of posterior rectus abdominis sheath block provides adequate analgesia covering thoracic dermatomes (T5–T10) in midline, without modification of conventional port sites.[7-10]On the other hand, the rectus sheath (RSB) block is administered between the rectus muscles, which form the middle wall of the abdomen, and the posterior rectus sheath. This technique provides adequate analgesia in the middle wall of the abdomen through the block of the terminal branch of the ventral ramus.Rectus sheath block (RSB) is targeted to block the terminal branches of the intercostal nerves that are present in the plane linking the rectus abdominis muscle with its posterior rectus sheath resulting in anaesthesia about the midline, leading to an effective analgesia in post-laparoscopic cholecystectomy surgery. The incisional pain contributes more in post-laparoscopic surgery pain than visceral pain.

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Clinical studies showed that the combination of RS block and STA or conventional TAP provides adequate analgesia in laparoscopic cholecyctectomy[11,12].

Aim: The aim of the present study was to compare the efficacy of right Subcostal Transversus Abdominis (STA) Block Supplemented by bilateral Rectus Sheath Block (RSB) under USG Guidance with widely practiced traditional port site infiltrations of local anaesthetic for post-operative pain relief and tramadol consumption in laparoscopic cholecystectomy.

Methods

This is a prospective, observer-blinded, randomized clinical study, conducted after ethical committee approval in 60 patients scheduled for elective laparoscopic cholecystectomy. Written informed consent was taken from eligible patients, aged between 25- 65 years of American Society of Anesthesiologists physical status (ASA) I& II.

Exclusion criteria: included allergies to local anaesthetic agents, those with bleeding diathesis, skin infection at the site of needle puncture preceding the block, surgeries converted to open cholecystectomy, pregnancy, a mental disorder, and patients with known cardiac, renal, hepatic and hematological diseases and refusal by patient. Patients with morbid obesity (body mass index ≥40) were also excluded.Preanesthetic checkup included a detailed history and thorough general physical examination of the patient carried out a day before surgery and was recorded, all the patients were investigated preoperatively, any specific investigation if required & weight of the patients were recorded. On arrival to operating room multi channel monitor were attached (electrocardiography, non-invasive blood pressure & oxygen saturation) and baseline value recorded. After securing intravenous line (i.v) premedication with injection Pantaprazole 40 mg i.v and preoperative analgesia with injection Diclofenac 75 mg i.v infusion given. After pre-oxygenation with 100 % O_2 for 3 min or 4 vital capacity breaths General Anaesthesia was induced with injection propofol 2.0-2.5 mg/kg followed by injection atracurium 0.5 mg/kg to facilitate endotracheal intubation. Airway secured with a cuffed endotracheal tube of appropriate size. Anaesthesia was maintained with 50% O_2: 50% N_2O, isoflurane ≤ 1% and intermittent boluses of injection Atracurium 0.1mg/kg i.v to achieve muscle relaxation. Minute ventilation was adjusted to maintain normocapnia. Each patient received intraoperative analgesia with injection paracetamol 1 gm i.v infusion.

At the end of the surgery, the included patients were randomized using computer-generated random numbers and divided into two groups as:

Group A (n=30): received right subcostal transversus abdominis plane block (STA) and bilateral rectus sheath block (RSB), performed by the same investigator every time before extubation using a high-frequency (linear 6-13 MHz) ultrasound (US) probe.

Group B (n=30): received local anaesthetic infiltration of the laparoscopy port sites by same surgeon before extubation. A total of four ports-supraumbillical, subxiphoid and two ports in the right subcostal area at mid-clavicular and anterior axillary line were made.

For right STA block (**Group A)**, after the skin was disinfected with 10% chlorhexidine, a high-frequency (linear 6-13 MHz USG probe was placed in the midline of the abdomen 2 cm below the xiphisternum and moved right laterally along the subcostal margin to the anterior axillary line. The transversus abdominis and internal oblique muscles were identified lying beneath and extending lateral to the rectus abdominis muscle. A 22-G ultrasound-visible block needle (Stimuplex® B-Braun l) was inserted at the junction of the right costal arch and midclavicular line under USG guidance (In-plane technique). The space between the internal oblique muscle and transverse abdominis muscle was visualized, a test dose of 2 ml normal saline was injected to confirm needle tip placement and determined resistance to flow. Following careful aspiration to exclude vascular puncture, 20 ml of the 0.25% bupivacaine solution was injected.

For bilateral RSB (**Group A)**, after aseptic preparation of the injection sites with 10% chlorhexidine, bilateral rectus muscles were scanned with the high-frequency (linear 6-13 MHz) USG probe. A 22-G ultrasound-visible block needle (Stimuplex® B-Braun l) was inserted in-plane to the transducer in a medial to lateral direction with the endpoint in the fascial plane between the rectus muscle and posterior rectus sheath and 10 ml of the 0.25% bupivacaine solution was injected bilaterally. The spread of the injectate should be observed to be distributed within these planes.

For port site local anesthetic infiltration group **(Group B)**, a post surgery port site infiltration was performed by the same operating surgeon. A total of 20 ml of the 0.5% bupivacaine solution was equally divided for all four ports (5ml for each port).

Anti-emetic medication (Inj. ondansetron 0.15 mg/kg intravenous) given 15 min prior to extubation. Thereafter, the residual neuromuscular block was reversed with injection neostigmine 0.05 mg/kg and injection glycopyrrolate 0.01 mg/kg. Extubation was performed with the patient awake with good breathing efforts and muscle tone.

Following adequate and complete recovery, all patients were transferred to the post-anaesthesia care unit (PACU). All patients were monitored for pain scores (pain assessed by 11-point numeric rating scale-NRS), need of rescue analgesia (Injection Tramadol @ 1 mg/kg i.v), and adverse effects like postoperative nausea, vomiting, local site reaction, local anesthetic toxicity & hematoma formation and vital parameters monitoring including heart rate, NIBP, SpO_2 and respiratory rate at 1, 2, 4, 6, 12 and 24 hr in the ward.

Pain was assessed by Numeric Rating Scale (NRS), a 10 cm long scale as: mild pain for NRS 1-3, moderate pain for NRS 4-6 and severe pain for NRS 7-9. For patients with NRS score > 3 Injection Tramadol was given as rescue analgesic and total injection Tramadol consumption was monitored. Rescue anti-emetic medication was given with injection Metoclopramide 10 mg i.v in case patient complained of recurrent nausea and vomiting.

The primary outcome of the study was to assess the efficacy of postoperative analgesia by NRS, time to the first request of rescue analgesia in the post-operative period and injection tramadol consumption in the first 24 hr postoperatively, at the mentioned intervals. Secondary outcome include hemodynamic parameters monitoring, side effects and patient satisfaction score. At the end of 24 hours, patients were asked to rank the quality of pain relief on a four point patient satisfaction scale where: 1-Excellent, 2-Very good, 3-Satisfactory, and 4-Poor.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Statistical software SPSS (version 20.0) and Microsoft Excel were used to carry out the statistical analysis of data. Continuous variables were expressed as Mean ± SD and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar and line diagrams. Student's independent t –test was employed for comparing continuous variables Chi-square test or Fisher's exact test, which ever appropriate, was applied for comparing categorical variables. A p-value of <0.05 was considered statistically significant.

Results

Our study included sixty patients posted for elective laparoscopic cholecystectomy and were randomly assigned in two groups (30 patients in each group) to receive either right sided STA & bilateral RSB (Group A) or laparoscopic port site local anaesthetic infiltration (Group B). In Group A, 30 (11 male & 19 female) patients received right-sided subcostal TAP (STA) block with bilateral rectus sheath block (RSB) by 40 ml of 0.25% bupivacaine, 20 ml in each block, and in Group B, 30 patients (13 male and 17 female) received port site local anesthetic infiltration by 20 ml of 0.5% bupivacaine, 5 ml equally divided into four ports.

There was no statistically significant difference between the two groups regarding the demographic characteristics age, gender, BMI (kg/m^2), ASA class and duration of surgery ($p > 0.05$) **(Table 1).**

Table 1: Demographic characteristic of two groups & duration of surgery

Variables	Group A(n=30)	Group B(n=30)	P value
Age (yrs)	32.0 ± 12.30	36.2 ± 11.44	0.422
Gender (male: female)	11/19	13/17	0.535
BMI (kg/m^2)	28.26 ± 3.51	27.99 ± 3.62	0.704
ASA (I/II)	23/7	21/9	0.566
Duration of surgery(min)	55.1 ± 6.11	58 ± 5.42	0.066

The mean time to request of first rescue analgesia in Group A was 605±30 min and in Group B was 385±45 min ($p<0.0001$) which was statistically significant **(Figure 1).**

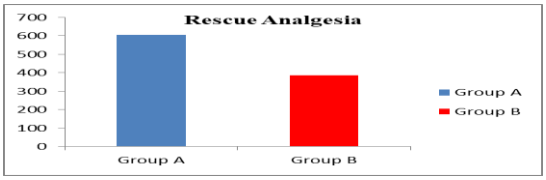

Fig 1: The time to request of first rescue analgesia in study groups.

Compared to the Group A, total tramadol consumption was twice in Group B. The mean consumption of total rescue analgesia was 100±50 mg in group A and 200±100 mg in group B, which was statistically significant ($p<0.0001$), as shown in **(Table 2).**

Table 2: Time of first request of analgesia, Total Tramadol consumption & Side effects in two groups

Variables	Group A	Group B	P value
Time of first request of analgesia (min)	385±45	605±30	<0.0001
Total Tramadol consumption (mg)	100±50	200±100	
PONV	8	11	<0.0001
Local anesthetic toxicity	0	0	
Surgical complications	0	0	> 0.005

When comparison was made on numeric rating scale (NRS) in two study groups at 1, 2, 4, 6, 12, and 24 hr in study groups, mean NRS in Group A was 0, 0, 0, 0.575±0.377, 1.283±0.456, and 1.429±0.667, respectively, and in Group B was 0, 0, 0.119±0.460, 2.656±1.452, 2±0.762, and 2.1±0.562, respectively **(Figure 2).**

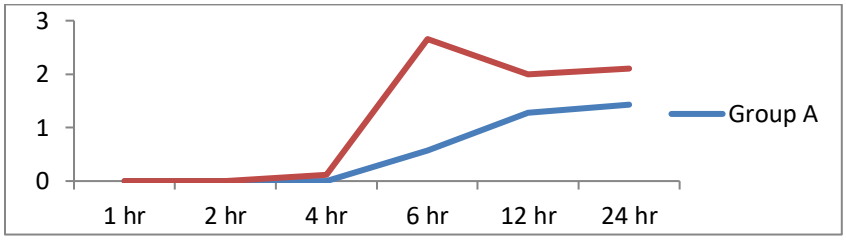

Fig 2: Comparison of postoperative mean Numeric Rating Scale (NRS) in study groups.

The mean NRS at 1, 2, and 4 hr was not statistically significant and had nearly equal NRS in both study groups. However, at 6, 12, and 24 hr, the mean NRS was statistically significant and lower in Group A than in Group B. Lower pain numeric rating scale (NRS) in patients receiving abdominal field blocks were accompanied by lower analgesic requirements postoperatively.

Overall patient satisfaction score at 24 hr postoperatively was found to be considerably higher in Group A than in Group B ($p=0.000$) **(Figure 3**). Patient satisfaction scores correlated well with analgesia and tramadol consumption.

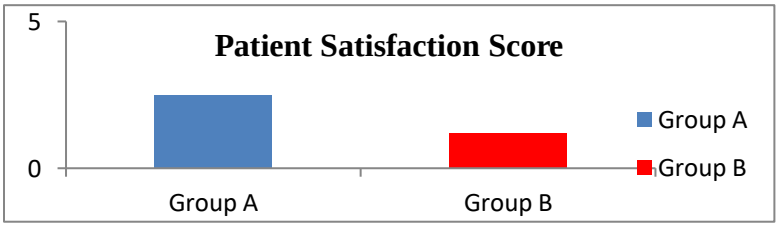

Fig 3: Patient satisfaction score

We also evaluated the postoperative complications, besides, there was no complication related to regional anesthesia and surgical intervention too. Postoperative nausea vomiting (PONV) occurred in 8 and 17 patients in STA-RSB and infiltration groups, respectively,

(p > 0.005) **(Table 2).**Our study also found that mean vitals such as heart rate, arterial blood oxygen saturation, mean arterial pressure, and respiratory rate were stable and comparable at all time.

Discussion

Post-operative laparoscopic cholecystectomy pain can be moderate to severe which have several components like incisional pain from the trocar site (somatic pain) and deep abdominal pain (visceral pain).Inadequately treated acute pain after laparoscopic can lead to chronic pain i.e., "post-laparoscopic cholecystectomy syndrome." Hence, as an integral component of adequate perioperative care, effective post-operative pain management is must. Adequate post-operative pain management is associated with better outcome, decrease post-operative stress, better patient satisfaction, reduced opioid requirement, and minimal side effects. Hence, multimodal approaches including opioids, nonsteroidal antiinflammatory drugs, dexamethasone, gabapentinoids, local anesthetic infiltration to port sites, epidural analgesia and transversus abdominis plane block (TAP) have been used to alleviate postoperative pain after laparoscopic cholecystectomy. [(15)] USG guided nerve block is a good alternative to opioids and central neuraxial block in laparoscopic cholecystectomy, as it is being performed on an outpatient basis.Our study aims to compare the analgesic efficacy of USG-guided abdominal field blocks with port site local anaesthetic infiltration technique for post-operative pain relief (NRS), tramadol consumption, side effects and patient satisfaction scores following elective laparoscopic cholecystectomy. Abdominal field blocks in our study comprises of right STA with bilateral RSB.STA block provides effective analgesia to anterolateral upper abdominal wall and posterior rectus sheath block provides adequate analgesia covering T5–T10 dermatomes in midline producing complementary results in terms of analgesic effects covering anatomical area of all the port sites without modifying their location. Analgesia with regional blocks lasts for 36–48 hr, which might be due to the slow clearance of local anaesthetics in the transversus abdominis plane where relatively fewer blood vessels are located. Reduced vascularity also reduces the risk of systemic toxicity from the local anesthetic agents.Port site infiltration involves the injection of local anaesthetics subcutaneously into the incisional site. This blocks Aδ and C fibers in periportal fascia, the muscle, and parietal peritoneum. The effect of port site infiltration is small, lasting only for few hours and of doubtful clinical relevance[13-17]In our study, regarding the demographic characteristics there was no statistically significant difference between the two study groups.The primary objective of our study was to compare postoperative analgesic efficacy, the time to first request of rescue analgesia and total tramadol consumption. As shown in **figure 1 & table 2**, the mean time to first request of analgesia was significantly prolonged in group A (605±30 min) compared to group B (385±45 min). Thus, total tramadol consumption was twice in group B (200±100 mg) compared to the group A (100±50 mg), which was statistically significant (p<0.0001). Our study results were in consistent with Zhao et al. Gurnaney et al. and Ra et al[18-20].In their studies they also demonstrated that total postoperative analgesic consumption was lower in ultrasound-guided abdominal blocks compared to local anaesthetic infiltration group.In our study, at all time in 24 hrs post-operative period (1, 2, 4, 6, 12 and 24 hr), Numeric Rating Scale (NRS) was lowest and statistically significant in patients who were given ultrasound guided abdominal field blocks as compared to the patients who received port site infiltration, with statistically significant difference (p-value <0.001) **(Figure 2).** Lower postoperative pain score is associated with reduced analgesic requirement. Our study was in agreement with Vrsajkov et al. , Niraj et al. and Siddiqui et al[21-23]In their studies they also observed that ultrasound-guided abdominal block provide superior postoperative analgesia compared to port site local anesthetic infiltration groups.Few cases of PONV were seen in both groups, however, difference was not statistically significant and no other side effects were observed. Hemodynamics remains comparable between study groups. The overall patient satisfaction score was much higher with Group A compared to the Group B (p<0.001) **(Figure 3).**Our study was in agreement with McDonnell et al. [(24)] and Ramkiran et al. [(25)] They demonstrated that combined block groups had significantly lower pain scores, higher patient satisfaction scores, fewer side effects and reduced rescue analgesic requirement both in early and late postoperative periods than the conventional local anesthetic port site infiltration groups.This study explains that combined STA and RSB provides effective analgesia in terms of prolonged duration of action, decreased postoperative pain scores, and hence, reduced tramadol consumption and its adverse effects

Conclusion

We concluded that the combined use of the right sided STA and bilateral RSB decrease tramadol consumption and pain scores compared to the local infiltration block after laparoscopic cholecystectomy. Therefore, we belie**ve** that these methods are effective in the management of postoperative pain.

References

1. Bennett CR. Monheim's Local Anesthesia and Pain Control in Dental Practice. 7th ed. St. Louis, MO: C. V. Mosby, 1984.
2. Mitra S, Khandelwal P, Roberts K, Kumar S, Vadivelu N. Pain relief in laparoscopic cholecystectomy-a review of the current options. Pain Pract. 2012; 12:485-9.
3. Jakobsson J, Wickerts L, Forsberg S, Ledin G. Transversus abdominal plane (TAP) block for postoperative pain management: a review. F1000 Res, 2015, 4.
4. Chin KJ, McDonnell JG, Carvalho B, Sharkey A, Pawa A, Gadsden J. Essentials of our current understanding: abdominal wall blocks. Reg Anesth Pain Med. 2017; 42(2):133–183
5. Jankovic Z. Transversus abdominis plane block: The Holy Grail of anesthesia for (lower) abdominal surgery. Period Biol. 2009; 111:203-8.
6. Hebbard P. Subcostal transversus abdominis plane block under ultrasound guidance. Anesth Analg. 2008; 106:674-5.
7. Tolchard S,Martindale S. Efficacy of the subcostal transversus abdominis plane block in laparoscopic cholecystectomy: comparison with conventional port-site infiltration. J Anaesthesiol Clin Pharmacol. 2012; 28(3):339–343
8. Shin HJ, Oh AY, Baik JS, Kim JH, Han SH, Hwang JW. Ultrasound-guided oblique subcostal transversus abdominis plane block for analgesia after laparoscopic cholecystectomy: a randomized, controlled, observer-blinded study. Minerva Anestesiol. 2014; 80(2):185–193
9. Bhatia N, Arora S, Jyotsna W, Kaur G. Comparison of posterior and subcostal approaches to ultrasound-guided transverse abdominis plane block for postoperative analgesia in laparoscopic cholecystectomy. J Clin Anesth. 2014; 26(4):294–299
10. Jeong HW, Kim CS, Choi KT, Jeong SM, Kim DH, Lee JH. Preoperative versus postoperative rectus sheath block for acute postoperative pain relief after laparoscopic cholecystectomy: a randomized controlled study. J Clin Med, 2019, 8(7):1
11. Abdelsalam K, Mohamdin OW. Ultrasound-guided rectus sheath and transversus abdominis plane blocks for perioperative analgesia in upper abdominal surgery: a randomized controlled study. Saudi J Anaesth. 2016; 10(1):25–28
12. Ramkiran S, Jacob M, Honwad M, Vivekanand D, Krishnakumar M, Patrikar S. Ultrasound-guided combined fascial plane blocks as an intervention for pain management after laparoscopic cholecystectomy: a randomized control study. Anesth Essays Res. 2018; 12(1):16–23
13. Ma J, Jiang Y, Tang S, Wang B, Lian Q, Xie Z et al. Analgesic efficacy of ultrasound guided subcostal transverses abdominis plane block. Medicine (Baltimore). 2017; 96(10):e6309.

14. Bisgaard T, Rosenberg J, Kehlet H. From acute to chronic pain after laparoscopic cholecystectomy: A prospective follow-up analysis. Scand J Gastroenterol. 2005; 40:1358-64.
15. Chin KJ, Adhikary S, Sarwani N, Forero M. The analgesic efficacy of pre-operative bilateral erector spinae plane (ESP) blocks in patients having ventral hernia repair. Anaesthesia. 2017; 72:452-60
16. McDonnell JG, Curley G, O'Donnell B, Heffernan A, Power C, Laffey JG. The analgesic efficacy of transversus abdominis plane block after caesarean section: A prospective randomized controlled trial. Anesth Analg. 2008; 106:186-91.
17. Bisgaard T. Analgesic treatment after laparoscopic cholecystectomy: A critical assessment of the evidence. Anesthesiology. 2006; 104:835-46.
18. Zhao X, Tong Y, Ren H, Ding XB, Wang X et al. Transversus abdominis plane block for postoperative analgesia after laparoscopic surgery: A systematic review and meta-analysis. Int J Clin Exp Med. 7:2966-2975.
19. Gurnaney HG, Maxwell LG, Kraemer FW, Goebel T, Nance ML et al. Prospective randomized observer-blinded study comparing the analgesic efficacy of ultrasound-guided rectus sheath block and local anaesthetic infiltration for umbilical hernia repair. Br J Anaesth. 2011; 107:790-795.
20. Ra YS, Kim CH, Lee GY, Han JI. The analgesic effect of the ultrasound-guided transverse abdominis plane block after laparoscopic cholecystectomy. Korean J Anesthesiol. 2010; 58:362-368.
21. Vrsajkov V, Mancic N, Mihajlovic D, Milicevic ST, Uvelina A et al. Subcostal transversus abdominis plane block can improve analgesia after laparoscopic cholecystectomy. Rev Bras Anestesiol. 2018; 68:149-153.
22. Niraj G, Kelkar A, Jeyapalan I, Graff-Baker P, Williams O et al. Comparison of analgesic efficacy of subcostal transversus abdominis plane blocks with epidural analgesia following upper abdominal surgery. Anaesthesia. 2011; 66:465-471.
23. Siddiqui MR, Sajid MS, Uncles DR, Cheek L, Baig MK. A meta-analysis on the clinical effectiveness of transversus abdominis plane block. J Clin Anesth. 2011; 23:7-14.
24. McDonnell JG, O'Donnell B, Curley G, Heffernan A, Power C et al. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: a prospective randomized controlled trial. Anesth Analg. 2007; 104:193-197.
25. Ramkiran S, Jacob M, Honwad M, Vivekanand D, Krishnakumar M et al. Ultrasound-guided combined fascial plane blocks asan intervention for pain management after laparoscopic cholecystectomy: a randomized control study. Anesth Essays Res. 2018; 12: 16-23.

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