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OPEN ACCESS JOURNAL ISSN: 2148-6832

MSD Medical Science and Discovery
2018; 5(6):224-8

Research Article Doi: 10.17546/msd.429382

Is ultrasound-guided transversus abdominis plane block in providing analgesia in pediatric cases safe and efficient?: A retrospective study

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Abstract

Objective: The use of high or insufficient doses of analgesics in pediatric cases unfavorably affects the patient's health in the postoperative period. Ultrasound-guided transversus abdominis plane (TAP) block is used in the management of postoperative pain in pediatric cases. The present study aims to evaluate the efficacy of ultrasound-guided TAP block in pediatric patients using a mixture of lidocaine and bupivacaine.

Methods: The medical records of cases, who underwent surgery for the repair of the inguinal hernia and undescended testis using ultrasound-guided TAP block in the department of pediatric surgery, were retrospectively reviewed (28 cases). The study included ASA I-II pediatric cases aged 2-12 years. The amount of drug administered while performing USG-guided TAP block, time to first analgesic use in the postoperative period, pain score and the amount of first analgesic administration were recorded. The satisfaction of the surgeon and patient's companion was evaluated.

Results: A p-value <0.05 was considered statistically significant. The findings showed that pain score was the lowest in the group with the highest patient's companion and physician satisfaction score, and the highest in group with the lowest satisfaction score and the difference was statistically significant (p<0.001). The satisfaction of the physicians (p=0.010) and the patient's companion (p=0.027) increased with increasing drug volume.

Conclusions: The volume of 0.4 ml.kg-1 (50:50 1% lidocaine and 2.5% bupivacaine) achieved the best physician and patient's companion satisfaction and the longest duration of analgesia in pediatric cases undergoing surgery for the repair of the inguinal hernia and undescended testis. The lack of any complications in the present study suggests that USG-guided TAP block is a safe procedure in pediatric patients in experienced hands. Further studies are required.

Keywords: Transversus abdominis plane, Ultrasound-guided, Pediatric cases.

Introduction

Postoperative pain management has a growing importance for the patient's quality of life and response to therapy. TAP block involves administration of local anesthetics into anatomic neuro fascial space between internal oblique and transversus abdominis muscles in the antero-lateral region of the abdomen to block anterior branches of the thoracic intercostal (T7-T12) and first lumbar (L1) nerves (1). Although this block was previously performed, Hebbard et al. were the first to describe ultrasound (USG)-guided TAP block technique (2). This technique has made the procedure easier to perform, and USG-guided TAP block was widely used with scarcely any complications, if any. Nowadays, TAP block is an auxiliary analgesic method often used to reduce opioid use in the intraoperative period or reduce systemic analgesic use in the postoperative pain management, thereby reducing the use of high doses of analgesic or eliminating the need for using IV or IM analgesics after procedures that may be extremely painful.

The use of high or insufficient doses of analgesics in pediatric cases unfavorably affects the patient health in the postoperative period. Today, the use of ultrasound-guided transversus abdominis plane (TAP) block has become a popular procedure for postoperative pain control in pediatric cases (3).

The aim of the present study is to retrospectively evaluate the efficacy of USG-guided TAP block in ASA I-II patients who underwent inguinal hernia or undescended testis repair under elective conditions.

Received 01-06-2018 **Accepted** 18-06-2018 **Available Online** 30-06-2018
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http://dx.doi.org/10.17546/msd.429382

Materials and Methods

After obtaining approval of the ethics committee on 15.10.2017, the medical records of cases, who underwent surgery for the repair of the inguinal hernia and undescended testis using ultrasound-guided TAP block in the department of pediatric surgery at Harran University Faculty of Medicine between January 15.10.2017 and September 2017, were retrospectively reviewed. The study included ASA I-II 28 pediatric cases aged 2-12 years. Patients with a history of opioid use or allergy to local anesthetics and patients with infections at the injection site and those with coagulation disorders were excluded. The data retained by the departments of surgery and anesthesiology, data of intelligence technologies department, and medical charts of the patients were reviewed. The patients underwent electrocardiography (EKG), heart rate monitoring (HRM), non-invasive blood pressure (NIBP) monitoring and peripheral oxygen saturation (SpO2) monitoring in the pre-anesthesia preparation room. Patients who underwent surgery received general anesthesia. After induction of anesthesia using a routine protocol involving propofol 2.5-3 mg.kg-1, fentanyl 2 µgr.kg-1, and rocuronium0.6 mg.kg-1, anesthesia was maintained using 50%/50% O2/air, sevoflurane 2-3%, and remifentanil infusion at a rate of 0.05-0.1 µgr.kg-1.min-1. While performing ultrasound-guided (Esaote MyLab 30 Gold, Italy) TAP block, abdominal cavity was scanned laterally with the probe (Figure 1); the drug was injected by passing the 50 mm 22 G nerve needle (Pajunk, SonoPlex STIM, Germany) through subcutaneous tissues, external oblique muscle, and internal oblique muscle. (Figure 2) TAP block was performed in ultrasound guidance using 0.2-0.3 or 0.4 ml.kg-1 50:50 mixture of lidocaine 1% and bupivacaine 0.25%. The face, legs, activity, cry, consolability scale or numeric pain scale (0-10) were used to evaluate postoperative pain in patients aged three years who are deemed suitable. Patients who achieved >4 points on the scale received paracetamol 10-15 mg.kg-1 for pain relief.

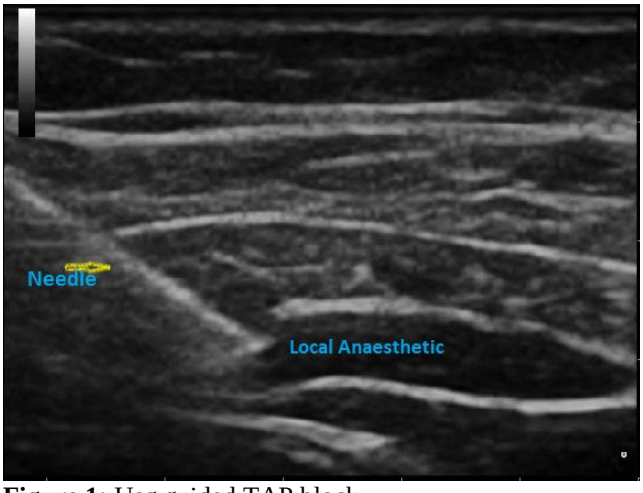

Figure 1: Usg guided TAP block

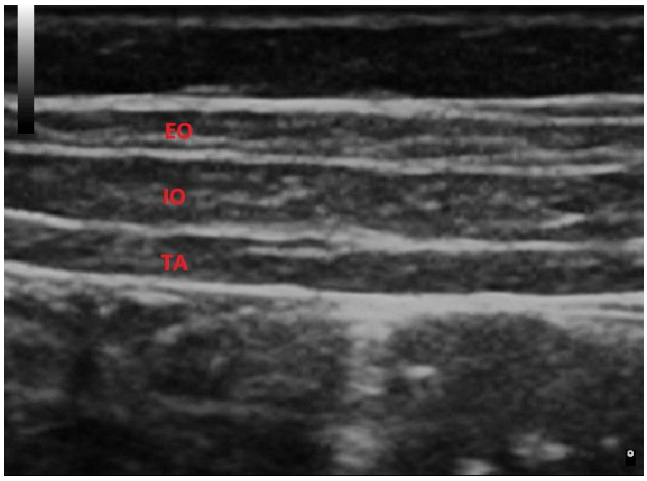

Figure 2: EO: External oblique, IO: Internal oblique, TA: Transversus abdominis

Demographic data of the patients, blood pressures at the entrance and with 5-minute intervals during surgery, peripheral oxygen saturation, heart rate and operation time were recorded. Specific diagnosis leading to surgery, uni or bilateral surgery, time to perform TAP block and the amount of drug administered was examined. The time to first analgesic use in the postoperative period, pain score and the amount of first analgesic administration were examined. The satisfaction of the surgeon and patient's companion was examined after surgery (poor: 1, moderate: 2, good: 3). The patients were monitored for postoperative complications, such as nausea, vomiting, urinary retention, femoral nerve paresthesia, hematoma, and organ and tissue injury.

Statistical Analysis

The data were analyzed using SPSS for Windows version 23.0. Descriptive statistics for continuous variables included mean and standard deviation and categorical variables were expressed as a percentage. The Mann-Whitney test was used in the comparison of paired groups without normal distribution, and Kruskal Wallis test was used to compare multiple groups. Chi-square test was used to compare the categorical variables. The Spearman's rank correlation coefficient was calculated to evaluate the correlation between continuous variables. A p-value <0.05 was considered statistically significant.

Results

Demographic data are presented in Table 1.

The scores in pain scale (PS) were highest in patient's companions that were dissatisfied the most, and pain scores were lowest in patient's companions that were satisfied the most ($p<0.001$). The duration of postoperative analgesia was the lowest in dissatisfied patient's companions and the highest in satisfied patient's companions ($p<0.001$) (Table 2).

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The physician satisfaction score (p=0.010) and patient's companion satisfaction score (p=0.027) increased with increasing drug volume, and the highest satisfaction score was observed with a volume of 0.4 ml.kg-1 (Table 3 and Table 4).

The score on PS was the lowest in physicians with the highest satisfaction score and the highest in physicians with the lowest satisfaction score (p<0.001). The duration of postoperative analgesia was the highest in physicians with the highest satisfaction score and the lowest in physicians with the lowest satisfaction score (p<0.001).

The time to perform TAP block, patient age and the number of postoperative analgesics were similar at all physician satisfaction levels (Table 5).

There was a strong negative correlation between the duration of postoperative analgesia and the score on PS (r=0.835, p<0.001). The score on PS decreased with increasing duration of postoperative analgesia.

Table 1: Types of surgery operations

	Unilateralhernia		Bilateralhernia		Undescended testis		P
	n	%	n	%	n	%	
Sex							
Male	11	68,8%	2	40,0%	7	100,0%	**0,239**
Female	5	31,3%	3	60,0%			
Block location							
Lateral	8	50,0%			2	28,6%	
Right	8	50,0%			3	42,9%	**0,046**
Bilateral			5	100,0%	2	28,6%	

Table 2: Postop: postoperative, PS: pain scala

	Poor		Moderate		Good		p
	Mean	SD	Mean	SD	Mean	SD	
Age	6,71	2,93	3,44	1,01	6,67	3,28	**0,009**
PS	5,86	1,21	2,11	1,9	0,92	0,67	**<0,001**
Postop analgesia duration (hour)	1	0	7,56	3,21	10,25	1,22	**<0,001**
Amount of postop analgesia (paracetamol mg.kg^{-1})	9,71	0,76	9,78	0,67	9,67	0,78	0,939
Application block time (minute)	4	0,58	5	1,5	5,5	1,45	0,051

Table 3: Satisfaction of physician

		Satisfaction of physician						P
		Poor (n=4)		Moderate (n=7)		Good (n=17)		
		n	%	n	%	n	%	
Sex	**Male**	3	15,0%	6	30,0%	11	55,0%	**0,422**
	Female	1	12,5%	1	12,5%	6	75,0%	
Drug Volume(ml kg^{-1})	**0,2**	3	37,5%	2	25,0%	3	37,5%	**0,010**
	0,3	1	10,0%	4	40,0%	5	50,0%	
	0,4	0	0,0%	1	10,0%	9	90,0%	

Table 4: Satisfaction of patient's companion

		Satisfaction of patient's companion						P
		Poor		Moderate		Good		
		n	%	n	%	n	%	
Age	**Male**	6	30,0%	6	30,0%	8	40,0%	**0,470**
	Female	1	12,5%	3	37,5%	4	50,0%	
Volume(ml kg^{-1})	**0,2**	4	50,0%	2	25,0%	2	25,0%	**0,027**
	0,3	2	20,0%	5	50,0%	3	30,0%	
	0,4	1	10,0%	2	20,0%	7	70,0%	

http://dx.doi.org/10.17546/msd.429382

Table 5: Postop: postoperative, PS: painscala

	Satisfaction of physician						
	Poor (n=4)		Moderate (n=7)		Good (n=17)		p
	Mean	SD	Mean	SD	Mean	SD	
Age	6,75	3,3	4,57	2,64	5,82	3,11	0,340
Ps	6,25	1,5	4,43	1,4	0,88	0,7	**<0,001**
Postop analgesia time (hour)	1	0	3	2,24	10,18	1,19	**<0,001**
Amount of postop analgesia (paracetamol mg.kg^{-1})	10	0	9,43	0,98	9,76	0,66	0,396
Application block time (minute)	4	0,82	4,57	1,51	5,35	1,37	0,072

Discussion

The studies have indicated that 25% to 67% of patients receive insufficient therapy for pain. Insufficient pain control results in cardiac problems, such as cardiac hypertension, arrhythmia, and myocardial ischemia, pulmonary complications, are associated with insufficient cough and reduced respiratory movements, such as atelectasia, and prolongs the duration of hospital stay by reducing the response to therapy (4-5). Opioids possess side effects, including sedation, respiratory depression, pruritus, and nausea-vomiting, while neuro axial methods may result in complications like paraplegia or hemorrhage. USG-guided TAP block is used for analgesic purposes in patients undergoing lower abdominal surgery.

USG-guided TAP block can be performed before the induction of anesthesia or immediately before closure of the incision (6-7). In the present study, TAP block was performed before closure of the incision, as this gives a longer duration of postoperative analgesia.

Although TAP block could be performed using various anesthetic agents, such as ropivacaine, bupivacaine, levobupivacaine, chirocaine, and lidocaine, the present study used a mixture of lidocaine and bupivacaine due to the rapid onset of action for lidocaine and better safety profile of bupivacaine (8,9-10).

The finding that the scores on NPS were significantly higher in the group with the highest patient's companion and physician satisfaction score suggests that patients with lower postoperative pain score result in higher level of satisfaction in patient's companions and physicians. The finding that the duration of postoperative analgesia was significantly higher in physicians and patient's companions with the highest satisfaction score suggests that increasing duration of analgesia increased the level of satisfaction.

There is research that evaluated the optimal dose in pediatric cases and reported that levobupivacaine 0.2 ml.kg-1 provided the highest level of analgesia (11). One study that evaluated ilio-inguinal block versus TAP block in pediatric cases undergoing inguinal surgery used 0.3 ml.kg-1 lidocaine 1% added in equal volume to ropivacaine 1%.

Research on infants used 0.1 ml.kg-1 0.25% levobupivacaine 0.25% (12). In the study conducted by Sahin et al., 0.5 ml.kg-1 levobupivacaine 0.25% was found to be the most appropriate dose providing prolonged analgesia in patients undergoing inguinal hernia repair with USG-guided TAP block (13). In the present study, TAP block was performed at doses of 0.2, 0.3 and 0.4 ml.kg-1 (50:50, lidocaine 1% and bupivacaine 0.25%) and the satisfaction score of patient's companions and physicians increased with increasing drug volume, and this finding was statistically significant. The highest satisfaction score was observed with a drug volume of 0.4 ml.kg-1. A postoperative PS score of <4 was most commonly observed in patients who received a dose of 0.4 ml.kg-1. The lack of complications, such as nausea, vomiting, urinary retention, femoral nerve paresthesia, hematoma, and organ and tissue injury, in patients receiving TAP block indicates that ultrasound-guided TAP block is a safe procedure in pediatric cases.

Conclusion

Postoperative pain control has a growing importance in pediatric cases. Despite the use of various drug volumes, the highest satisfaction scores in physicians and patient's companions and the longest duration of analgesia were achieved using a drug volume of 0.4 ml.kg-1 (lidocaine 1% and bupivacaine 0.25%) in pediatric cases undergoing inguinal hernia and undescended testis repair. The lack of any postoperative complications in the present study suggests that USG-guided TAP block could be a safe method for providing analgesia in pediatric patients in experienced hands. Further controlled studies are required to provide valuable insights into the relevant literature.

Conflict of Interest: The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author's Contributions: OB, OHK, EB, MAK, NA: Research concept and design; patient examination, data collecting, analysis and interpretation of data**. OB:** Preparation of article, Revisions. All authors approved the final version of the manuscript.

Ethical issues: All Authors declare, Originality and ethical approval of research. Responsibilities of research, responsibilities against local ethics commission are under the Authors responsibilities. The study was conducted under defined rules by the Local Ethics Commission guidelines and audits.

References

1. El-Dawlatly AA, Turkistani A, Kettner SC, Machata AM, Delvi MB, Thallaj A, Kapral S, Marhofer P. Ultrasound-guided transversus abdominis plane block: description of a new technique and comparison with conventional systemic analgesia during laparoscopic cholecystectomy. Br J Anaesth. 2009 Jun;102(6):763-7. doi: 10.1093/bja/aep067. Epub 2009 Apr 17

2. Hebbard P, Fujiwara Y, Shibata Y, Royse C. Ultrasound-guided transversus abdominis plane (TAP) block. Anaesth Intensive Care. 2007 Aug;35(4):616-7.

3. Fredrickson M, Seal P, Houghton J. Early experience with the transversus abdominis plane block in children. Paediatr Anaesth. 2008 Sep;18(9):891-2. doi: 10.1111/j.1460-9592.2008.02591.x.

4. Apfelbaum JL, Chen C, Mehta SS, Gan TJPostoperative pain experience: results from a national survey suggest postoperative pain continues to be undermanaged. Anesth Analg. 2003 Aug;97(2):534-40

5. Dolin SJ1, Cashman JN, Bland JM. Effectiveness of acute postoperative pain management: I. Evidence from published data. Br J Anaesth. 2002 Sep;89(3):409-23.

6. Griffiths JD1, Middle JV, Barron FA, Grant SJ, Popham PA, Royse CF. Transversus abdominis plane block does not provide additional benefit to multimodal analgesia in gynecological cancer surgery. Anesth Analg. 2010 Sep;111(3):797-801. doi: 10.1213/ANE.0b013e3181e53517. Epub 2010 Jun 14.

7. Bharti N1, Kumar P, Bala I, Gupta V. The efficacy of a novel approach to transversus abdominis plane block for postoperative analgesia after colorectal surgery. Anesth Analg. 2011 Jun;112(6):1504-8. doi: 10.1213/ANE.0b013e3182159bf8. Epub 2011 Apr 5.

8. Petersen PL1, Mathiesen O, Stjernholm P, Kristiansen VB, Torup H, Hansen EG, Mitchell AU, Moeller A, Rosenberg J, Dahl JB. The effect of transversus abdominis plane block or local anaesthetic infiltration in inguinal herniarepair: a randomised clinical trial. Eur J Anaesthesiol. 2013 Jul;30(7):415-21. doi: 10.1097/EJA.0b013e32835fc86f.

9. Petersen PL1, Mathiesen O, Stjernholm P, Kristiansen VB, Torup H, Hansen EG, Mitchell AU, Moeller A, Rosenberg J, Dahl JB. The effect of transversus abdominis plane block or local anaesthetic infiltration in inguinal herniarepair: a randomised clinical trial. Eur J Anaesthesiol. 2013 Jul;30(7):415-21. doi: 10.1097/EJA.0b013e32835fc86f.

10. Milone M1, Di Minno MN, Musella M, Maietta P, Iacovazzo C, Milone F. Ultrasound-guided transversus abdominis plane block for retroperitoneal varicocele repair. Could it be an anesthesia method? Updates Surg. 2013 Sep;65(3):225-30. doi: 10.1007/s13304-013-0211-6. Epub 2013 Apr 26.

11. Sola C1, Menace C, Rochette A, Raux O, Bringuier S, Molinari N, Kalfa N, Capdevila X, Dadure C. Ultrasound-guided tranversus abdominis plane block for herniorrhaphy in children: what is the optimal dose of levobupivacaine? Eur J Anaesthesiol. 2014 Jun;31(6):327-32. doi: 10.1097/EJA.0000000000000040.

12. Chen CK1, Teo SC2, Phui VE3, Saman MA2. Analgesic efficacy of transversus abdominis plane block in neonates and early infants for colostomy and reversal of colostomy. Agri. 2015;27(4):210-4. doi: 10.5505/agri.2015.66487.

13. Sahin L1, Sahin M, Gul R, Saricicek V, Isikay N. Ultrasound-guided transversus abdominis plane block in children: a randomised comparison with wound infiltration. Eur J Anaesthesiol. 2013 Jul;30(7):409-14. doi: 10.1097/EJA.0b013e32835d2fcb.