

*Research Article*

## **A comparative study of postoperative analgesia of transversus abdominis plane block versus intrathecal nalbuphine injection in preeclamptic patients undergoing cesarean section**

**Amany Kh. Abo-Elhussein, Josef Z. Attia and Mohamed G. Mustafa**

Department of Anesthesiology and intensive care, faculty of medicine, Minia University, Egypt

### **Abstract**

**Introduction:** Effective pain relief aids in early mobilization and decreases risk of thromboembolic diseases following Post-cesarean section. The transversus abdominis plane (TAP) block is a well-known analgesic technique with established role in postoperative analgesia for lower abdominal surgeries. Intrathecal opioids (as Nalbuphine) are synergistic with local anesthetics and intensify the sensory block without increasing the sympathetic block. **Patient and methods:** 30 patients divided into three groups (10 patients in each), all groups received intrathecal bupivacaine and TAP injection, group S had TAP injection with saline, Group B had TAP injection with bupivacaine, and Group N had intrathecal nalbuphine and TAP injection with saline. Postoperative follow up of analgesic time, first analgesic request time and total analgesic dose in 24h. **Results:** as regards analgesic time and first analgesic request time there was a significant increase in group N compared with other two groups and in group B compared with group S. while there was a significant decrease in total analgesic dose in group N compared with other two groups and in group B compared with group S. **Conclusion:** intrathecal nalbuphine and TAP block produce a significant prolongation in postoperative analgesic time and decrease postoperative analgesic consumption. However intrathecal nalbuphine showed significant advantages over TAP block.

**Key words:** intrathecal nalbuphine, TAP block, Bupivacaine, Cesarean section.

### **Introduction**

Post-cesarean section effective analgesia is important. Pain and subsequent anxiety impair the mother's ability and early mobilization. Effective pain relief aids in early mobilization and decreases risk of thromboembolic diseases which is common after cesarean delivery. Essentially, analgesic technique should be safe, effective and prevent development of chronic pain (Horlocker, Burton et al., 2009).

The transversus abdominis plane (TAP) block is a regional analgesic technique which blocks T<sub>6</sub> – L<sub>1</sub> nerve branches and has an evolving role in postoperative analgesia for lower abdominal surgeries (Petersen, Mathiesen et al., 2010).

TAP block is a simple and safe technique

and is a potential alternative to spinal opioid for analgesia after Caesarean section, whether guided by traditional anatomic landmarks or by ultrasound (Belavy, Cowlshaw et al., 2009).

It has been shown to be effective in Caesarean section and after hysterectomy, open prostatectomy, laparoscopic cholecystectomy, and appendicectomy (McDonnell, Curley et al., 2008)

TAP block would have the advantage of improved analgesia, a reduction in opioid-associated adverse effects, and the absence of motor blockade (Tornerio-Campello 2007)

Intrathecal opioids are synergistic with local anesthetics and intensify the sensory block without increasing the sympathetic

block. They are commonly added to local anesthetics for potentiating their effects, reducing their doses, and thereby reducing their complications and side effects and offer hemodynamic stability. They also prolong the duration of postoperative analgesia (Tan, Chia et al., 2001)

Nalbuphine, a mixed agonist-antagonist opioid, has a potential to attenuate the  $\mu$  -opioid effects and to enhance the kappa-opioid effects. It was synthesized in an attempt to produce analgesia without the undesirable side effects of  $\mu$  agonist; meanwhile, the benefits of both  $\mu$  and  $\kappa$  receptors analgesia can be obtained (Eisenach, Carpenter et al., 2003)

Lumbar neuraxial analgesia reduces pain-mediated hypertensive responses (Dennis 2012).

There are few studies examining different analgesic options for women with pre-eclampsia after caesarean birth. Neuraxial techniques, local anaesthetic techniques, opioids, paracetamol and tramadol have not been examined to any significant degree in this population (Macintyre and Walker 2010).

Non-steroidal anti-inflammatory agents are frequently used for analgesia after childbirth; however, these agents have well-documented adverse effects and contraindications and there have been specific case reports of hypertensive crises in women with pre-eclampsia (Makris, Thornton et al., 2004).

Our study aims were (i) to determine the analgesic efficacy of TAP block and intrathecal nalbuphine, (ii) to compare TAP block with intrathecal nalbuphine.

### Patient and methods

After approval of the institutional ethics committee; 90 ASA grade II severe pre-eclamptic women systolic blood pressure  $>160$  and, or diastolic blood pressure  $>110$ , with proteinuria and gestational age  $>38$  weeks were admitted for emergency caesarean section under spinal anesthesia in a prospective, randomized, double-blinded, placebo-controlled trial.

All patients under treatment of I.V infusion Glyceryl Trinitrate if severe pre-eclampsia (systole  $>160$  mmHg or diastole  $>110$  mmHg).

A written informed consent was obtained from each patient.

Patients were excluded if there was a history of relevant drug allergy, tolerance to opiates, BMI  $>30$  kg m<sup>-2</sup> at initial hospital visit, or contraindication to neuraxial anesthesia. Patient with Platelet count  $<100,000$  per mm<sup>3</sup>, Elevated liver enzymes (twice normal concentrations), Renal insufficiency (serum creatinine concentration  $>1.1$  mg/dl or a doubling of serum creatinine concentration) or oliguria ( $<0.5$  ml in 2h), Pulmonary edema or cyanosis, New-onset cerebral or visual disturbances, Severe persistent right upper quadrant or epigastric pain were also excluded from study.

All patients were clinically assessed and routine preoperative investigations were done: hemoglobin, platelet, INR, Alanine transaminase (ALT), serum creatinine, fasting blood sugar and ECG.

The patients were divided equally into three groups according to and using sealed envelopes to one of three groups (n=30 in each group) to:

**Group (N):** Thirty patients received intrathecal injection of 2.5 ml of 0.5% hyperbaric bupivacaine plus 2 mg (0.1 ml) nalbuphine HCL (Nalufin 20 mg/ml, Amoun Pharmaceutical CO.), an ultrasound-guided TAP block was performed at the end of surgery a total of 20 ml normal saline was injected in each side (left and right).

**Group (B):** Thirty patients received intrathecal injection of 2.5 ml of 0.5% hyperbaric bupivacaine plus, An ultrasound-guided TAP block was performed at the end of surgery a total of 20 ml 0.375% bupivacaine HCL was injected in each side (left and right).

**Group (S):** Thirty patients received intrathecal injection of 2.5 ml of 0.5% hyperbaric bupivacaine, An ultrasound-guided TAP block was performed at the end of surgery a total of 20 ml normal saline was injected in each side (left and right).

The patients, their anesthesiologists, and staff providing postoperative care were blinded to group assignment.

Each patient received an intravenous infusion of 500 mL (100 mL/hr) of saline solution were given via a 16-gauge intravenous catheter and 10 mg metoclopramide intravenously before spinal block.

In addition to the loading dose of IV fluids, patients received a further saline solution during the remainder of the operation. Only minimal sedative medications were administered during the operation (midazolam 1-2 mg). Standard continuous electrocardiogram monitoring and pulse oximetry was included.

Baseline maternal heartbeat and blood pressure values were established before the lumbar puncture.

Patients received a standard spinal anesthetic comprising hyperbaric 0.5% bupivacaine 12.5 mg. All patients were put in the sitting position with leaning forward. Sterilization was done.

Dural puncture was performed at or L3-L4 interspace with a 20 gauge Quincke spinal needle.

After confirming the correct placement of the spinal needle by aspiration of the cerebrospinal fluid (CSF) and after completion of the injection (the spinal volume was injected over 20-30 seconds) the patients were immediately returned to the supine position with 10 to 20 degrees of left uterine displacement breathing oxygen via face mask.

An ultrasound-guided TAP block was performed at the end of surgery, skin was prepared with 2% chlorhexidine solution and a high-frequency (11-12 MHz) linear

ultrasound probe (2.5 cm footprint) (Chison ECO3, Chison Inc.) was used. The injectate syringes were prepared under aseptic technique. Ultrasound probe was positioned in mid-axillary line half way between costal margin and iliac crest. The satisfactory image was aimed to visualize the subcutaneous fat, external oblique muscle, internal oblique muscle, transversus abdominis muscle, peritoneum, and intraperitoneal cavity.

A 100 mm long 20G short bevel needle (Stimuplex A B/BRAUN Melsungen AG, Germany) was inserted in plane to the probe of the ultrasound anteriorly to lie between internal oblique muscle and transversus abdominis muscle, a total of 20 mL study solution was injected in each side (left and right). Successful injection was obtained when an echoluculent lens-shape appeared between the two muscles

In all patients (the three groups) paracetamol i.v infusion (1000 mg / 4 hours) and Magnesium sulfate is the medication of choice for the prevention of eclamptic seizures.

Oral calcium channel blocker was given to all patients. And i.v infusion Glycerol Trinitrate if systole >160 mmHg or diastole >110 mmHg

### Statistical method

The data are collected, tabulated and statistically analyzed using statistical package of social science (SPSS) version 23. The quantitative data expressed as mean  $\pm$  SD and minimum and maximum of range. The quantitative data are analyzed using One Way ANOVA test between the three groups followed by post hoc Tukey analysis between each two groups. The significant level was taken at P value < 0.05

**Results**

**Table 1: Demographic data in different groups**

	Group S	Group B	Group N	P value		
<b>Age</b>				.917		
<b>Range</b>	(19-32)	(19-29)	(21-29)	<b>S vs B</b>	<b>S vs N</b>	<b>B vs N</b>
<b>Mean ± SD</b>	24.7±3.8	24.7±2.7	24.9±2.0	.999	.923	.939
<b>Weight</b>				.009		
<b>Range</b>	(50-80)	(50-75)	(56-73)	<b>S vs B</b>	<b>S vs N</b>	<b>B vs N</b>
<b>Mean ± SD</b>	67.2±7.4	63.7±5.4	64.3±4.9	.076	.102	.920
<b>Height</b>				.100		
<b>Range</b>	(150-170)	(150-170)	(150-189)	<b>S vs B</b>	<b>S vs N</b>	<b>B vs N</b>
<b>Mean ± SD</b>	164±4	163.2±4.1	160.7±6.2	.799	.412	.140
<b>Operative time</b>				.144		
<b>Range</b>	(40-70)	(40-50)	(40-50)	<b>S vs B</b>	<b>S vs N</b>	<b>B vs N</b>
<b>Mean ± SD</b>	49±4.8	47.0±3.4	49.0±3.8	.327	.882	.141

There were no significant differences between groups as regarding age, weight, height and duration of operation, as shown in *table 1*

**Table (2): Effect of TAP block and intrathecal nalbuphine on time analgesia, effective analgesia time and total analgesic requirement in patient with cesarean section.**

	Group S	Group B	Group N	P value		
<b>Time of analgesia (minutes)</b>				<.001*		
<b>Mean ± SD</b>	(70-90) 81.3±8.8	(100-180) 142.7±18.9	(200-280) 242.3±24.4	<b>S vs B</b>	<b>S vs N</b>	<b>B vs N</b>
				<.001*	<.001*	<.001*
<b>The time of the first analgesic dose (minutes)</b>				<.001*		
<b>Range</b>	(90-130)	(180-230)	(200-370)	<b>S vs B</b>	<b>S vs N</b>	<b>B vs N</b>
<b>Mean ± SD</b>	107.7±11	210.3±10.9	320.3±30.2	<.001*	<.001*	<.001*
<b>Total nalbuphine dose requirement in 24 hours (mg)</b>				<.001*		
<b>Range</b>	(16-20)	(8-12)	(4-6)	<b>S vs B</b>	<b>S vs N</b>	<b>B vs N</b>
<b>Mean ± SD</b>	18.3±2	8.7±1.3	4.0±0.9	<.001*	<.001*	<.001*

\*is a significant difference at p value < .001

As regards analgesic time and first analgesic request time there was a significant increase in group N compared with other two groups and in group B compared with group S. While there was a significant decrease in total analgesic dose in group N compared with other two groups and in group B compared with group S.

Intrathecal nalbuphine and TAP block produce a significant prolongation in postoperative analgesic time and decrease postoperative analgesic consumption. However intrathecal nalbuphine showed significant advantages over TAP block.

**Conclusion**

**References**

- Ahmed, F., H. Narula, M. Khandelwal and D. Dutta (2016). "A comparative

- study of three different doses of nalbuphine as an adjuvant to intrathecal bupivacaine for post-operative analgesia in abdominal hysterectomy." *Indian Journal of Pain* 20(1): 23-28.
۴. Baaj, J. M., R. A. Alsatli, H. A. Majaj, Z. A. Babay and A. K. Thallaj (2010). "Efficacy of ultrasound-guided transversus abdominis plane (TAP) block for postcesarean section delivery analgesia--a double-blind, placebo-controlled, randomized study." *Middle East journal of anaesthesiology* 20(6): 821-826.
۵. Bansal, M., S. Agarwal, K. Gupta, P. K. Gupta, S. Agarwal and M. N. Pandey (2017). "Clinical efficacy of clonidine versus nalbuphine as intrathecal adjuvants to 0.5% hyperbaric bupivacaine for subarachnoid block during gynaecological procedures: a double blind study." 2017 0(6): 6.
۶. Belavy, D., P. J. Cowlshaw, M. Howes and F. Phillips (2009). "Ultrasound-guided transversus abdominis plane block for analgesia after Caesarean delivery." *BJA: British Journal of Anaesthesia* 103(5): 726-730.
۷. Belavy, D., P. J. Cowlshaw, M. Howes and F. Phillips (2009). "Ultrasound-guided transversus abdominis plane block for analgesia after Caesarean delivery." *Br J Anaesth* 103(5): 726-730.
۸. Brennan, F., D. B. Carr and M. Cousins (2007). "Pain management: a fundamental human right." *Anesth Analg* 105(1): 205-221.
۹. Chaney, M. A. (1995). "Side effects of intrathecal and epidural opioids." *Can J Anaesth* 42(10): 891-903.
۱۰. Costello, J. F., A. R. Moore, P. M. Wiczorek, A. J. Macarthur, M. Balki and J. C. A. Carvalho (2009). "The Transversus Abdominis Plane Block, When Used as Part of a Multimodal Regimen Inclusive of Intrathecal Morphine, Does Not Improve Analgesia After Cesarean Delivery." *Regional Anesthesia and Pain Medicine* 34(6): 587-589.
۱۱. Culebras, X., G. Gaggero, J. Zatloukal, C. Kern and R. A. Marti (2000). "Advantages of intrathecal nalbuphine, compared with intrathecal morphine, after cesarean delivery: an evaluation of postoperative analgesia and adverse effects." *Anesth Analg* 91(3): 611-615.
۱۲. de Beer, J. d. V., M. J. Winemaker, G. A. Donnelly, P. C. Miceli, J. L. Reiz, Z. Harsanyi, L. W. Payne and A. C. Darke (2005). "Efficacy and safety of controlled-release oxycodone and standard therapies for postoperative pain after knee or hip replacement." *Canadian journal of surgery* 48(5): 277.
۱۳. De Souza, E. B., W. K. Schmidt and M. J. Kuhar (1988). "Nalbuphine: an autoradiographic opioid receptor binding profile in the central nervous system of an agonist/antagonist analgesic" *J Pharmacol Exp Ther* 244(1): 391-402.
۱۴. Dennis, A. T. (2012). "Management of pre-eclampsia: issues for anaesthetists." *Anaesthesia* 67(9): 1009-1020.
۱۵. Eisenach, J. C., R. Carpenter and R. Curry (2003). "Analgesia from a peripherally active kappa-opioid receptor agonist in patients with chronic pancreatitis." *Pain* 101(1-2): 89-95.
۱۶. Eslamian, L., Z. Jalili, A. Jamal, V. Marsoosi and A. Movafegh (2012). "Transversus abdominis plane block reduces postoperative pain intensity and analgesic consumption in elective cesarean delivery under general anesthesia." *J Anesth* 26(3): 334-338.
۱۷. Gomaa, H. M., N. N. Mohamed, H. A. H. Zoheir and M. S. Ali (2014). "A comparison between post-operative analgesia after intrathecal nalbuphine with bupivacaine and intrathecal fentanyl with bupivacaine after cesarean section." *Egyptian Journal of Anaesthesia* 30(4): 405-410.
۱۸. Horlocker, T., A. Burton and R. Connis (2009). "American Society of Anesthesiologists Task Force on Neuraxial Opioids. Practice guidelines for the prevention, detection, and management of respiratory depression

- associated with neuraxial opioid administration." *Anesthesiology* 110(2): 218-220.
17. Jyothi, B., S. Gowda and S. A. Shaikh (2014). "A comparison of analgesic effect of different doses of intrathecal nalbuphine hydrochloride with bupivacaine and bupivacaine alone for lower abdominal and orthopedic surgeries." *Indian Journal of Pain* 28: 18-23.
18. Kumaresan, S. and A. A. M. Raj (2017). "Intrathecal Nalbuphine as an Adjuvant to Spinal Anaesthesia: What is Most Optimum Dose?" *Int J Sci Stud* 2017 0(1): 07-10.
19. Macintyre, P. E. and S. M. Walker (2010). "The scientific evidence for acute pain treatment." *Curr Opin Anaesthesiol* 23(0): 623-628.
20. Makris, A., C. Thornton and A. Hennessy (2004). "Postpartum hypertension and nonsteroidal analgesia." *Am J Obstet Gynecol* 190(2): 077-078.
21. McDonnell, J. G., G. Curley, J. Carney, A. Benton, J. Costello, C. H. Maharaj and J. G. Laffey (2008). "The analgesic efficacy of transversus abdominis plane block after cesarean delivery: a randomized controlled trial." *Anesth Analg* 106(1): 186-191, table of contents.
22. McDonnell, J. G., G. Curley, J. Carney, A. Benton, J. Costello, C. H. Maharaj and J. G. Laffey (2008). "The Analgesic Efficacy of Transversus Abdominis Plane Block After Cesarean Delivery: A Randomized Controlled Trial." *Anesthesia & Analgesia* 106(1): 186-191.
23. McKeen, D. M., R. B. George, J. C. Boyd, V. M. Allen and A. Pink (2014). "Transversus abdominis plane block does not improve early or late pain outcomes after Cesarean delivery: a randomized controlled trial." *Can J Anaesth* 61(7): 631-640.
24. McMorro, R. C. N., R. J. Ni Mhuircheartaigh, K. A. Ahmed, A. Aslani, S. C. Ng, I. Conrick-Martin, J. J. Dowling, A. Gaffney, J. P. R. Loughrey and C. L. McCaul (2011). "Comparison of transversus abdominis plane block vs spinal morphine for pain relief after Caesarean section." *BJA: British Journal of Anaesthesia* 106(0): 706-712.
25. Mostafa, M. G., M. F. Mohamad and W. S. Farrag (2011). "Which has greater analgesic effect; Intrathecal nalbuphine or intrathecal tramadol." *J Am Sci* 7: 480-484.
26. Mukherjee, A., A. Pal, J. Agrawal, A. Mehrotra and N. Dawar (2011). "Intrathecal nalbuphine as an adjuvant to subarachnoid block: What is the most effective dose?" *Anesthesia, Essays and Researches* 0(2): 171-170.
27. Naaz, S., U. Shukla, S. Srivastava, E. Ozair and A. Asghar (2017). "A Comparative Study of Analgesic Effect of Intrathecal Nalbuphine and Fentanyl as Adjuvant in Lower Limb Orthopaedic Surgery." *Journal of Clinical and Diagnostic Research : JCDR* 11(7): UC20-UC28.
28. O'Connor, K. and C. Renfrew (2010). "Subcostal transversus abdominis plane block." *Anaesthesia* 60(1): 91-92.
29. Petersen, P., O. Mathiesen, H. Torup and J. Dahl (2010). "The transversus abdominis plane block: a valuable option for postoperative analgesia? A topical review." *Acta Anaesthesiologica Scandinavica* 04(0): 029-030.
30. Saxena, A. K. and S. K. Arava (2004). "Current concepts in neuraxial administration of opioids and non-opioids: An overview and future perspectives." *Indian J Anaesth* 48(1): 13-24.
31. Schmauss, C., C. Doherty and T. L. Yaksh (1982). "The analgetic effects of an intrathecally administered partial opiate agonist, nalbuphine hydrochloride." *Eur J Pharmacol* 86(1): 1-7.
32. Singh, S., S. Dhir, K. Marmai, S. Rehou, M. Silva and C. Bradbury (2013). "Efficacy of ultrasound-guided transversus abdominis plane blocks for post-cesarean delivery analgesia: a double-blind, dose-comparison, placebo-controlled randomized trial." *Int J Obstet Anesth* 22(3): 188-193.
33. Tan, P. H., Y. Y. Chia, Y. Lo, K. Liu, L. C. Yang and T. H. Lee (2011). "Intrathecal bupivacaine with

- morphine or neostigmine for post-operative analgesia after total knee replacement surgery." *Can J Anaesth* 53(7): 551-556.
33. Tan, T. T., W. H. L. Teoh, D. C. M. Woo, C. E. Ocampo, M. K. Shah and A. T. H. Sia (2012). "A randomised trial of the analgesic efficacy of ultrasound-guided transversus abdominis plane block after caesarean delivery under general anaesthesia." *European Journal of Anaesthesiology (EJA)* 29(2): 88-94.
34. Tiwari, A. K., G. S. Tomar and J. Agrawal (2013). "Intrathecal Bupivacaine in Comparison with a Combination of Nalbuphine and Bupivacaine for Subarachnoid Block: A Randomized Prospective Double-Blind Clinical Study." *American Journal of Therapeutics* 20(6): 592-595.
35. Tornero-Campello, G. (2007). "Transversus abdominis plane block should be compared with epidural for postoperative analgesia after abdominal surgery." *Anesth Analg* 105(1): 281-282; author reply 282-283.
36. Uday pratap, D., D. Arun mathur, D. Manindar patni and D. Ruchi gupta (2014). Comparison of Intrathecal Nalbuphine Versus Intrathecal Buprenorphine As An Adjuvant to Intrathecal Bupivacaine for Post-operative Analgesia in Patients Undergoing Lower Abdominal Surgeries.
37. Verma, D., U. Naithani, D. Chand Jain and A. Singh (2013). Post operative analgesic efficacy of intrathecal tramadol versus nalbuphine added to bupivacaine in spinal anaesthesia for lower limb orthopaedic surgery.