

# Ultrasound guided tap block: Comparison of analgesic efficacy of levobupivacaine and ropivacaine

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## Abstract

**Study objective:** Ultrasound guided transverse abdominis plane (TAP) block is an effective method of providing postoperative analgesia in patients undergoing abdominal surgeries. We compared the postoperative analgesic efficacy of 0.5% levobupivacaine and 0.5% ropivacaine and post-operative hemodynamic variables after total abdominal hysterectomy (TAH) performed through a Pfannenstiel incision. **Design:** A prospective randomized double blinded study. **Setting:** Operating room of Navodaya Medical College Hospital and Research Centre, Raichur. **Patients:** Seventy female patients aged 45-60 years, of ASA-PS I or II, scheduled for elective TAH under general anesthesia, were recruited in this study. **Interventions:** Patients were randomized into 2 groups (Group L-0.5% levobupivacaine, Group R-0.5% ropivacaine). At the end of surgery, bilateral TAP block given under ultrasound guidance. **Measurements:** Duration of postoperative analgesia, time for requirement of first rescue analgesic, VAS score and postoperative hemodynamic variables were assessed for 48 hours postoperatively. Statistical analysis was done using SPSS 18.0, and R environment ver.3.2.2. ANOVA/Chi-square/ Fisher Exact test to assess significance of the study. **Results:** Patients in Group R had longer duration of postoperative analgesia, 15.33±0.40 hours than Group L, 14.16±0.24 hours. Postoperative VAS score hours (p<0.001) was lower up to 14 hours in group-L compared to 16 hours in group-R. 65.7% patients required rescue analgesic at 14th hour in group L whereas; in group R were 80% patients required first dose of rescue analgesic at 16th hour. Hemodynamic parameters were comparable in both the groups. **Conclusion:** 0.5% ropivacaine in ultrasound guided TAP block provides longer duration of post-operative analgesia, delays the requirement of first dose of rescue analgesic. Whereas, its hemodynamic stability is comparable with 0.5% levobupivacaine.

**Key Word:** TAP block, ropivacaine, levobupivacaine, analgesic efficacy, VAS score, pulse rate, MAP

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## INTRODUCTION

Total abdominal hysterectomy (TAH) is a commonly performed operation that results in substantial amount of

postoperative pain and discomfort. An important component of the pain experienced by patients after abdominal surgery is derived from the abdominal wall incision. An effective postoperative analgesic regimen must facilitate early ambulation; prevent postoperative morbidity with minimal adverse effects. Transversus abdominis plane (TAP) block has gained popularity as an important component in multimodal postoperative analgesic regimen, which reduces the requirement of opioids and NSAIDs after TAH. The transversus abdominis plane (TAP) technique, originally described by Rafi<sup>3</sup>, involves injection of local anesthetic in the plane between internal oblique and transversus abdominis muscle layer, with the aim of anaesthetizing the nerves (T6-L1) supplying the anterior abdominal wall. The

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landmark-guided technique uses loss of resistance as the needle is advanced through the fascial layers of external oblique and internal oblique. After locating the triangle of Petit, (latissimus dorsi posteriorly, external oblique superiorly, iliac crest inferiorly) the TAP is identified using the subjective double-pop loss of resistance technique. Landmark-guided technique is no longer recommended because of ambiguity in the procedure, variation of the lumbar triangle of Petit, and the risk of peritoneal perforation during the blind technique. The use of ultrasonography improves the accuracy of the technique and also reduces the complications. This study compares postoperative analgesic efficacy of 0.5% levobupivacaine and 0.5% ropivacaine in ultrasound guided TAP block, time for requirement of first dose of rescue analgesic and postoperative hemodynamic variables after total abdominal hysterectomy (TAH).

## METHOD AND MATERIALS

**Study design and participants:** A prospective randomized double blinded clinical trial was conducted at Navodaya Medical College Hospital and Research Centre, after receiving approval by the institutional ethical committee. Informed written consent was taken from the patients enrolled in the study. Seventy adult female patients aged 45-60 years, of American Society of Anaesthesiologists (ASA) physical status (PS) I or II, scheduled for total abdominal hysterectomy by a Pfannenstiel incision, under general anesthesia were randomized into two groups: **Group L:** 0.5% levobupivacaine (n = 35) and **Group R:** 0.5% ropivacaine (n = 35) by sealed envelope method to undergo TAP block. Exclusion criteria included, ASA-PSIII and above, allergy to Local anesthetic, patient refusal, history of bleeding diathesis and patient on anticoagulants, and local infection of abdominal area. All the patients were followed up for 24 hours post-operatively, by an anesthesiologist who was blinded to the drug administered. The primary objective of the study was assessment of duration of postoperative analgesia and time for requirement of first dose of rescue analgesic. The secondary objective was to assess the hemodynamic variables.

**Study protocol:** The patients were clinically assessed, evaluated, and investigated before anesthesia. The visual analog scale (VAS) used for rating pain was explained to all the patients before surgery. Patients were kept nil by mouth for 8 hours. On the day of surgery, in the operating room an intravenous (IV) access using 18-gauge cannula was established. Standard monitoring including electrocardiogram, non-invasive blood pressure, and pulse-oximetry and end-tidal carbon dioxide monitoring were instituted. Patients were pre-oxygenated and pre-

medicated with midazolam (0.03mg/kg) and fentanyl (2mg/kg) induced with injection propofol (2 mg/kg). Neuromuscular blockade was achieved with atracurium (0.5 mg/kg) and subsequently intubated with appropriate sized cuffed endotracheal tube. Anesthesia was maintained with oxygen (33%), nitrous oxide (66%), and isoflurane. Ultrasound guided bilateral TAP block was performed at the end of the surgery. The patients were randomly allocated to two groups:

- Group L (levobupivacaine): TAP block with 15 ml of 0.5% levobupivacaine on either side of abdominal wall
- Group R (ropivacaine): TAP block with 15 ml of 0.5% ropivacaine on either side of the abdominal wall.

The patients and the investigators performing the block and providing postoperative care were blinded to the drug injected in TAP block. Drugs were prepared by an anesthesiologist not involved in performing block or data collection. All patients received IV ondansetron (0.1 mg/kg) before the completion of surgery. At the end of surgery, neuromuscular paralysis was reversed using neostigmine (0.04 mg/kg) and glycopyrrolate (0.01 mg/kg). Extubation was done once the patient was breathing spontaneously and obeyed verbal commands. Patients were monitored in the recovery room for every fifteen minutes for an hour, then at 2,4,8,10,12,14,16,24,48 hours postoperatively for pulse rate, blood pressure, pain using VAS score and any complications. Patients were given rescue analgesia with intravenous injection tramadol 100mg in 100ml of normal saline at VAS score of  $\geq 4$ . The duration of analgesia was considered from the time of performing the block till VAS score of  $\geq 4$ . Patients were observed for post procedure complications like hematoma, flank fullness and inadvertent peritoneal puncture.

**TAP block under ultrasound guidance:** With patients in supine position, the linear array ultrasound probe of high frequency (6-13MHz) was placed in a transverse plane between the lower costal margin and the iliac crest in the mid axillary line. The radiopaque block needle (10cm) was advanced using in-plane technique with an anteromedial to posterolateral direction. The needle was advanced between the aponeurosis of internal oblique and transversus abdominis muscles. With intermittent aspiration, 15ml of the local anesthetic under study was deposited and seen as a hypo-echoic shadow pushing the 2 layers apart. Visualizing hypo-echoic spread, with the fascial layer above and the muscle layer below ensured proper deposition of the drug. Needle was repositioned until the drug was seen to spread within the plane, separating the fascia between the muscles. Same was repeated on the other side.

**Statistical analysis:** The Statistical analysis was done using SPSS (Statistical Package for Social Sciences) 18.0, and R environment ver.3.2.2. Continuous measurements were presented as mean $\pm$ SD and results on categorical measurements were presented in number (%). Significance was assessed at 5% level of significance. ANOVA /Chi-square/ Fisher Exact test was used to find the significance of study parameters on categorical scale between two groups. P-value <0.05 was considered significant.

**RESULTS**

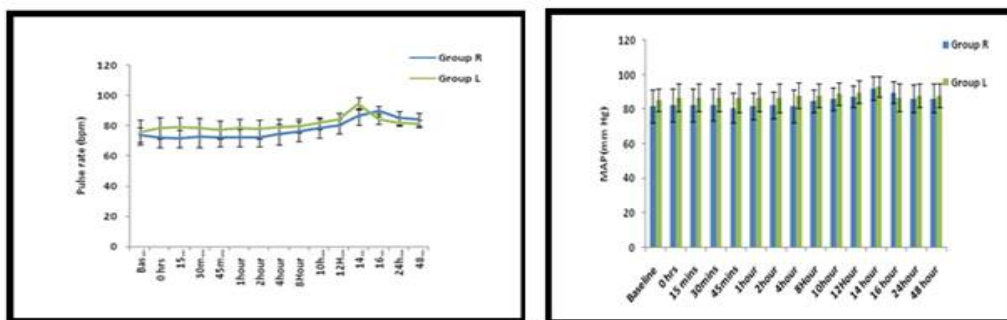
As shown in table1. baseline parameters(age, weight and ASA-PS) were comparable between two groups. There

was a no statistically significant difference in mean pulse rate (p=0.229) and mean arterial blood pressure (p=0.252) between the two groups recorded over 48hours post operatively(figure 1,2). The postoperative analgesia was assessed using VAS score. The VAS score (table 2) was not statistically significant between the two groups at 1h (p=1), 2h (p=0.9)4h (p=1), 8h (p=1), 10h (p=1) and 12h (p=1). However, the VAS score at 14 and 16hours were statistically significant with p<0.001. 23(65.7%) patients required rescue analgesic at 14<sup>th</sup> hour in group L whereas, in group R 28(80%) patients required first dose of rescue analgesic at 16<sup>th</sup> hour. In this study mean duration of postoperative analgesia in Group R was 15.33 $\pm$ 0.40hours when compared to Group L, 14.16 $\pm$ 0.24hours (table 3)

**Table 1:** Comparison of baseline parameters.

Parameters	Group R (n=35)	Group L (n=35)	p-value
Age	50.40 $\pm$ 4.22	52.60 $\pm$ 4.39	0.1 <sup>a</sup>
Weight	56.86 $\pm$ 4.96	58.00 $\pm$ 7.76	0.012 <sup>a</sup>
ASA-PS 1/2	32/3	33/2	1 <sup>b</sup>

a=ANOVA test, b= Fischer Exact test.



**Figure1:** Comparison of pulse rate between two groups; **Figure2:** Comparison of mean arterial blood pressure between two groups

**Table2:** Comparison of VAS score between 2 groups

Time	VAS Score	Group R (n=35)	Group L (n=35)	P value
0hour	<4.0	35(100%)	35(100%)	1.000
	$\geq$ 4.0	0(0%)	0(0%)	
1hour	<4.0	35(100%)	35(100%)	1.000
	$\geq$ 4.0	0(0%)	0(0%)	
2hour	<4.0	35(100%)	35(100%)	1.000
	$\geq$ 4.0	0(0%)	0(0%)	
4hour	<4.0	35(100%)	35(100%)	1.000
	$\geq$ 4.0	0(0%)	0(0%)	
8hour	<4.0	35(100%)	35(100%)	1.000
	$\geq$ 4.0	0(0%)	0(0%)	
10hour	<4.0	34(97.1%)	35(100%)	1.000
	$\geq$ 4.0	1(2.9%)	0(0%)	
12hour	<4.0	35(100%)	35(100%)	1.000
	$\geq$ 4.0	0(0%)	0(0%)	
14hour	<4.0	35(100%)	12(34.3%)	<0.001**
	$\geq$ 4.0	0(0%)	23(65.7%)	
16hour	<4.0	7(20%)	35(100%)	<0.001**
	$\geq$ 4.0	28(80%)	0(0%)	

**Table 3:** Comparison of duration of analgesia.

Duration of analgesia	Group R	Group L
<12 hour	0(0%)	0(0%)
12-16 hour	28(80%)	35(100%)
>16 hour	7(20%)	0(0%)
Total	35(100%)	35(100%)
Mean $\pm$ SD	15.33 $\pm$ 0.40	14.16 $\pm$ 0.24

## DISCUSSION

The adequate postoperative analgesia facilitates early mobilization, accelerates recovery from surgery, and reduces postoperative stress response and postoperative morbidity. An effective postoperative analgesic regimen needs to meet the goals of providing safe analgesia with minimal adverse effects. A series of studies have highlighted the efficacy of various local anesthetic agents in Transversus Abdominis Plane (TAP) block, after the initial description of the technique by Rafi who performed abdominal field block via the lumbar triangle without any untoward sequelae. TAP block is a simple and effective analgesic technique, for surgical procedures where parietal pain is a significant component of postoperative pain. The local anesthetic agents in TAP block have been demonstrated to provide excellent analgesia in patients undergoing total abdominal hysterectomies, colonic resection surgery involving a midline abdominal wall incision, caesarean delivery,<sup>4</sup> and radical prostatectomy<sup>5</sup>. Moreover, the risk of systemic toxicity from the local anesthetics is less in TAP block due to reduced vascularity of this plane. The simplicity of the procedure also provides an advantage for clinical use. This study was conducted after receiving institutional ethical committee approval. In our study, TAP block with (group R) 0.5% ropivacaine provided longer duration of postoperative analgesia (15.33 $\pm$ 0.40hours) and 28(80%) patients in this group had VAS scores of >4 requiring rescue analgesic at 16 hours; compared to (group L) 0.5% levobupivacaine provided analgesia for 14.16 $\pm$ 0.24hours and 23(65.7%) of patients in this group required first dose rescue analgesic earlier at 14hours with VAS score of >4. Bhavna *et al.*,<sup>6</sup> conducted study in 2012 on fifty women to undergo bilateral TAP block with ropivacaine 0.5%(n=25) versus placebo (n=25). Postoperative morphine requirements up to 24 hrs were significantly reduced (median 18.0mg) compared with placebo group (median 33 mg). Patients in TAP group reported lower visual analogue scale scores than patients in the placebo group. Sooyoung Cho, Youn-Jin Kim, Dong-Peon Kim and *et al*<sup>7</sup> in 2013 conducted study on forty-four patients undergoing appendectomy. Patients were assigned either to undergo a right sided-TAP block or to receive standard care. All patients received standard anesthetics, and the TAP block group received ultrasound-guided right side TAP block using 20 mL of 0.5% levobupivacaine after induction of anesthesia. The TAP

block group with levobupivacaine compared to the control group had reduced VNRS significantly up to 12 hours postoperatively. Both the groups in our study were hemodynamically stable throughout the study duration. A study conducted by Bhattacharjee.*et.al.* on 90 adult female patient of ASA-1 or 2 undergoing TAH by lower abdominal transverse incision showed that TAP block prevents hemodynamic responses to surgical stimuli and provides effective postoperative analgesia<sup>8</sup>. The finding that the TAP block prolonged postoperative analgesia for static pain following a single-shot TAP technique using local anesthetic. The reasons for the prolonged duration of analgesic effect after TAP blockade are not entirely elucidated. However, it may be related to the fact that the TAP is relatively less vascularized, and therefore drug clearance may be delayed<sup>9</sup>. The technique of ultrasound guided nerve block is gaining popularity as it is more accurate and associated with less adverse outcomes. This technique is applied more frequently and effectively for injection of local anesthetic in the TAP block<sup>10,11,12</sup>. So we opted for ultrasound guided approach in our study and we did not have any complications. Unlike most other studies, our study used TAP block as sole method of providing postoperative analgesia. The study was terminated at the first requirement of rescue analgesic or at 24 hours, whichever was earlier. The difference in the duration of analgesia between the drugs under study could be attributed to some extent to the intrinsic vasoconstrictor effect of amino amide local anesthetics like ropivacaine<sup>13</sup>. The present study has few limitations. Firstly, the study did not include the control group, i.e. TAP block with placebo. Secondly, we assessed only the static component of pain and did not assess the dynamic component. Thirdly, we failed to measure the number of boluses of rescue analgesic required by the patient.

## CONCLUSION

The present study was undertaken to assess postoperative analgesic efficacy of 0.5% levobupivacaine and 0.5% ropivacaine in ultrasound guided TAP block and postoperative hemodynamic variables after total abdominal hysterectomy. We found that the analgesia following ultrasound-guided single-shot TAP block using 0.5% ropivacaine is more efficacious and also delays the requirement of first dose of rescue analgesic in comparison to 0.5%levobupivacaine, with hemodynamic

variables being comparable in both the groups under study. However, adequate practice and expertise is required to perform ultrasound guided TAP block.

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