Original Article

Indian Journal of Anesthesia and Analgesia
2017, 4 (4, Part-II), 1192-1198
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.4417.45

Ultrasound Guided Transversus Abdominis Plane Block for Post Operative Analgesia in Patient Undergoing Open Appendicectomy: A Randomized Controlled Study

Namita Gupta[1], Udita Anand[2], Avnish K. Bharadwaj[3], Durga Jethava[4]

[1]Assistant Professor [2]PG Resident [3]Professor [4]Professor and Head, Department of Anesthesia, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan 302022, India.

Abstract

Background: Analgesia is an important concern in the post operative period in terms of complications like delayed mobility, respiratory distress and thromboembolic events. There have been a number of approaches for post operative analgesia in open appendectomy surgeries like Patient Controlled Analgesia (PCA), narcotics, NSAIDS, blocks, etc with certain limitations of each. Amongst these entire methods transversus abdominis plane (TAP) block is recently highlighted in terms of reduction in verbal numerical rating scale (VNRS) and opioids consumption. *Aims:* Verbal numerical rating scale (VNRS) at resting and VNRS at coughing, total opioids consumption, post operative time at which first rescue analgesia needed. *Setting and Design:* It is a randomized double blind controlled study. Sixty [60] adult patients included in this study of ASA grade I/II undergoing open appendectomy under general anaesthesia. *Methods and Material:* Patients were allocated in two groups of, TAP block group and control group. Each group has 30 patients. Patients received TAP block under USG guidance with inj. Levobupivacaine 0.5% 20ml, while Control group patients received standard care. *Statistical Design:* Statistical analysis was performed with the SPSS software, Trial version 23 for Windows statistical software package (SPSS inc., Chicago, USA) and Primer. *Result:* In our study we found that the requirement for first rescue analgesia was prolonged in TAP group 312 min v/s 76.80 min in control group, with highly significant p value ($p \leq 0.001$). Total tramadol doses requirement in twenty four hour in number was also reduced in TAP group which was 2.88±0.726 but 4.48±0,51 in control group and VNRS score of patients receiving TAP block was less than patients of control group. *Conclusion:* Ultrasound guided TAP blocks with 20ml 0.5% levobupivacaine is superior in providing post operative analgesia than the control group.

Keywords: Postoperative Pain; Ultrasound; Analgesia; Anaesthetic Technique; Regional.

Introduction

Acute appendicitis is one of the causes for considerable abdominal pain and most common surgical emergency [1].

Multimodal approaches to the provision of post operative analgesia often incorporate blockade of the abdominal wall such as illioinguinal blockade or wound infiltration. However the efficacy of these approaches is unclear [10,23].

Pain after appendectomy can also be managed with intermittent systemic analgesia such as opioids, ketamine, nonsteroidal anti inflammatory drugs (NASAIDS), alpha 2 agonist, acetaminophens [4].

The Transversus abdominis plane (TAP) block is a peripheral abdominal field block is effective and easy to perform technique which blocks the illioinguinal, hypogastric and lower intercostal nerves (T7-T11)[19] by depositing local anaesthetics within the plane between the internal oblique (IO) and transversus abdominis (TA) muscle targeting the spinal nerves in this plane [14].

TAP block has been utilized for postoperative analgesic following various different surgeries such as large bowel resection, open appendectomy [9],

Corresponding Author: Namita Gupta, Assistant Professor, Department of Anesthesia, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan 302022, India.
E-mail: namitagupta79@gmail.com

Received on 18.07.2017, **Accepted on** 10.08.2017

retropubic-prostactomy, nephrectomy [7]. Various studies have been done in which TAP block is being used as a part of multimodal analgesia in hernia repair [2], laparoscopic Cholecystectomy [8,17] and caesarean sections [12].

This study was done in patients posted for open appendectomy to evaluate the analgesic efficacy of ultrasound guided TAP block.. In this prospective, randomized double blind study we compared the verbal numerical rating scale (VNRS) at resting and at coughing as pain score, time at which first dose of rescue analgesia needed and total doses of tramadol consumption as analgesia in 24 hours following TAP block versus control group.

Material and Methods

After institutional Ethics Committee approval and written informed Consent, Sixty ASA grade I and II patients posted for open appendectomy were included in this prospective, randomized, double blind controlled study.

Patients were excluded from the study if they had history of any allergy to levobupivacaine, coagulopathy, uncontrolled hypertension and diabetes mellitus, patients on antiplatelet drugs and infection at site of needle insertion.

Patients were randomised by sealed envelope technique to undergo USG guided TAP block with 0.5% levobupivacaine 20ml (TAP block group n=30) and the other group to receive standard care (control group n=30).

There was no significant difference between the two groups in age, weight, sex, ASA physical status.

All patients were administered general anaesthesia with endotracheal intubation using Fentanyl 2ug/kg, Propofol 2mg/kg and Atracurium 0.5mg/kg and maintained with minimum alveolar concentration of 1.0 isoflurane with nitrous and oxygen. Intraoperative analgesia was maintained with paracetamol 15mg/kg intravenous infusion and i.v. diclofenec 75mg.

Monitors applied were NIBP, pulse oxymetry, ECG, Capnography (End tidal carbon di oxide was maintained at 30-35mmHg).

After completion of surgery experienced anaesthesiologist blinded to the group allocation performed the TAP block under ultrasound guidance with Sonosite Nanomaxx ultrasound device with a linear array transducer probe of (6-13 MHz). Under all aseptic technique the probe was placed transversely in the midaxillary line between the iliac crest and the costal margin and the external oblique, internal oblique and transversus abdominis muscles were identified.

After infiltration with lignocaine 2% an 22 gauze 80 mm needle was advanced using in plane insertion with ultrasound real- time assessment. After reaching the transverses abdominis plane 1ml of 0.5% levobupivacaine was injected into the TAP block group after negative aspiration and the spread of drug was confirmed, than the remaining 19ml was injected and the spread of drug was appreciated as a dark oval shape.

Beside checking negative aspiration and we also confirm that needle did not puncture peritoneum or visceral organ

All patients were administered inj.Ondansetron 4mg i.v. Residual neuromuscular blockade was reversed. Patient was observed in the postoperative recovery room with standard ASA monitoring for 2 hours. Pain intensity was assessed by the verbal numerical rating scale (VNRS: 0-no pain to 10 as severest pain imaginable) at arrival in recovery room. (time 0, 30mins, 2 hours, 4 hours, 6 hours, 8 hours, 16 hours, 20 hours, 24 hours.) postoperatively. Pain was scored under two situation ,one verbal numerical rating scale at rest (VNRSr), other verbal numerical rating scale at coughing (VNRSc) by a blind investigator every time. Nausea/vomiting and dizziness events were also recorded. Patient was given Inj.Tramadol 100mg when VNRSr were greater than 4 in recovery room as rescue analgesia. Patient was managed with a standard protocol including Inj. Diclofenac 75mg I.V infusion 8 hourly. In the ward when VNRSr is greater than 4 or the patient wanted analgesic, rescue analgesia (Inj. Tramadol 100mg) was given. All given analgesics at recovery room and ward were recorded and time and dose were noted. Nausea and vomiting and any other complication were also recorded.

Statistical analysis was performed with the SPSS software, Trial version 23 for Windows statistical software package (SPSS inc., Chicago, USA) and Primer. The Categorical data were analyzed among groups using Chi square test. The quantitative data were presented as mean and standard deviation and were compared using by students t-test. The level of all analysis was set at P=0.05 and probability P value <0.05 was considered statistically significant.

For sample size calculation, we considered a pilot study and found that 24 hour tramadol requirement was 4 doses of 100 mg each in control group. We

considered that there should be 25% absolute reduction in dose in TAP group. We calculated that 26 patient per group would be required for experimental study of two equal sized group, using an α=0.05 and β=0.2. We elected to recruit 30 patients per group to minimise any effect of data loss into the study.

Result

The time to first rescue analgesia was 76.80 ± 45.891 minutes in control group and 312.00 ±134.64 minutes in the TAP group (Table 1) and this difference in time was statistically highly significant (p<0.001).

The total doses of Tramadol consumption in our study was 4.48±0.51 in control group and 2.88 ±0.726 in TAP group (Table-2) and their difference in total doses was highly significant too (p<0.001).

The VNRS resting at 10mins, 30mins, 2 hours, 4 hours, 6 hours up to 8 hours was lower in TAP block group than the control group. The difference was statistically highly significant up to 2 hr but after 8 hr score was more or less same. The same is with VNRS coughing. The difference between TAP and control group is highly significant up to 8 hours, that indicate that effect of TAP block remain up to 6-8 hours (Table 3, 4).

We did not find any complication like peritoneal puncture, bowel perforation, pneumoperitoneum, bleeding at needle insertion site.

There was no difference between two groups in demographic data (Table 5).

Table 1: Time for first rescue analgesia in minutes

Group	N	Mean (min)	Std. Deviation	P Value
control	30	76.80	45.891	<0.001
TAP	30	312.00	134.164	
Total	60	194.40	154.790	

Table 2: Total no of tramadol doses given (Single Dose Contain 100mg)

Group	N	Mean (no of dose)	Std. Deviation	P Value
control	30	4.48	.510	
TAP	30	2.88	.726	<0.001
Total	60	3.68	1.019	

Table 3: Comparison of VNRS at resting in control and TAP gp according to time

Group		VNRS resting @ 10 mins	VNRS resting @ 30 mins	VNRS resting @ 2hrs	VNRS resting @ 4 hrs	VNRS resting @ 8 hrs	VNRS resting @ 12 hrs	VNRS resting @ 16 hrs	VNRS resting @ 20 hrs	VNRS resting @ 24 hrs
control	N	30	30	30	30	30	30	30	30	30
	Mean	3.72	5.36	5.04	3.96	6.48	2.00	7.96	2.24	7.80
	Std. Deviation	.614	1.630	1.020	1.020	.510	0.000	.200	1.200	1.000
TAP	N	30	30	30	30	30	30	30	30	30
	Mean	2.12	2.12	2.72	3.28	5.28	3.32	4.52	3.52	5.16
	Std. Deviation	.332	.332	1.882	1.621	2.189	1.973	2.163	1.873	2.718
		<0.001	<0.001	<0.001	.082	.010	.002	<0.001	.006	<0.001

Table 4: Comparison of VNRS at coughing in control and TAP gp according to time

Group		VNRS coughing @ 10mins	VNRS coughing @30 mins	VNRS coughing @2 hours	VNRS coughing @4 hours	VNRS coughing @8 hours	VNRS coughing @12 hours	VNRS coughing @16 hours	VNRS coughing @20 hours	VNRS coughing @ 24 hours
Control	N	30	30	30	30	30	30	30	30	30
	Mean	4.60	6.36	5.56	4.92	7.48	2.00	7.92	2.24	7.84
	Std. Deviation	.500	1.630	1.530	1.077	.510	0.000	.400	1.200	.800
TAP	N	30	30	30	30	30	24	30	30	30
	Mean	2.24	2.24	2.76	3.84	6.00	3.71	5.00	4.04	5.44
	Std. Deviation	.663	.663	1.786	2.014	2.533	2.476	2.598	2.300	2.888
P value LS		<0.001	<0.001	<0.001	.022	.006	.001	<0.001	.001	<0.001

Table 5: Demographic Data

	Control GP	TAP GP
Age [mean±SD)	35.24±13.34	31.20 ±13.60
M/F Ratio	12/18	10/20
ASA Grade I/II	14/16	13/17

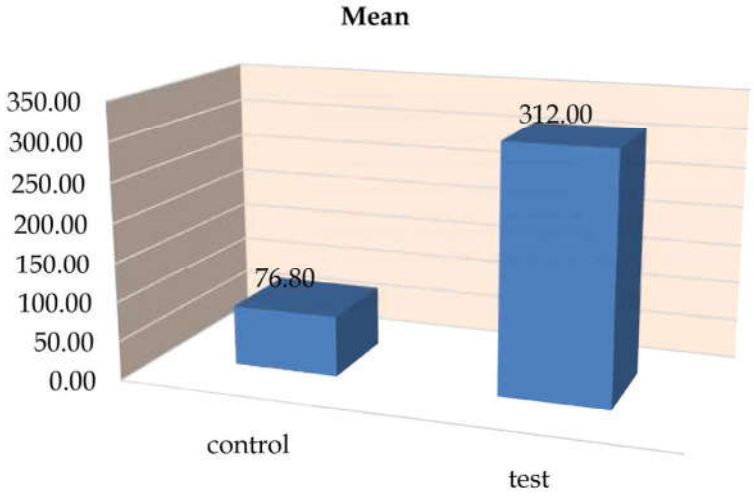

Fig. 1: Control n=30 and TAP n=30 pts on x axis. Time for first rescue analgesia in minutes on y axis. Data expressed as mean.

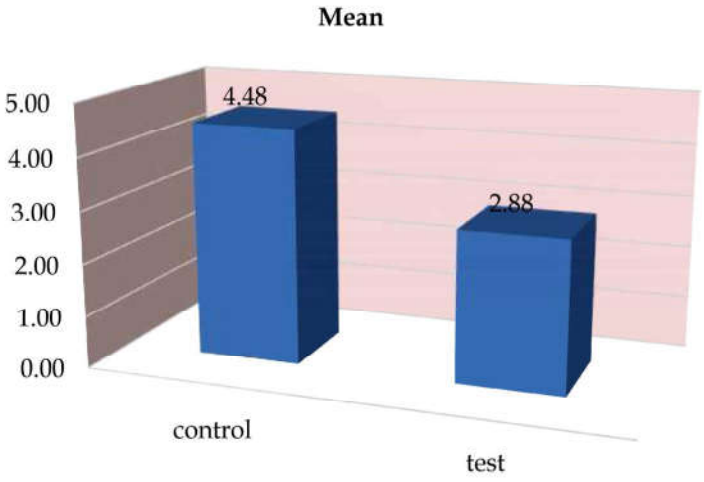

Fig. 2: Control n=30 and TAP n=30 pts on x axis. Number of doses on y axis. Data expressed as mean

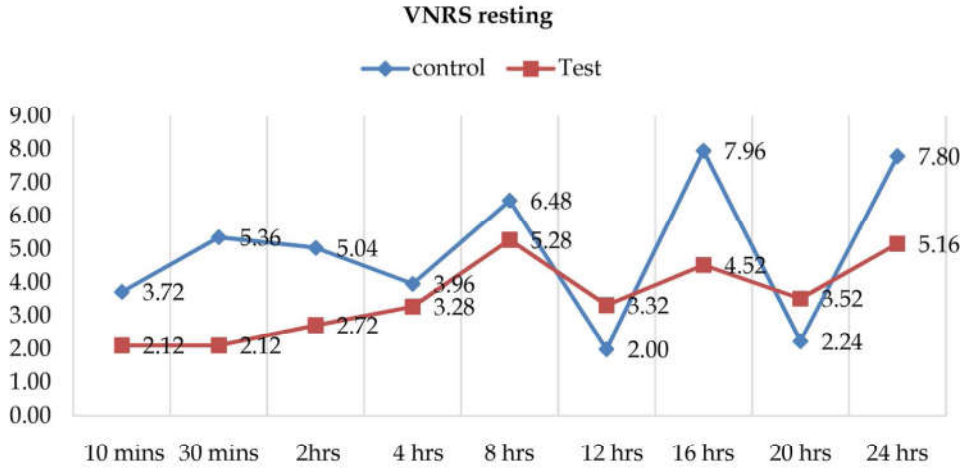

Fig. 3: X axis shows different time interval and y axis shows VNRS at resting.

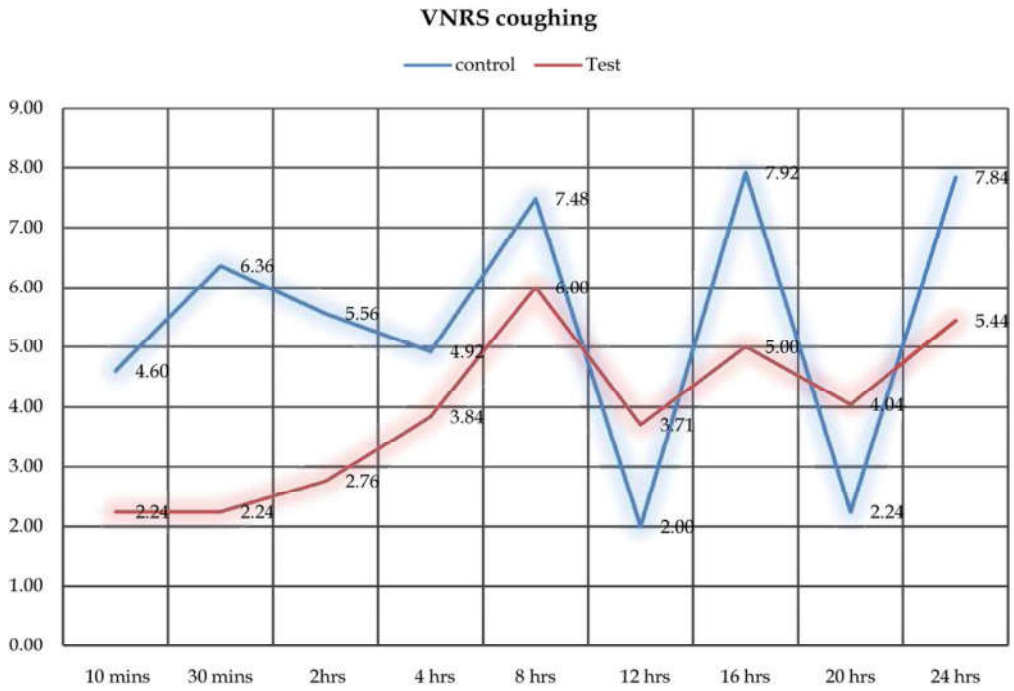

Fig. 4: X axis shows different time interval and y axis shows VNRS at coughing.

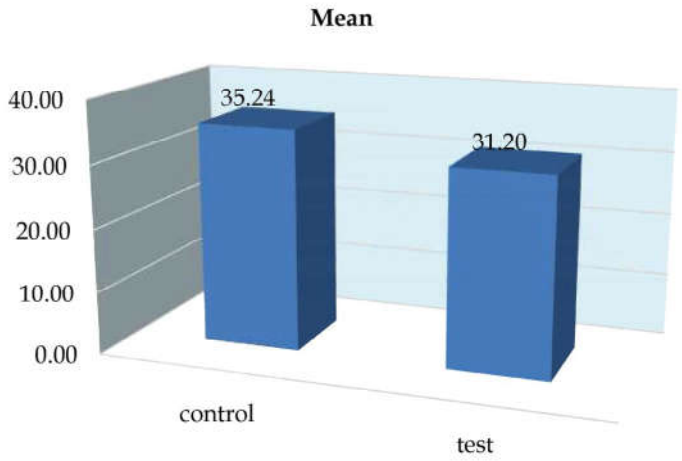

Fig. 5: Control n=30 and TAP n=30 pts on x axis. Data expressed as mean for age on y axis

Disscussion

Benefits of good postoperative analgesia are reduced postoperative stress response, better satisfaction of patient and improved patient outcome [13].

Many studies have been conducted there to determine the analgesic effect of TAP block under different surgeries, different type of drugs (bupivacaine, ropivacaine) and different concentration of drugs and time of block.

Studies which have shown positive effect of TAP block [6,12,13] in major operation such as hysterectomy, caesarean section and large bowel operation.

In our study total dose of Tramadol consumption in 24 hr is reduced significantly with $p<0.001$ in the TAP block group than control group (Table 1).

Mc O Donell et al. [12,13] also reported reduced morphine requirement after large bowel resssection in TAP group using 0.375% levobupivacaine and also decreased requirement after caesarean delivery using 0.375% levobupivacaine in the first 48 hour.

Carney et al. [6] also reported decreased morphine requirement in the TAP block group with 0.75% ropivacaine.

Niraj et al.[15] used TAP block with 0.5% bupivacaine in open appendectomy and morphine requirement and pain score decreased in 1st 24hours.

Study done by Soo Young et al. [21] by using TAP block in open appendectomy also reported decrease number of postoperative analgesia.

Vijaylaxmi et al. [22] in their study of comparison of TAP block in lower abdominal gynaecological surgeries also reported that morphine requirement and VAS at 0,4,6,24 hours were less in group TAP .

In our study USG guided TAP block with 20ml 0.5%levobupivacaine in open appendectomy reduced VNRS resting [Table 3,4] and coughing up to 6-8 hours [Table 3 & 4]. After TAP block duration of analgesia is prolonged because TAP plane is poorly vascular, so absorption of drugs is delayed [18].

Study done by Bhatacharjee et al [3] reported duration of postoperative analgesia following TAP block to be 290 minutes which is very much similar to our study.

RajagopalanVenkatraman [18] also found that duration for analgesia after TAP block with ropivacaine lasted for 390 minutes.

Sharma et al. [20] evaluated analgesic effect of TAP block after abdominal surgery, In their study TAP block reduced VAS pain score up to 24 hours.

Study done by Maitreyi et al. [11] with 0.5% ropivacaine , noted that for first 8-10 hour post operative VAS score was reduced in TAP block group as compared to placebo block. Their mean Tramadol requirement also reduced in TAP block group for 24 hours.

Carney et al [5] in their study of TAP block after appendectomy in children stated that when TAP block was used with ropivacaine, their mean (±SD) morphine requirement in the first 48 hours was reduced as, compared with placebo.

Carney et al.[6] also noted that time to first need of rescue analgesia needed was significantly prolonged after abdominal hysterectomy.

All these findings correlate with our study.

However some studies showed different results, Ortiz et al. [16] compared TAP block and local anaesthetic infiltration to trocar insertion sites in laparoscopic Cholecystectomy and they found no difference in pain score and total analgesic requirements.

Study done by Sooyoung C et al. [21] also suggested difference in time to first rescue analgesia (100.2±254.3 v/s 40.9±34.7) minute up to 12 hours but no difference thereafter..

We did not found any complication in our study. Some incidence of colon injury and liver injury has been seen with TAP block

Chandan et al. [6] done a randomised trial on ultrasound guided TAP block versus continuous wound infusion for post caesarean analgesia, but their study was terminated very soon. They reported the occurrence of generalised seizure in one patient of TAP group. This was reported due to higher dose of drug used or accidental intravenous injection.

There is some limitation in our study. The major one is that, duration of analgesia lasted not beyond than 24 hours. We could have also prolonged the duration by using the catheter. We have not used morphine or any other drug by patient controlled analgesia, because this is not routinely used in our hospital. We would have given better result by using this method of analgesia.

The standard pain control regimen for open appendectomy in our hospital is i.v. NSAIDs and the use of i.v. Tramadol. In our study VNRS during the first 3 hour reduced significantly [$p<0.001$] and decrease VNRS up to 6-8 hours.

Conclusion

As result of this study USG guided TAP block with 0.5% levobupivacaine reduce post operative pain and postoperative opioids consumption, it will be very helpful to us and also for patient who are vulnerable to opioids, especially in night time and by this manner, we increase the satisfaction of patient and reduce the length and cost of hospital stay.

References

1. Aida S, Baba H, Yamakura T, Taga K, Fukuda S, Shimoji K. The effectiveness of preemptive analgesia varies according to the type of surgery: a randomized, double-blind study. Anesthesia Analgesia 1999;89: 711-16.
2. Aveline C, Le Hetet H, Le Roux A, et al. Comparison between ultrasound-guided transversus abdominis plane and conventional ilioinguinal/iliohypogastric nerve blocks for day-case open inguinal hernia repair. Br J Anaesth. 2011;106(3):380–386.

3. Bhattacharjee S, Ray M, Ghose T, Maitra S, Layek A. Analgesic efficacy of transversus abdominis plane block in providing effective perioperative analgesia in patients undergoing total abdominal hysterectomy: a randomized controlled trial. J Anaesthesiol Clin Pharmacol. 2014;30:391–396.
4. Buvanendran A, Kroin JS. Useful adjuvants for postoperative pain management. Best Pract Res Clin Anaesthesiol 2007;21(1):31-49.
5. Carney J, Finnerty O, Rauf J, Curley G, McDonnell JG, Laffey JG. Ipsilateral transversus abdominis plane block provides effective analgesia after appendectomy in children: a randomized controlled trial. Anesth Analg. 2010;111:998–1003.
6. Carney J, McDonnell JG, Ochana A, Bhinder R, Laffey JG. The transverses abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy. Anesth Analg 2008;107:2056-60.
7. Chandon M, Bonnet A, Burg Y, et al. Ultrasound-guided transversus abdominis plane block versus continuous wound infusion for post-caesarean analgesia: a randomized trial. PLoS One. 2014;9(8):1–6.
8. El-Dawlatly AA, Turkistani A, Kettner SC, et al. Ultrasound-guided transversus abdominis plane block: description of a new technique and comparison with conventional systemic analgesia during laparoscopic cholecystectomy. Br J Anaesth. 2009;102 (6):763–767.
9. Hosgood SA, Thiyagarajan UM, Nicholson HF, Jeyapalan I, Nicholson ML. Randomized clinical trial of transversus abdominis plane block versus placebo control in live-donor nephrectomy. Transplantation. 2012;94:520–525.
10. Jensen SI, Andersen M, Nielsen J, Qvist N. Incisional local anaesthesia versus placebo for pain relief after appendectomy in children: a double-blinded controlled randomised trial. European Journal of Paediatric Surgery 2004;14:410–413.
11. Maitreyi G,Shalini P, Poonam S . Ultrasound-guided transverses abdominis plane block for post-operative analgesia in patients undergoing caesarean section. Indian J Anaesth.2016 Apr;60(4):253-257.
12. McDonnell JG, Curley G, Carney J, et al. The analgesic efficacy of transversus abdominis plane block after cesarean delivery: a randomized controlled trial. Anesth Analg. 2008;106:186–191.
13. McDonnell JG, O'Donnell B, Curley G, Heffernan A, Power C, Laffey JG. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: a prospective randomized controlled trial. Anesth Analg. 2007;104:193–197.
14. McDonnell JG, O'Donnell BD, Farrell T, et al. Transversus abdominis plane block: A cadaveric and radiological evaluation. Reg Anesth Pain Med. 2007; 32:399–404.
15. Niraj G, Searle A, Mathews M, Misra V, Baban M, Kiani S, et al. Analgesic efficacy of ultrasound-guided transversus abdominis plane block in patients undergoing open appendicectomy. Br J Anaesth 2009;103:601-5.
16. Ortiz J, Suliburk JW, Wu K, Bailard NS, Mason C, Minard CG, et al. Bilateral transversus abdominis plane block does not decrease postoperative pain after laparoscopic cholecystectomy when compared with local anesthetic infiltration of trocar insertion sites. Reg Anesth Pain Med 2012;37:188-92.
17. Petersen PL, Stjernholm P, Kristiansen VB, et al. The beneficial effect of transversus abdominis plane block after laparoscopic cholecystectomy in day-case surgery: a randomized clinical trial. Anesth Analg. 2012;115:527–533.
18. Rajagopalan V, Ranganathan J, Ayyanar S, Govindarajan S. Efficacy of ultrasound-guided transverses abdominis plane block for postoperative analgesia in patient undergoing inguinal hernia repair. .Local Reg Anesth. 2016 Jan 18;9:7-12.
19. Salman AE, Yeti°ir F, Yurekli B, Aksoy M, Yildirim M, Kilic M. The efficacy of the semi-blind approach of transversus abdominis plane block on postoperative analgesia in patients undergoing inguinal hernia repair: a prospective randomized double-blind study. Local Reg Anesth. 2013;6:1–7.
20. Sharma P, Chand T, Saxena A, Bansal R, Mittal A, Shrivastava U. Evaluation of postoperative analgesic efficacy of transversus abdominis plane block after abdominal surgery: a comparative study. J Nat Sci Biol Med. 2013;4:177–180.
21. Sooyoung Cho,Youn-Jin Kim,Dong-Yeon Kim,Soon-Sup Chung. Postoperative analgesic effect of ultrasound-guided transverses abdominis plane block for open appendectomy. J Korean Surg soc 2013;85 (3):128-133.
22. Vijayalakshmi S, Arumugam V, Sumanlata G, Ashok S. Coamparison of analgesic of transverses abdominis plane block with direct infiltration of local anesthetic into surgical incision in lower abdominal gynecological surgeries. J Anaesthesiol Clin Pharmacol. 2013 Jan-Mar;29(1):71-75.
23. Weintraud M, Marhofer P, Bo¨senberg A, Kapral S, Willschke H, Felfernig M, Kettner S. Ilioinguinal/ iliohypogastric blocks in children: where do we administer the local anaesthetic without direct visualization. Anesthesia Analgesia 2008;106.