Med. J. Cairo Univ., Vol. 87, No. 2, March: 1287-1291, 2019
www.medicaljournalofcairouniversity.net

Ultrasound Guided Transversus Abdominis Plane Block Using Dexmedetomidine and Bupivacaine in Children Undergoing Laparoscopic Orcheopexy: Randomized Controlled Trial

FATMA A. ABD EL-AAL, M.D.; RAGAA A. HERDAN, M.D. and JUMMAH J.M. ABORIMA, M.Sc.

The Department of Anesthesia and Intensive Care Surgery, Assiut University Hospitals, Assiut, Egypt

Abstract

Background: To assess the onset time, duration and post-operative analgesic efficacy of ultrasound guided TAP block in children with undescended testis who underwent laparoscopic orcheopexy.

Aim of Study: The addition of dexmedetomidine to bupivacaine in TAP block achieves better local anesthesia quality and provides better pain control postoperatively without any major side-effects.

Patients and Methods: A prospective randomized controlled double blind study using a computer generated randomization was conducted in Assiut University between March 2016 and September 2017.

Results: Regarding SpO_2 and HR of the studied groups at different times; it was noticed that there was no statistically significant differences between the two groups ($p>0.05$). Regarding end tidal CO_2 measurements, there was a statistically significant difference ($p<0.05$) after induction, at 10 minutes and at 70 minutes. There was statistically significant difference ($p<0.001$) after 30-60 minutes and from 80 minutes up to end of surgery with higher mean values at Group A. There was no statistically significant difference at others times. For mean arterial blood pressure recordings, there was statistically significant difference ($p>0.001$) from time before induction up to after 40 minutes, 80 minutes and at end. There was no statistically significance difference ($p>0.05$) at time 50-70 minutes, 90 minutes and before extubation. Regarding post-operative pain scores, in Cry, Facial and Torso there was no statistically significant difference at 4 hours, but there was statistically significant difference ($p<0.001$) at 8 and 12 hours. As regarding child verbal, touch and legs there was a statistically significant difference ($p<0.05$) at 4, 8 and 12 hours. Regarding frequency of post-operative analgesic request, there was a statistically significant difference between Groups A and B ($p<0.05$) with (85.0%) request analgesia in Group A vs. (60.0%) in Group B. Egarding the time of the first analgesic request, there was statistically significant difference between Group A and Group B ($p<0.001$) with higher mean values in Group B than Group A.

Conclusion: The addition of dexmedetomidine to bupivacaine in TAP block achieves better local anesthesia quality and provides better pain control post-operatively without any major side-effects.

Key Words: *Transversus abdominis plane block – Dexmedetomidine – Bupivacaine – Laparoscopic orcheopexy.*

Correspondence to: Dr. Jummah J.M. Aborima,
The Department of Anesthesia and Intensive Care Surgery, Assiut University Hospitals, Assiut, Egypt

Introduction

PEDIATRIC laparoscopy has been first described in 1923 by Kelling but its use has increased since the last decade. A laparoscopic approach offers several advantages over an open procedures; potentially reduces the surgical stress and fluid shifts that may accompany it; in addition there is less need for post-operative analgesia, reduction of post-operative respiratory and wound complications; shortens post-operative convalescence, including an intensive care unit stay; rapid return to normal diet and decreased overall hospital stay [1].

Despite the minimally invasive nature, pain can be moderate to severe in the immediate post-operative period [2].

Inadequate control of post-operative pain leads to several unwanted adverse events ranging from patients' discomfort prolonged immobilization to thromboembolic phenomenon and pulmonary complications [3]. Analgesic multimodalities were recommended to relieve the post-operative pain [4]. Opioids although provide satisfactory analgesia, they are associated with unwanted side-effects [5].

Transversus Abdominis Plane (TAP) block is a type of peripheral nerve block that involves innervations of the anterolateral abdominal wall [5]. It provides adequate post-operative pain relieve following various abdominal surgeries [7].

Patients and Methods

Patients' guardians were provided with complete information about the techniques of anesthesia and analgesia and an informed written consent was obtained from each patient's guardian after approval from our Faculty Ethical Committee.

Study design:

A prospective randomized controlled double blind study using a computer generated randomization was conducted in Assiut University Hospitals and carried on 80 pediatric patients undergoing laparoscopic orcheopexy under general anesthesia and receiving bilateral ultrasound guided TAP block using dexmedetomidine and bupivacaine for post-operative analgesia. The trial was planned that neither the doctors (investigators) nor the patients' guardians or even children themselves was aware of the group allocation and the drug received. The study drugs was be prepared by an anesthesiologist not involved in performing the block, patient care or in data collection. Patients were randomly allocated into two equal groups of 40 patients each:

- *Group A:* Patients received ultrasound guided TAP block using 0.3ml/kg bupivacaine (0.125%) with a maximum dose of 20ml + 2ml normal saline (0.9%).
- *Group B:* Patients received ultrasound guided TAP block using 0.3ml/kg bupivacaine (0.125%) with a maximum dose of 20ml + 0.25mg/kg dexmedetomidine dissolved in 2ml normal saline (0.9%).

Inclusion criteria:

- ASA I-II physical status patients.
- Age between 3 and 10 years.
- Children undergoing laparoscopic orcheopexy.

Patients were placed in the supine position and TAP block was performed under ultrasound guidance. After skin preparation, the linear ultrasound probe (high frequency probe 7-12MHz) connected to a portable ultrasound unit (SonoAce 6) was placed in the axial plane across the mid-axillary line midway between the costal margin and the highest point of iliac crest. A 50mm VYGON needle attached with tubing system to a syringe filled with the LA solution was inserted in plane with the ultrasound probe and advanced until it reaches the plane between the internal oblique and transversus abdominis muscles. After careful aspiration to exclude vascular puncture, injection of the study medication was performed leading to separation between the internal oblique and the transversus.

Statistical analysis:

Data was analyzed using SPSS Version 16 (SPSS Inc., Chicago, Illinois, USA). Normally distributed numerical data was presented as mean ± SD, range, number and percentage. Hemodynamic parameters were compared in-between both groups using the independent samples student t-test whereas the nonparametric data such as post-operative CHEOPS were compared using the Mann-Whiney U-test. Categorical variables (age, sex and parents' satisfaction scores) were analyzed using Chi-square test. p-value of less than 0.05 was considered statistically significant.

Results

This is a double randomized study carried out in Assuit University Hospital, Assiut, Egypt; between 80 pediatric patients undergoing laparoscopic orchiopexy with (ASA I, II) at age of (3-9) year were included. They were divided into two groups; group: (A) Received 0.3ml/kg bupivacaine 0.125% with a maximum dose of 20ml + 2ml normal saline (0.9%). Group (B): Patients received 0.3ml/kg bupivacaine (0.125%) with a maximum dose of 20ml + 0.25mg/kg dexmedetomidine dissolved in 2ml normal saline (0.9%).

In comparison between studied groups as regards demographic data, theres no statistical significant difference in each of age & weight ($p>0.05$) but shows statistical significant difference in duration of surgery ($p<0.001$) (Table 1).

Also comparison between studied groups as regards dose. With non statistical significant difference ($p>0.05$) about dose of Bupivacain between Group A & Group B. But only Group B take dose of Dexamedetomidine.

Clinical data collected every 10 minutes intraoperative which include (heart rate, arterial oxygen saturation, end tidal CO_2, mean arterial blood pressure, post-operative pain).

There was no statistically significant difference between the studied groups regarding heart rate, but there was statistically significant difference in mean arterial blood pressure ($p>0.001$) from time before induction up to after 40 minutes, 80 minutes and at end. Also there was no statistically significant difference between the studied groups regarding arterial oxygen saturation but there was a statistically significant difference in end tidal Co_2 ($p<0.05$) after induction, at 10 minutes and at 70 minutes.

There was statistically significant difference (p<0.001) before induction, after 30-60 minutes and from 80 minutes up to end of surgery with higher mean values at Group A. There was no statistically significant difference at others times. Post-operative pain scores of the studied groups in Cry, Facial and Torso there was no statistically significant difference at 4 hours, but there was statistically significant difference (p<0.001) at 8 and 12 hours. As regarding child verbal, touch and legs there was a statistically significant difference (p<0.05) at 4 hours and statistically significant difference (p<0.001) at time 8 and 12 hours (Table 2).

In comparison between studied groups as regards post-operative request analgesic. With statistical significant difference between Group A & B (p<0.05) with (85.0%) request analgesia in Group A Vs. (60.0%) in Group B.

Table (1): Comparison between studied groups as regards demographic data.

	Group A Mean ± SD	Group B Mean ± SD	p-value
• Age (year)	5.8±2.4	6.0±2.3	p=0.713
• Weight (Kg)	20.3±5.6	18.7±4.1	p=0.134
• Duration of surgry (minut)	65.5±20.2	84.7±18.6	<0.001

Table (2): Comparison between studied groups as regards post-operative pain score details.

Time	Group A (n=40)	Group B (n=40)	p-value
At 4hr	4.4±0.6	4.7±1.8	N.S.
At 8hr	7.8±2.6	4.7±1.8	<0.001
At 12hr	10.5±2.1	4.7±1.8	<0.001

Discussion

The management of post-operative pain is an important issue. The uncontrolled post-operative pain is the major limiting factor for early ambulation and thereby puts patient to the increased risk of various complications as well. The desirable properties of an analgesic agent are that it provides safe and effective analgesia, with minimal side effects. The multimodal pain management is the answer of this **[8]**.

The studies have shown that TAP block provides significant analgesic effect, especially below T 10 up to L1 level; hence, it is perfectly suited for use after lower abdominal and gynecological surgeries **[9]**.

Although most of the available studies on TAP block have used Local Anesthetic (LA) agent, few studies have reported that the adjuvant medications were added to LA to prolong the effect of TAP block. Dexmedetomidine is a selective alpha 2 adrenergic agonist, with both analgesic and sedative properties **[10]**.

The use of LA agents with dexmedetomidine epidurally or intrathecally associated with prolongation of the LA effect. We have performed a prospective, double-blinded, randomized study to assess the analgesic effect of adding dexmedetomidine to bupivacaine on TAP block for patients undergoing laparoscopy surgeries **[11]**.

Ranjit & Shrestha compared the use of ultrasound guided TAP block versus local wound infiltration for post-operative analgesia in patients undergoing laparoscopy surgery under general anesthesia and found that bilateral TAP block was effective in reducing post-operative pain scores for 8-12 hours post-operatively. This block was also successful in reducing post-operative opioid requirement.

In our study, we noticed a significant fall in the HR following the administration of dexmedetomidine opposite to the other group. This effect persisted for 4 hours, but without any hemodynamic instability. The decrease in pulse rate might be related to the postsynaptic activation of central $\alpha 2$ adrenoceptors, leading to decreasedsympathetic activity and slower HR **[13]**.

Reported similar results to ours regarding HR and increased sedation was noticed in the first post-operative hour among Group B patients. None of our patients required treatment for the low HR or sedation. The low dose of dexmedetomidine used in our study might be the reason behind the minor adverse events. Regarding post-operative pain scores, in Cry, Facial and Torso there was no statistically significant difference at 4 hours, but there was statistically significant difference (p <0.001) at 8 & 12 hours. As regarding child verbal, touch and legs there was a statistically significant difference (p<0.05) at 4, 8 and 12 hours.

This agrees with **[14]** who reported that addition of dexmedetomidine to bupivacaine in TAP block provides prolonged post-operative analgesia and better pain control than LA alone. The duration of LA was longer, VAS was lower and the need for rescue morphine doses was less when dexmedetomidine was added to bupivacaine.

In the present study we compared both studied groups as regards post-operative analgesic request. There was a statistically significant difference between Group A & B ($p<0.05$) with 85.0% of patients requested analgesia in Group A versus 60.0% of patients in Group B.

In our study, the addition of dexmedetomidine to bupivacaine in TAP block led to further prolongation of analgesia, less requirement of rescue analgesic and lower pain scores. Similar to our finding, many investigators reported that the addition of dexmedetomidine to different types of LA agents in various types of peripheral nerve blocks resulted in prolongation of analgesic effect **[15-17]**.

Many studies had found that the addition of dexmedetomidine to LA in central neuraxial blocks and in peripheral nerve blockades in human was a safe and effective way to potentiate the LA effect and reduce the required analgesics **[18]**. On the other hand, **[19]** had compared dexmedetomidine-ropivacaine mixture with ropivacaine alone in patient controlled interscalene analgesia and they reported similar pain scores in both groups without any advantageous effect of dexemedetomidine.

Masuki et al., in their study contributed the prolonged effect of ropivacaine TAP block to the relatively poorly vascularized TAP resulting in a slower rate of drug clearance.

On the other hand, dexmedetomidine was found to induces asoconstriction through an action on a2 adrenoceptors in the human forearm and later might contribute to the longer duration of action. Other investigators had supported a third mechanism of action through a2 adrenoceptors agonist effect rather than vasoconstriction. They contributed that to the direct effect on the peripheral nerve activity.

Whatever the mechanism of dexmedetomidine action, it seems that it potentiates the LA effect and prolongs the analgesic duration.

References

1- PRETORIUS M., RASMUSSEN G.E. and HOLCOMB G.W.: Hemodynamic and catecholamine responses to a laparoscopic adrenalectomy for pheochromocytoma in a pediatric patient. Anesth. Analg., 87: 1268-70, 1998.

2- GOUSHEH S.M., NESIOONPOUR S., JAVAHER FOROOSH F., AKHONDZADEH R., SAHAFI S.A. and ALIZADEH Z.: Intravenous paracetamol for post-operative analgesia in laparoscopic cholecystectomy. Anesth. Pain Med., 3 (1): 214-8, 2013.

3- GANAI S., LEE K.F., MERRILL A., LEE M.H., BELLANTONIO S., BRENNAN M., et al.: Adverse outcomes of geriatric patients undergoing abdominal surgery who are at high risk for delirium. Arch. Surg., 142: 1072-8, 2007.

4- ELIA N., LYSAKOWSKI C. and TRAMÈR M.R.: Does multimodal analgesia with acetaminophen, nonsteroidal antiinflammatory drugs, or selective cyclooxygenase-2 inhibitors and patient-controlled analgesia morphine offer advantages over morphine alone? Meta-analyses of randomized trials. Anesthesiology, 103: 1296-304, 2005.

5- LO Y., CHIA Y.Y., LIU K. and KO N.H.: Morphine sparing with droperidol in patient-controlled analgesia. J. Clin. Anesth., 17: 271-5, 2005.

6- ROZEN W.M., TRAN T.M., ASHTON M.W., BARRINGTON M.J., IVANUSIC J.J. and TAYLOR G.I.: Refining the course of the thoracolumbar nerves: A new understanding of the innervation of the anterior abdominal wall. Clin. Anat., 21: 325-33, 2008.

7- CARNEY J., McDONNELL J.G., OCHANA A., BHINDER R. and LAFFEY J.G.: The transversus abdominis plane block provides effective post-operative analgesia in patients undergoing total abdominal hysterectomy. Anesth. Analg., 107: 2056-60, 2008.

8- ARACO A., POONEY J., ARACO F. and GRAVANTE G.: Transversus abdominis plane block reduces the analgesic requirements after abdominoplasty with flank liposuction. Annals of Plastic Surger.

9- MISHRA M. and MISHRA S.P.: Transversus abdominis plane block: The new horizon for post-operative analgesia following abdominal surgery. Egypt J. Anaesth., 32: 243-7. [Doi.org/10.1016/j.egja. 2015.12.003].

10- BELAVY D., COWLISHAW P.J., HOWES M. and PHILLIPS F.: Ultrasound-guided transversus abdominis plane block for analgesia after caesarean delivery. Br. J. Anaesth., 103: 726-30, 2009.

11- SKJELSAGER A., RUHNAU B., KISTORP T.K., KRIDINA I., HVARNESS H., MATHIESEN O. and DAHL J.B.: Transversus abdominis plane block or subcutaneous wound infiltration after open radical prostatectomy: A randomized study. Acta Anaesthesiol. Scand., 57: 502-8, 2013.

12- RANJIT S. and SHRESTHA S.K.: Comparison of ultrasound guided transversus abdominis plane block versus local wound infiltration for post-operative analgesia in patients undergoing gynaecological surgery under general anaesthesia. Kathmandu. Univ. Med. J. (K.U.M.J.), 12: 93-6, 2016.

13- TALKE P., LOBO E. and BROWN R.: Systemically administered alpha2-agonist-induced peripheral vasoconstriction in humans. Anesthesiology, 99: 65-70, 2003.

14- ALMARAKBI W.A. and KAKI A.M.: Addition of dexmedetomidine to bupivacaine in transversus abdominis plane block potentiates post-operative pain relief among abdominal hysterectomy patients: A prospective randomized controlled trial. Saudi J. Anaesth., 8: 161-6, 2014.

15- RANCOURT M.P., ALBERT N.T., CÔTÉ M., LÉTOURNEAU D.R. and BERNARD P.M.: Posterior tibial nerve sensory blockade duration prolonged by adding dexmedetomidine to ropivacaine. Anesth. Analg., 115: 958-62, 2012.

16- ESMAOGLU A., YEGENOGLU F., AKIN A. and TURK C.Y.: Dexmedetomidine added to levobupivacaine pro-

longs axillary brachial plexus block. Anesth. Analg., 111: 1548-51, 2010.

17- MARHOFER D., KETTNER S.C., MARHOFER P., PILS S., WEBER M. and ZEITLINGER M.: Dexmedetomidine as an adjuvant to ropivacaine prolongs peripheral nerve block: A volunteer study. Br. J. Anaesth., 110: 438-42, 2012.

18- OZALP G., TUNCEL G., SAVLI S., CELIK A., DOGER C., KAYA M., et al.: The analgesic efficacy of dexmedetomidine added to ropivacaine patient controlled interscalene analgesia via the posterior approach. J. Anaesth., 21: 409-12, 2006.

19- McDONNELL J.G., O'DONNELL B., CURLEY G., HEFFERNAN A., POWER C. and LAFFEY J.: The analgesic efficacy of transversus abdominis plane block after abdominal surgery: A prospective randomized controlled trial. Anesth. Analg., 104 (1): 193-7, 2008.

20- MASUKI S., EISENACH J.H., DINENNO F.A. and JOYNER M.J.: a-Adrenergic vasoconstrictor responsiveness and baroreflex control of heart rate in humans. FASEB J., 19: A1300, 2003.

إستخدام الموجات فوق الصوتية الموجه فى تخدير العضلة البطنية المستعرضة بواسطة حقن عقار البوبيفاكين والدكسامدايتوميدين فى الآطفال الذين يخضعون لعملية تثبيت الخصية بالمناظير : تجربة عشوائية مخططة

أجريت الدراسة الحالية فى مستشفيات جامعة أسيوط تحديدا مستشفى جراحة المسالك البولية، فى الفترة بين مارس ٢٠١٦ وسبتمبر ٢٠١٧ وشملت ٨٠ مريضا من الآطفال تتراوح أعمارهم بين ٣ و١٠ سنوات من العمر، من التصنيف الأول والثانى لجمعية أطباء التخدير الأمريكيين.

فيما يتعلق بقراءات آلام ما بعد الجراحة، لم يكن هناك فروق ذات دلالة إحصائية عدد ٤ ساعات، ولكن كان هناك فرق معتدل إحصائيا عدد ٨ و١٢ ساعة. أما فيما يتعلق بالإستجابة اللفظية واللمسية والساقين كان هناك فرق ذو دلالة إحصائية عدد ٤ ساعات وفرق معتدل إحصائيا معنويا فى الوقت بين ٨ و١٢ ساعة.

وخلصت الدراسة إلى أن إضافة عقار الدكسامدايتوميدين إلى عقار البوبيفاكين يعطى نتائج أفضل فى تسكين الآلم بعد العملية دون حدوث أى مشاكل.