

Single Injection Unilateral Ultrasound Guided Transversus Abdominis Plane Block versus Local Anaesthetic Infiltration for Post-Operative Analgesia after Nephrectomy in a Tertiary Care Hospital, Raipur - A Randomised Single-Blind Study

Shraddha Agrawal¹, Avan Suryawanshi², Umesh Sharma³, Thara Jojo⁴, Vaishali Choure⁵

¹Department of Anaesthesiology and Critical Care, DKS Post Graduate Institute and Research Centre, Raipur, Chhattisgarh, India. ^{2, 3, 4} NHMMI Multispecialty Hospital, Lalpur, Raipur, Chhattisgarh, India. ⁵Seth Nandlal Dhoot Hospital, Aurangabad, Maharashtra, India.

ABSTRACT

BACKGROUND

This was a randomised single-blinded study. It was designed to compare the superiority of infiltration analgesia and ultrasound guided unilateral transversus abdominis plane block on pain scores, total opioid consumption, and assess the side effects of opioid after nephrectomy.

METHODS

This study included 56 patients aged between 18 - 50 years with American Society of Anaesthesiologists (ASA) status II - III who underwent nephrectomy. Patients were broadly placed in 2 groups, who underwent transversus abdominis plane block for postoperative analgesia as Group TAP and infiltration analgesia as Group LA. Visual analog scale was used for post-operative pain evaluation at the 0, 2, 4, 6, 8, 12, 24 hours. Patients with VAS of more than 3 were given tramadol 1 mg / Kg. In the first 24 hours postoperatively, total analgesic consumption, rate of nausea vomiting and other side effect of patients were recorded and results were evaluated statistically.

RESULTS

Demographic characteristics were similar in the two groups; post-operative visual analog scale (VAS) score were significantly less in the transversus abdominis plane block group at the 6th, 8th and 12th hours compared to the infiltration analgesia group. The total analgesic consumption and nausea-vomiting rates were significantly lower in the transversus abdominis plane block.

CONCLUSIONS

In our study transversus abdominis plane block method was found superior to infiltration analgesia method on post-operative pain management in unilateral nephrectomy. In conclusion, we recommend the transversus abdominis plane block to be effective for post-operative analgesia after unilateral nephrectomy.

KEYWORDS

Nephrectomy, Postoperative Pain Management, Transversus Abdominis Plane Block, Infiltration Analgesia, opioid Consumption

Corresponding Author:

*Dr. Shraddha Agrawal,
Flat D, 2nd Floor, Crown, Ashoka Park,
Khamardih Road, Shankar Nagar,
Raipur – 492007, Chhattisgarh, India.
E-mail: drshraddhaag11@gmail.com*

DOI: 10.18410/jebmh/2021/137

How to Cite This Article:

Agrawal S, Suryawanshi A, Sharma U, et al. Single injection unilateral ultrasound guided transversus abdominis plane block versus local anaesthetic infiltration for post-operative analgesia after nephrectomy in tertiary care hospital, Raipur - a randomised single-blind study. J Evid Based Med Healthc 2021;8(12):699-703. DOI: 10.18410/jebmh/2021/137

Submission 11-08-2020,

Peer Review 18-08-2020,

Acceptance 01-02-2021,

Published 22-03-2021.

Copyright © 2021 Shraddha Agrawal et al. This is an open access article distributed under Creative Commons Attribution License [Attribution 4.0 International (CC BY 4.0)]

BACKGROUND

International Association for Study of Pain (IASP), has described pain as unpleasant emotional and sensory experience due to actual or potential tissue damage or described in terms of such damage. Surgical pain is a universal phenomenon, which causes several deleterious effects in the physique and the psyche of sufferer, in addition to the agonizing sensory experience.

Effective post-operative pain control is an essential component of post-operative surgical care. Opioids are commonly used as a part of the multimodal analgesic regimen. But opioids are associated with adverse effects such as nausea, vomiting, pruritus, respiratory depression etc. Hence, techniques that reduce opioid requirement may be of benefit such as LA (local anaesthesia) infiltration, epidural analgesia, peripheral nerve blocks, IV (intravenous) analgesia.¹

Transversus abdominis plane (TAP) block is a safe and effective adjunct to post-operative analgesia and enhances recovery after lower abdominal surgery. Ultrasound sonography (USG) guided approach helps further reduce the risk of complications. In TAP block, blockade of peripheral nerves supplying thoraco-lumbar nerves of anterior abdominal wall is done. Patient is positioned in supine and head is slightly elevated with a pillow under the thorax, this brings the abdominal muscle to prominence. High frequency probe is chosen unless the patient is very obese.

Scan is generally from lateral to medial side, till the external oblique abdominis muscle forms an aponeurosis. The 3 muscle layers are the rectus abdominis, external and internal obliques and the transverse abdominis (TA) muscles. Under the TA is the peritoneum and the bowel loops.

The needle is introduced in-plane and the drug is deposited in the space between the internal oblique and the TA. Clear hydro-dissection is noted and this generally pushes away the muscles away from each other on the monitor rather than splitting the muscle fibres. Patients undergoing renal surgery mostly present with impaired renal function, which requires judicious use of systemic analgesics. LA infiltration does not relieve deep muscle pain.

Hence, TAP block can be a good alternative and useful adjunct for post-operative pain management in patients undergoing nephrectomy.

This study was conducted to compare the effectiveness of unilateral USG-guided TAP block and infiltration analgesia using 0.25 % ropivacaine in reducing post-operative pain in patients undergoing nephrectomy for 24 hours postoperatively.

Objectives

1. To determine the total number of opioid doses consumed in the first 24 hours post operatively in both the groups.
2. To describe the adverse effects of opioids.

METHODS

This was a randomised single-blind study conducted from Aug 2019 and September 2020 in Department of Anaesthesia, DKS Hospital Raipur. The desired number of patients were reached in both the groups after hospital ethical committee approval. Patients of ASA (American Society of Anaesthesiologists) physical status class II - III, aged between 18 - 50 years of age of both sexes undergoing nephrectomy were included in the study. Patients aged less than 18 years, coagulation disorders, neurological disorders, psychiatric disorders, local anaesthetic hypersensitivity, pregnant women and on treatment with anticoagulants were excluded from the study.

Patients were randomly assigned by a computer-generated list of random numbers using opaque, sealed envelopes to two groups as TAP group and LA group (local anaesthesia infiltration) 28 patients in each group. The patients were blinded to the study. 1 - 2 mg of midazolam was given as premedication for all the patients. Induction was achieved with fentanyl 1 - 2 mcg / Kg, propofol 1.5 - 2 mg / Kg and atracurium 0.5 mg / Kg. Isoflurane, oxygen and air mixture were used for maintenance.

For TAP Block

Nephrectomy was done and the patient was placed in supine position on operation theatre (OT) table prior to extubation. Anaesthetist performed the TAP block on surgical site using a linear 6 - 13 MHz ultrasound transducer. Preparation of ultrasound probe and puncture area was done taking aseptic precaution. External oblique abdominis muscle (EOAM), internal oblique abdominis muscle (IOAM) and transversus abdominis muscle (TAM) were identified along the anterior axillary line between the 12th rib and iliac crest. Block was performed using a 20 G spinal needle at the neuro fascial plane between IOAM and TAM. The needle was directed in order to approach the TAP with 'in-plane' USG guided technique. Needle tip was placed between IOAM and TAM, 20 ml of 25 % ropivacaine was injected in the TAP plane, drug spread took a dark oval shape.

For LA

After nephrectomy was performed by the surgeon, local anaesthetic infiltration was performed by the surgeon using 20 ml of 0.25 % ropivacaine at the site of skin incision and muscle plane.

After extubation, the patients were transferred to the Post Anaesthesia Care Unit. The post-operative pain was assessed using VAS (visual analog scale). The severity of pain was numbered from 1 - 10 by the patients, in which the absence of pain was taken as VAS 0 and most severe pain was taken as VAS 10. For the treatment of post-operative pain of patients in whom VAS score was more than 3, tramadol 1 mg / Kg was administered intravenously. Azawi NH, Mosholt KSS.² and Aniskevich S, et al.³ performed a study on a total of 56 patients, in whom 28 patients underwent infiltration analgesia by the surgical team and 28 patients underwent TAP block by the anaesthetist.

The post-operative pain using VAS was evaluated at 0, 2nd, 4th, 6th, 8th, 12th and 24th hours. The number of opioid doses consumed by the patient and the side effects (nausea, vomiting, pruritus, sedation and urinary retention) in the first 24 hours post operatively were recorded. The difference between the group with TAP block and the group with infiltration analgesia was evaluated.

TAP block is a quite safe procedure with very less complications like local anaesthetic toxicity, nerve injury, bleeding and infection, inadvertent peritoneal puncture. (Sinha S, Mukherjee M).⁴

Sample Size

by formula

$$N = 2 \left[\frac{z_{1-\alpha} + z_{1-\beta}}{\delta} \right]^2 \times P (1 - P)$$

Where,

N = minimum sample size per group, P = prevalence rate (unknown, so assumed 50 %) = .50, 1 - P = 1 - .50 = .50, α = level of significance, δ² = the real difference between two treatment procedure or clinical acceptance margin or error = 7 % (assumed) = .07 Z_{1-α} = standard normal variable = 1.96 (from statistical table), Z_{1-β} = 0.84 (from statistical table), 1 - β = power of test. Hence, N = 2 (1.96 + .84)² / .07 x .50 x .50 = 2 x 7.84 x .25 = 56, N = 56.

Therefore, it is required minimum total sample size. Therefore, it can be divided in two study groups according to our objective. In each group we will select 28 samples, As I group for TAP = 28, II group for LA = 28.

Statistical Analysis

Statistical analysis was performed by Statistical Package for The Social Sciences (SPSS) version 17.0 version. Data was presented as tables. The mean ± standard deviation of different variables was given. By taking type of α (alpha error) = .05, the results were as given below.

The mean difference was found statistically not significant in between two groups as TAP & LA with respect to age, weight, systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate. The mean score of VAS was statistically significant in both groups at 8 hours by the help of Mann-Whitney U test. In another time frame, the difference of VAS scores was not found statistically significant in both groups by Mann-Whitney U test. By Fisher’s Exact test it was found statistically significant (P < 0.05) in both groups with respect to (w.r.t) comparison of rescue analgesia doses in 24 Hours & time to first rescue analgesic. (Table 3 & 4).

RESULTS

Age, weight baseline vitals like systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate, American Society of Anaesthesiologists (ASA) grading were comparable in both the groups (Table 1). VAS score in both the groups showed

that though immediately after operation VAS score was comparable between groups. At 6th, 8th and 12th hours post operatively VAS score was significantly low in group TAP (Table 2). Total dosage of rescue analgesic 24 hours in group TAP was 1.1+/-0.31 and in group LA was 1.56+/-0.51 which showed that analgesic consumption was significantly decreased in group TAP (Table 3). Mean time to first rescue analgesic required in group TAP was 12.20+/-4.54 hour and in group LA was 7.11+/-1.01 hour which was statistically significant (Table 4). Complications like nausea / vomiting were significantly lower in group TAP. No complications related to the TAP block technique were observed in both the group (Table 5).

Patient Characteristics	Group TAP	Group LA	P Value*
Age (years)	32.36 ± 7.89	32.11 ± 7.61	0.90 NS
Weight (Kg)	60.57 ± 7.56	62.61 ± 5.75	0.26 NS
SBP (mmHg)	118.96 ± 13.67	114.89 ± 9.86	0.21 NS
DBP (mmHg)	72.64 ± 8.48	70.39 ± 9.64	0.36 NS
Heart rate (bpm)	85.93 ± 18.73	83.79 ± 10.97	0.60 NS
ASA Grade	Group TAP	Group LA	0.78 NS
	N	N	%
Grade II	18	17	60.71
Grade III	10	11	39.29
Total	28	28	100

Table 1. Demographic Data and Base Line Vitals in the Two Groups

(*) Independent t test

VAS Score	Group TAP	Group LA	P Value*
At 0 hours	1.68 ± 0.77	1.71 ± 1.24	0.90 NS
At 2 hours	1.79 ± 0.83	1.82 ± 1.33	0.71 NS
At 4 hours	1.79 ± 0.92	1.89 ± 1.42	0.72 NS
At 6 hours	2.82 ± 0.94	3.39 ± 0.92	0.026 S
At 8 hours	2.89 ± 0.99	4.25 ± 0.89	< 0.001 HS
At 12 hours	3.64 ± 1.1	4.32 ± 0.94	0.02 S
At 24 hours	3.96 ± 1.53	3.93 ± 1.09	0.92 NS

Table 2. Comparison of Visual Analog Scores

(*) Mann-Whitney U test

Number of Rescue Analgesic Required	Group TAP	Group LA	P Value*
0 not required	8 (28.57 %)	1 (3.57 %)	
1 time required	18 (64.29 %)	12 (42.86 %)	< 0.0001 HS
2 time required	2 (7.14 %)	14 (50 %)	
3 time required	0 (0 %)	1 (3.57 %)	
Total	28 (100 %)	28 (100 %)	
Mean total dosage of rescue analgesic in 24 hrs. Mean ± SD	1.1 ± 0.31	1.56 ± 0.51	0.001 HS

Table 3. Comparison of Rescue Analgesia Doses in 24 Hours

(*) Fisher’s Exact test

Time to First Rescue Analgesic	Group TAP	Group LA	P Value*
6 hour	2 (7.14 %)	12 (42.86 %)	< 0.0001 HS
8 hour	2 (7.14 %)	15 (53.57 %)	
12 hour	14 (50 %)		
24 hour	2 (7.14 %)		
Mean time to first rescue analgesic Mean ± SD	12.20 ± 4.54	7.11 ± 1.01	< 0.0001 HS

Table 4. Distribution of Patients According to Time to First Analgesic Request

(*) Fisher’s Exact test

Complications	Group TAP	Group LA
Nausea / vomiting	7 (25 %)	16 (57.14 %)
Other complications (pruritus, urine retention, sedation)	Nil	Nil

Table 5. Comparison of Side Effects

DISCUSSION

This randomised single-blind study was designed to compare USG guided TAP block and local anaesthetic infiltration on postoperative analgesia during unilateral nephrectomy and found that TAP block significantly reduced the number of patients who required postoperative tramadol rescue analgesia, 24 hours tramadol consumption with increased time of first analgesia and less postoperative pain score. Nausea and vomiting were significantly low in TAP group. The current study did not find any other adverse effect of TAP block Velchev V, Malamov K.⁵ Our study shows that quality of analgesia improves in TAP group. VAS score at 6 hours, 8 hours and 12 hours postoperatively was significantly low in TAP group. ($P < 0.05$) Time to 1st rescue analgesic was significantly more in group TAP (12 hours) than group LA (6 hours).

2 patients in only TAP group and 18 patients in LA group required rescue analgesic within 6 hours post-operatively. Prolonged duration of analgesia following TAP block is because transversus abdominis plane is poorly vascularised, this causes slow drug clearance as the absorption in the blood is reduced.

Bhattacharjee S, et al.⁶ reported that TAP block with bupivacaine provides effective perioperative analgesia in patient with total abdominal hysterectomy. Duration of post-operative analgesia was 290 minutes following TAP block with bupivacaine. They also reported that four patients did not receive any rescue analgesia for 24 hours. In first 2 hours, pain score was same in both the groups.

This was explained by the post-operative analgesia offered by spinal bupivacaine in both the groups for first 2 hours. At 24 hours also, no difference was found in pain score due to regression of TAP block and patient's pain was similar to that of the control group. In 2016, Sinha S, Palta S, et al.⁷ compared the patients undergoing laparoscopic cholecystectomy with the ultrasound guided deposition of ropivacaine 0.375 % in the TAP provided effective analgesia in the early postoperative period in comparison to bupivacaine 0.25 %.

Parikh et al.⁸ found that ultrasound guided TAP block was easy to perform and effective as post-operative analgesic regimen in retro peritoneoscopy donor nephrectomy, with opioid sparing effect and without any complications.

Hosgood et al.⁹ also found in their study randomised, double blind, placebo controlled trial in patients undergoing laparoscopic nephrectomy, TAP-block with bupivacaine reduced early morphine requirements (up to 6 hours surgery, $P = 0.015$) but the amount of morphine required was same ($P = 0.711$) when compared to saline TAP-block injection and patient reported less postoperative pain on days one ($P = 0.003$) and two ($P = 0.031$) and required less oral analgesics during their hospital stay.

Hosgood et al.⁹ administered 0.375 % bupivacaine. We chose ropivacaine as in accidental intravascular injection ropivacaine was found to have safer cardiovascular risk, Das N et al.¹⁰

The use of USG guided sensory block of anterior abdominal wall with local anaesthesia for postoperative pain relief is an attractive method. USG-guided TAP-block has

been shown to be a promising technique for providing analgesia after surgery involving anterior abdominal wall. Considering the intraoperative spillage or leaking of the local analgesic from the TAP plane and to prolong the analgesic effect, we decided to give USG-guided TAP-block postoperatively.

CONCLUSIONS

Unilateral USG guided TAP block applied in patients undergoing unilateral nephrectomy was superior to infiltration analgesia in terms of pain scores, total opioid consumption, and their side effects.

Limitations of the Study

Lack of proper assessment of pain by VAS score postoperatively was the limitation mainly because of illiteracy of the patients (Ahmed M. et al).¹¹

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

REFERENCES

- [1] Goswami D, Dey S, Dutta S, et al. Addition of dexmedetomidine to ropivacaine in transversus abdominis plane block potentiates post-operative pain relief among laparoscopic cholecystectomy patients – a randomised controlled trial. *J Evolution Med Dent Sci* 2019;8(43):3216-3219.
- [2] Azawi NH, Mosholt KSS, Fode M, et al. Unilateral ultrasound - guided transversus abdominis pain block after nephrectomy: postoperative pain and use of opioids. *Nephrourol Mon* 2016;8(2):e35356.
- [3] Aniskevich S, Taner BC, Perry DK, et al. Ultrasound guided transversus abdominis plane blocks for patients undergoing laparoscopic hand – assisted nephrectomy: a randomized, placebo-controlled trial. *Local Reg Anesth* 2014;7:11-16.
- [4] Sinha S, Mukherjee M, Chatterjee S, et al. Comparative study of analgesic efficacy of ropivacaine with ropivacaine with ropivacaine plus dexmedetomidine for paravertebral block in unilateral renal surgery. *Anaesth Pain & Intensive Care* 2012;16(1):38-42.
- [5] Velchev V, Malamov K. The analgesic efficacy of transversus abdominis plane (TAP) block. *Kirurgija (Sofia)* 2010;(1):15-18.
- [6] Bhattacharjee S, Ray M, Ghose T, et al. Analgesic efficacy of transversus abdominis plane block in providing effective perioperative analgesia in patients undergoing total abdominal hysterectomy: a randomized controlled trial *Anaesthesiol Clin Pharmacol* 2014;30(3):391-396.
- [7] Sinha S, Palta S, Saroa R. Comparison of ultrasound guided transversus abdominis plane block with

- bupivacaine and postoperative ropivacaine as adjuncts for in laparoscopic cholecystectomies. *Indian J Anaesth* 2016;60(4):264-269.
- [8] Parikh KB, Waghmare VT, Shah VR, et al. The analgesic efficacy of ultrasound – guided transversus abdominis plane block for retroperitoneoscopic donor nephrectomy: a randomized controlled study. *Saudi J Anaesth* 2013;7(1):43-47.
- [9] Hosgood SA, Thiyagarajan UM, Nicholson HF, et al. Randomized clinical trial of transversus abdominis plane block versus placebo control in live-donor nephrectomy. *Transplantation* 2012;94(5):520-525.
- [10] Das N, Shukla U, Singh D, et al. Comparison of analgesic efficacy between TAP block and local site infiltration postoperatively in caesarean section. *Int J Res Med Sci* 2018;6(4):1407-1413.
- [11] Abd El-Hamid AM, Afifi EE. Transversus abdominis plane block versus local anaesthetic wound infiltration in patients undergoing open inguinal hernia repair surgery. *Ain-Shams J Anaesthesiol* 2016;9(2):280-283.