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**Original article**

## THE EVALUATION OF THE EFFICACY OF 0.25% BUPIVACAINE AND 0.5% ROPIVACAINE IN ULTRASOUND GUIDED BILATERAL TRANSVERSUS ABDOMINIS PLANE BLOCK FOR POST OPERATIVE ANALGESIA IN LOWER ABDOMINAL SURGERIES

Ashwini Gujjar Swamy Rao<sup>1</sup>, Shruti Ghodageri<sup>1</sup>, Megha Gowrasamudra Hanumanthappa<sup>1</sup>, Srilekha Kurella<sup>1</sup>

<sup>1</sup>Department Of Anaesthesiology, Basaveshwara Medical College and Hospital Chitradurga, Karnataka, India

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### Abstract

**Introduction:** The increasing use of nerve blocks for post operative analgesia has led to the development of several newer interfascial injection techniques for analgesia of the chest and abdominal wall. The unique feature of ultrasound guided truncal blocks is that in all of these techniques, in contrast to peripheral nerve blocks, no nerve or plexus needs to be identified. Local anaesthesia is injected in a particular muscle plane, in which the injectate spreads and reaches the intended nerves. Transversus abdominis plane (TAP) block has become a common analgesic method after surgery involving the abdominal wall. **Aim:** 1. To assess the efficacy of 0.25% Bupivacaine and 0.5% Ropivacaine in pain relief after lower abdominal surgeries using ultrasound guided transversus abdominis plane block (TAP). 2. Requirement of first rescue dose. 3. To assess complications related to the technique and drug related adverse effects. **Methods:** A comparative, randomised, double blinded study was carried out on 60 ASA physical status grade I and II patients of either sex between 18-40 years of age, scheduled for elective lower abdominal surgeries. 60 patients were divided equally by using computer generated random numbers into two groups. Group B received 15 ml of 0.25% Bupivacaine. Group R received 15 ml of 0.5% Ropivacaine. The TAP block was performed at the end of the surgery using the ultrasound. **Results:** Mean duration of analgesia was 373.75 minutes with SD of 66.1512 in Bupivacaine group and 687 minutes with SD of 119.433 in Ropivacaine group. The difference was highly significant in Group R compared to Group B ( $p < 0.0001$ ). **Conclusion:** Thus, we conclude that 0.5% Ropivacaine provided longer duration of analgesia than 0.25% Bupivacaine when used in TAP block for providing post operative analgesia after lower abdominal surgeries.

**Keywords:** Bupivacaine; Ropivacaine; Transversus abdominis plane block

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### Introduction

Pain is the most dreaded problem which a person fears after surgery. A substantial component of the pain experienced by patients after abdominal surgery is derived from the abdominal wall incision<sup>1</sup>. The Transversus Abdominis Plane Block is an effective method of providing postoperative analgesia in patients undergoing midline abdominal wall incisions<sup>2</sup>. NSAIDs, Opioids etc are being used for analgesia each of which has its own side effects. The opioids have a number of side effects such as respiratory depression, emesis, sedation and reduction in motility of gut etc. NSAIDs also have certain side effects like haemostasis alterati-

on, renal dysfunction, gastrointestinal haemorrhage etc. The use of peripheral regional analgesic techniques in the form of single injection or continuous infusion is gaining popularity for post operative analgesia<sup>1</sup>. Transversus Abdominis Plane Block is gaining popularity as one of such blocks performed using ultrasound<sup>1</sup>. Local anaesthetic is injected into the plane between internal oblique and transversus abdominis muscle and it blocks the sensory nerves of the anterior abdominal wall before they pierce the musculature to innervate the abdomen<sup>4</sup>. It produces a dermatomal sensory block of the lower six thoracic and upper lumbar abdominal afferents<sup>4</sup>. Rafi et al. (2001) was the first to describe this<sup>3</sup>. The technique has been shown by

the originators to supplement multimodal analgesia in midline incision colonic surgery, abdominal hysterectomy, caesarean section and appendectomy<sup>2,5,6,7</sup>. The present study was conducted to compare efficacy of Bupivacaine and Ropivacaine in relieving post operative pain in lower abdominal surgery by Transversus Abdominis Plane Block. The aim of our study was to analyse the effectiveness of ultrasound guided Transversus Abdominis Plane Block in terms of duration of analgesia and requirement of first rescue dose and to assess the complications related to the technique and drug related adverse effects

### **Methodology**

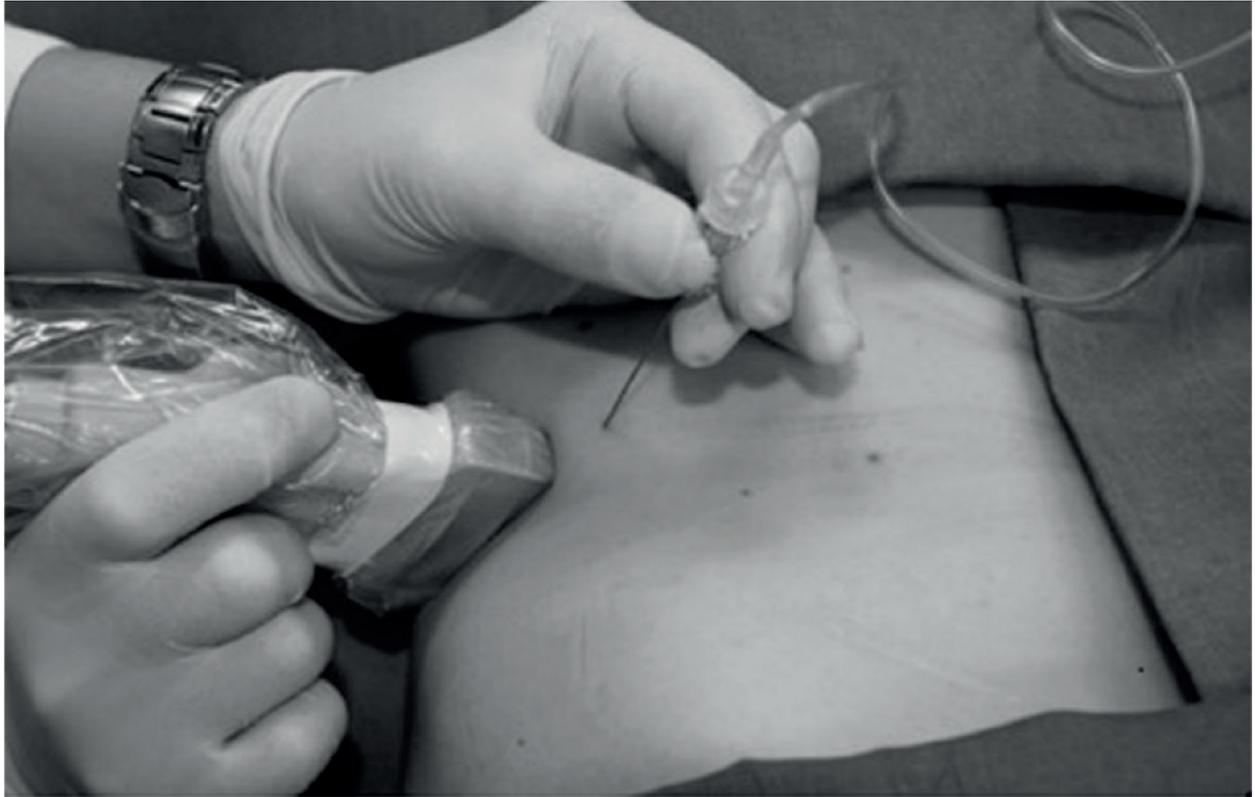
A comparative, randomised, double blinded study was carried out on 60, ASA physical status grade I and II patients of either sex, between 18–60 years of age, scheduled for elective lower abdominal surgeries. The study was conducted in the department of Anesthesiology, BMCH, Chitradurga. After the approval by the Institutional Ethical Committee on 16<sup>th</sup> January 2021 numbered 2020–2021/98, written informed consent was obtained from all the patients before being included in the study. The sample size was calculated from the data obtained by the previous study Srivastava U et al (Duration of TAP block and consumption of rescue analgesia). Sampling was done by Simple Random Sampling using computer generated table. Sample size was calculated using Open-epi software (AG Dean, KM Sullivan, MM Soe – 3.03/September 22, 2014) considering 95% confidence interval, 80% power of study and assumed standard deviation of 4.5 with 10% drop rate. The sample size obtained was 30 in each group. The mean duration of analgesia using Bupivacaine and Ropivacaine was  $401.73 \pm 297.85$  and  $747.5 \pm 394.7$  mins respectively<sup>16</sup>. 60 patients were divided equally by using computer generated random numbers into two groups containing 30 each. Group B (n = 30) received 15 ml of 0.25% Bupivacaine on each side. Group R (n = 30) received 15 ml of 0.5% Ropivacaine on each side. Patients with age group of 18–60 years of either sex, ASA grade I or II and patients who gave informed and written consent were included in the study. Patients not willing to participate in the study, ASA III and IV, history of

bleeding diathesis, patients on systemic anticoagulation therapy, infection at the site of injection, patients with chronic pain syndromes, history of allergy to local anesthetics, Body Mass Index (BMI) < 18 or > 35 Kg/m<sup>2</sup> were excluded from the study. Statistical Analysis was done using Statistical package for social sciences (SPSS) software version 20. Results of categorical variables was presented using proportions and analyzed using Chi square test or Fisher's exact test as appropriate. Results of continuous variables was presented as means and analyzed using t-test or Mann Whitney test.

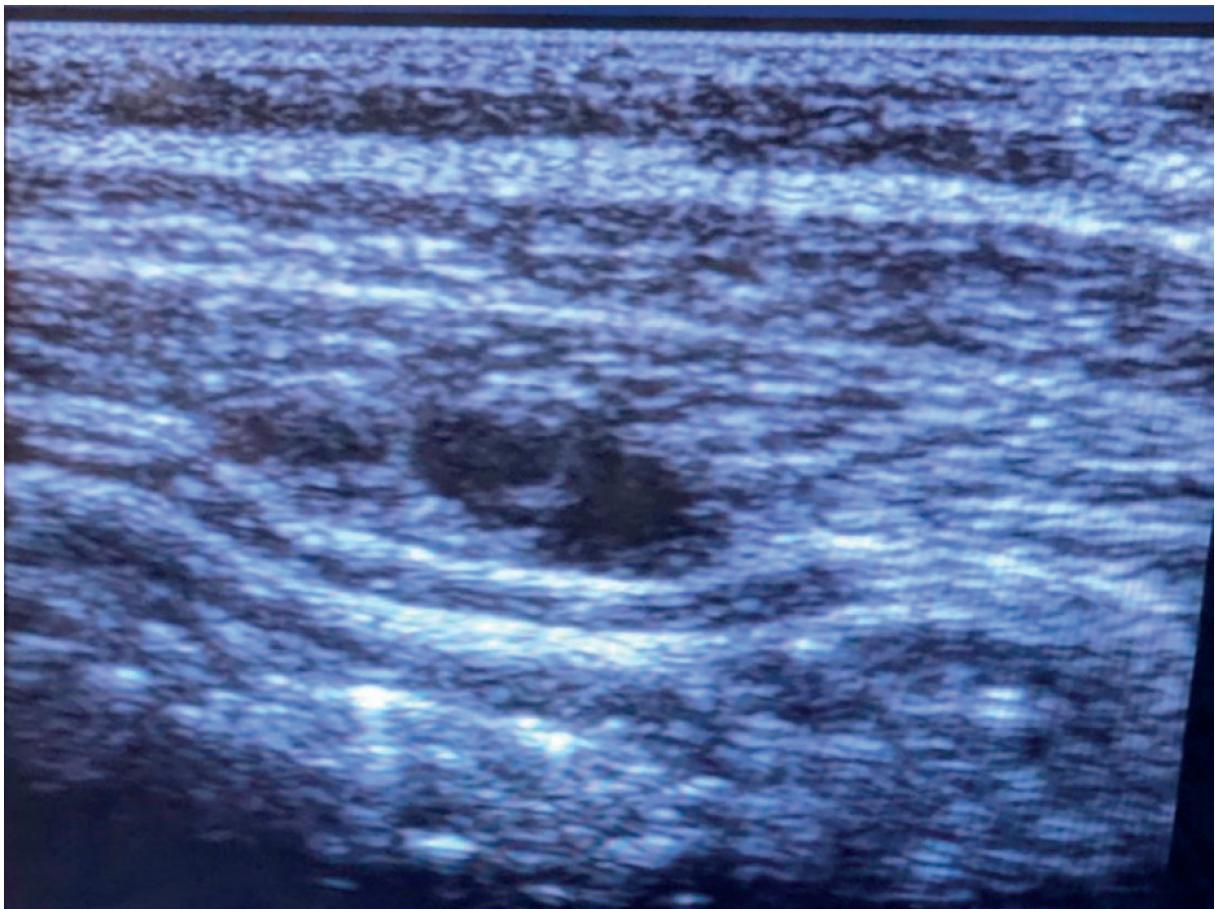
All patients underwent preanaesthetic evaluation on the previous day of surgery. Routine pre-operative lab investigations like Hb, FBS or RBS, blood urea, serum creatinine and ECG were carried out routinely in all patients. After Anaesthetic drill is completed, an i.v. line was secured and routine monitors (ECG, NIBP, pulse oximetry) were applied in the operating room. Baseline readings were recorded. All patients received Inj Ondansetron 4 mg i.v. and Inj Ranitidine 150 mg i.v. 30 minutes before the procedure. Before performing spinal anesthesia, each patient is pre-loaded with 10 ml/kg of lactated Ringer's solution. Following the guidelines for asepsis and antisepsis, subarachnoid block was conducted at either the L3-4 or L4-5 interspaces. A volume of 3.4 ml of Hyperbaric 0.5% Bupivacaine was injected using a 25 G Quincke spinal needle. The patient was randomized to undergo TAP block with either 30 ml of 0.25% Bupivacaine (Neon, India) i.e. 15 ml each side, which will be classified as Group B versus 30 ml of 0.5% Ropivacaine (Neon, India) i.e. 15 ml each side which will be Group R.

The TAP block was performed at the end of the surgery using ultrasound device. High frequency Linear probe (5–10 mHz) of USG device (GE, October 2019) was used under sterile conditions. The probe was placed in midaxillary line between costal margin and iliac crest in the lateral abdominal wall in supine position.

The TAP is located between Transversus abdominis and Internal oblique. Once the TAP is located, the depth is noted in midaxillary line between costal margin and iliac crest. In-plane technique was employed to be safe. The Stimuplex 23G 10 cm echogenic regional anaesthesia needle (B Braun, Mesungen, Germany) is advanced into the Transversus abdominis and pulled back and the



**Figure 1:** Showing the position of USG probe and in plane technique of needler placement



**Figure 2:** USG image showing “Eye Sign” with hydrodissection

plane is hydrodissected until “Eye Sign”, an elliptical, hypoechoic spread of local anaesthetic is seen.

All the TAP block procedures were performed by the same person who was blinded. A pain nurse who had undergone prior education in the assessment of post operative analgesia and who was unaware of group assignment collected data of each patient. Thus, the observer was blinded. After careful aspiration to exclude vascular puncture, 15 ml of 0.25% Bupivacaine on each side or 15 ml of 0.5% Ropivacaine on each side was injected observing closely for signs of toxicity.

The presence and severity of pain, sedation and nausea was then assessed systematically. Visual Analog Scores (VAS) (i.e. 0 = no pain, 10 = worst imaginable) for pain was assessed serially at 1 hr, 1 and half hr, 2 hr, 3 hr, 4 hr, 6 hr, 8 hr, 10 hr, 12 hr, 18 hr and 24 hours after surgery. The duration of block was recorded from the time of study drug administration up to the time required to reach VAS 4. Inj. Paracetamol 1 gm i.v. was used

as rescue agent. The time for first analgesic request was noted if the VAS was more than 4. Number of patients requiring rescue analgesics in the first 24 hours postoperatively was recorded. The total dose of rescue analgesics required in the first 24 hours was recorded.

Occurrence of any technique related complications like hematoma, bleeding, infection, pneumoperitoneum was assessed. Side effects like nausea, vomiting, hematoma, symptoms of local anaesthetic toxicity (disorientation, somnolence, hypotension, respiratory depression and convulsions) were looked for.

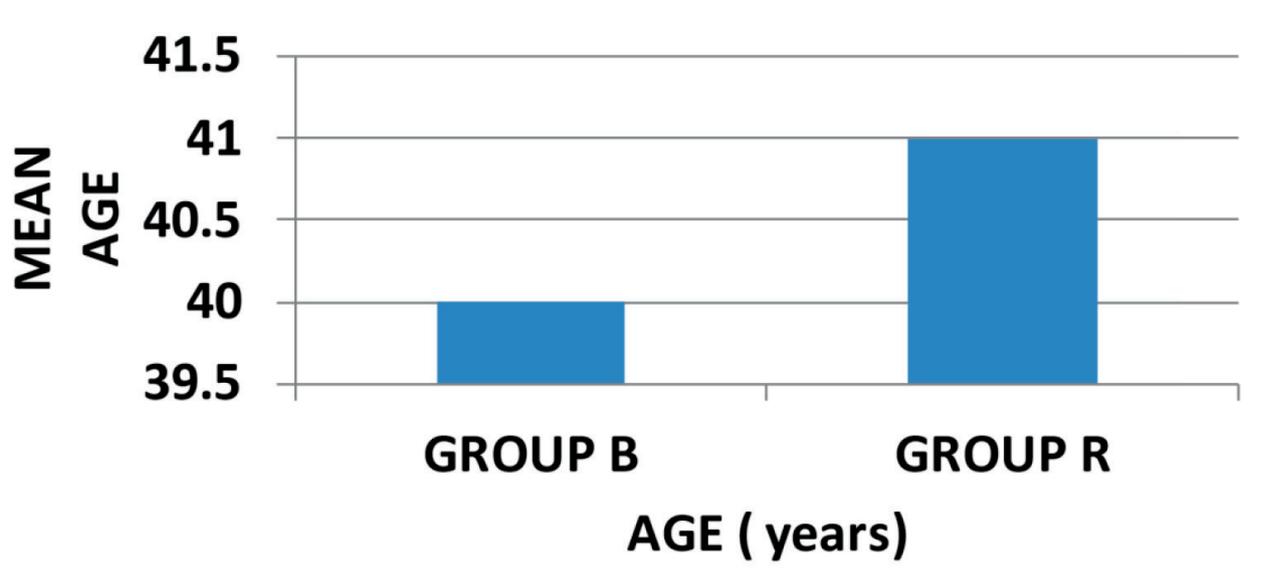
**Results**

The mean age were comparable in both the groups. The mean age in group B was 40.53 years and in group R was 41.87 years.

**Table 1:** Distribution of Age

Parameters	Group B		Group R		Mean Difference	p value
	Mean	SD	Mean	SD		
AGE (years)	40.53	0.856	41.87	1.064	1	0.05

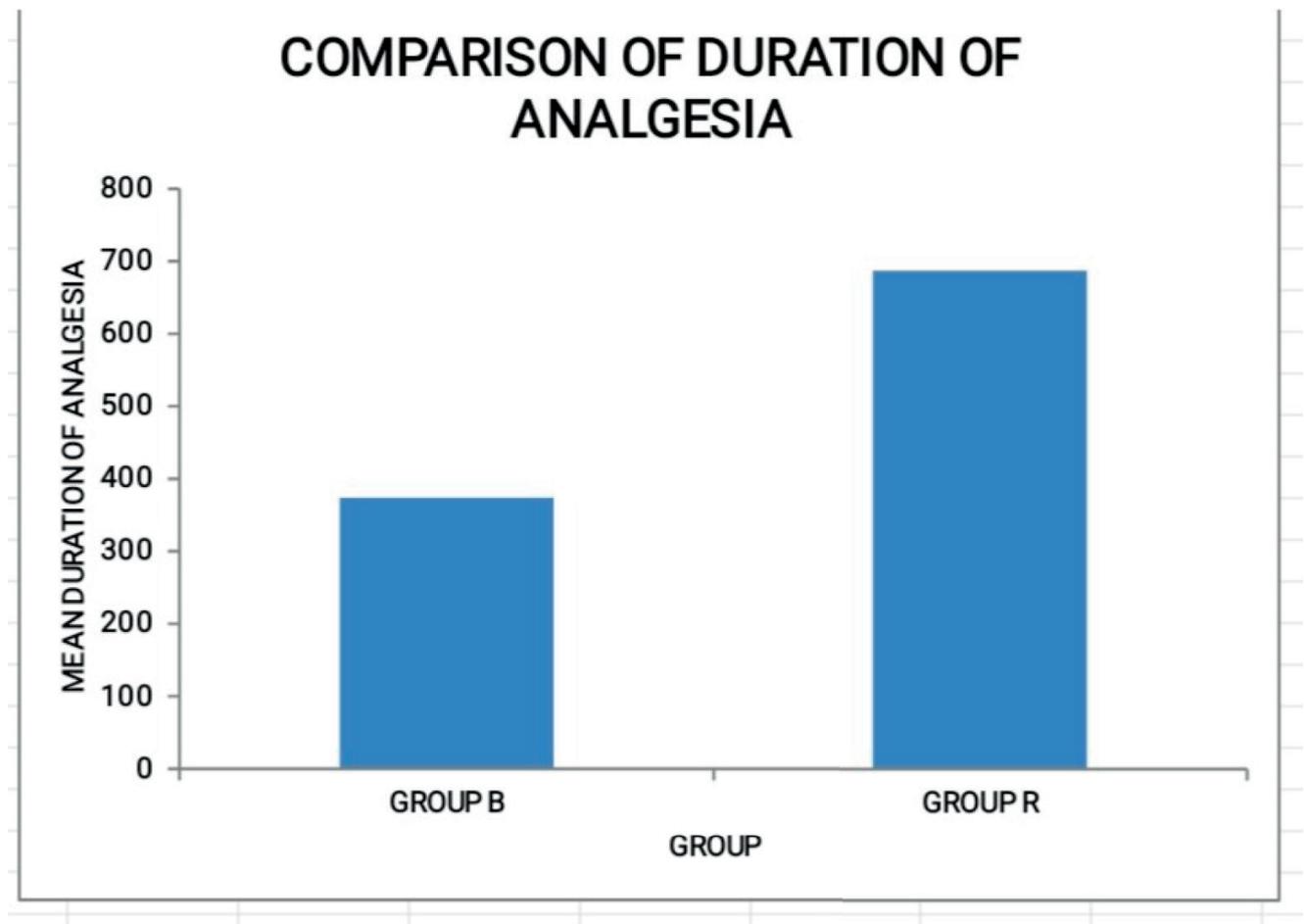
**Graph 1:** Graphical representation of Distribution of Age (years)



Mean duration of analgesia was 373.75 minutes with SD of 66.15 in Bupivacaine group and 687 minutes with SD of 119.43 in Ropivacaine group with a mean difference of 313.25. The difference was highly significant in Group R compared to Group B ( $p < 0.0001$ ).

In group B, first rescue analgesia was required in 26 patients between 6–8 hours. Remaining 4 patients required between 8–10 hours. In group R, 24 patients required the first rescue after 10 hours, 4 patients required between 6–8 hours and remaining 2 patients required between 8–10 hours.

**Graph 2:** Graphical representation of Distribution of Analgesia



**Table 2:** Requirement of first rescue dose.

First rescue dose	Group B	Group R
Between 6 and 8 hours	26	4
Between 8 and 10 hours	4	2
After 10 hours	0	24
<b>Total</b>	<b>30</b>	<b>30</b>

There were no complications associated with TAP block and drug related adverse effects in either group.

## Discussion

Pain is the most frequent cause of suffering and disability which seriously impairs the quality of life of millions of people worldwide. The TAP is a simple and effective analgesic technique, appropriate for surgical procedures where parietal pain is a significant component of postoperative pain. Rafi et al. (2001) was the first to describe this novel abdominal field block. He described an anatomical landmark technique and provided evidence of blockade to the mid/lower thoracic and upper lumbar spinal nerves as they travelled in the fascial plane between the transversus abdominis and internal oblique muscles<sup>11</sup>.

Hebbard et al. (2007) have subsequently described an ultrasound-guided approach to the TAP Block. It has been performed for the following procedures: caesarean delivery, hysterectomy, hernioplasty, retropubic prostatectomy, appendicectomy and laparoscopic cholecystectomy<sup>12</sup>. Efficacy of TAP block was also studied by Belavyet et al using Ropivacaine 0.5% as a tool for multi modal analgesia in addition to PCA Morphine, Paracetamol and NSAIDs. But in this study, Inj Diclofenac 75 mg was the single analgesic given to the patient. Efficacy of the block was evaluated by assessing pain level with VAS and the postoperative analgesic consumption<sup>13</sup>. Shibata Y, Sato Y, Fujiwara Y et al. 2007<sup>4</sup> assessed the extent of USG guided TAP block by pinprick in 26 patients undergoing laparoscopic gynaecological surgery. They found that the mean upper level of sensory block at 30 min after local anaesthetic injection was T10. They concluded that lower abdominal surgery should be an indication for TAP block<sup>14</sup>. Mark J Young et al.<sup>15</sup> described TAP block as an effective component of multimodal postoperative analgesia for wide variety of abdominal procedures including large bowel resection, open/laparoscopic cholecystectomy, caesarean section, total abdominal hysterectomy, laparoscopic cholecystectomy, open prostatectomy, renal transplant surgery, abdominoplasty, with/without flank liposuction and iliac crest bone graft<sup>15</sup>. Neha Fuladi et al.<sup>16</sup> found that

the mean duration of analgesia in their study was longer in Ropivacaine group ( $12.61 \pm 5.13$  hrs) as compared to Bupivacaine group ( $9.92 \pm 4.81$  hrs) by  $2.69 \pm 0.52$  hrs, which is statistically significant. Dipika Patel et al.<sup>4</sup> compared 0.25% Bupivacaine with 0.5% Ropivacaine and found out that mean duration of analgesia was  $7.38 \pm 2.35$  hrs in Bupivacaine group and  $9.98 \pm 2.38$  hrs in Ropivacaine group. The difference was statistically highly significant in Ropivacaine group compared to Bupivacaine group. ( $p < 0.01$ ). Gilidasio S. De Oliveira<sup>17</sup> compared postoperative opioid requirement in patients undergoing laparoscopic surgery who received TAP block with 0.25 % Ropivacaine, 0.5% Ropivacaine or saline. There was significant reduction in opioid consumption in the Ropivacaine group as compared to saline group. Bharti N, Kumar P and colleagues (2011) evaluated analgesic efficacy of TAP block with Bupivacaine in patients undergoing colorectal surgery and concluded that TAP block provides effective postoperative analgesia after colorectal surgery<sup>18</sup>.

In our study duration of post operative analgesia was 373.75 minutes with SD of 66.1512 in Bupivacaine group and 687 minutes with SD of 119.433 in Ropivacaine group. The difference was statistically highly significant ( $p < 0.0001$ ). Concerning hemodynamics, in our study there were no statistically significant changes in pulse rate and systolic blood pressure between two groups in first 24 hours ( $p > 0.05$ ). However, at 6, 12 and 18 hours, there were significantly lower pulse rates and systolic blood pressure in Group R compared to Group B ( $p < 0.05$ ). There were no statistically significant changes in diastolic blood pressure between two groups in first 24 hours ( $p > 0.05$ ). The first rescue dose was needed between 6–8 hours post-operatively in as many as 26 patients in group B unlike just 4 patients in group R. On the other hand, 24 patients in group R needed the first rescue dose after 10 hours postoperative hours.

Salaria ON et al. (2017)<sup>19</sup> have reported a case of bilateral femoral nerve palsy after Ultrasound guided TAP block. This was attributed to improper deposition of local anaesthetic between transversus abdominis and fascia transversalis which seeps down the fascia and accumulate around the femoral nerve.

In a study conducted by Jadon A et al. (2018)<sup>6</sup> one subject had convulsion in TAP block group, performed under Ultrasound guidance.

In our study, we have not come across any local or systemic complications with either group. However, resuscitation measures in case of toxicity or drug reaction were kept ready, including Steroids, Intralipid 20% and Defibrillator.

## Conclusion

Thus, we conclude that 0.5% Ropivacaine provided longer duration of analgesia than 0.25% Bupivacaine when used in ultrasound guided Transversus Abdominis plane block for providing post operative analgesia after lower abdominal surgeries. Also, the requirement of first rescue analgesia was at a later time in Ropivacaine group compared to Bupivacaine. So, looking to safety profile, longer duration of post operative analgesia and patient satisfaction, 0.5% Ropivacaine can be used for ultrasound guided TAP block. Overall, the findings were suggestive that ultrasound guided TAP block may be an effective component of a multimodal approach to pain management in the post operative period in patient with lower abdominal surgeries.

## References

- 1) Sharma N, Mehta N, Sharma S. An evaluation of (0.25%) Bupivacaine Vs (0.5%) Ropivacaine for postoperative analgesia using ultrasound guided transversus abdominis plane block for abdominal surgeries: A comparative study. *Indian J Clin Anaesth.* 2016; 3(4):635–639.
- 2) McDonnell J, Curley G, Carney J, Benton A, Costello J, Maharaj C. and Laffey J, 2008. The Analgesic Efficacy of Transversus Abdominis Plane Block After Cesarean Delivery: A Randomized Controlled Trial. *Anesthesia & Analgesia*, 106(1), pp.186–191.
- 3) Rafi A, 2001. Abdominal field block: a new approach via the lumbar triangle. *Anaesthesia*, 56(10), pp.1024–1026.
- 4) Dr Dipika patel et al. Transversus abdominis plane block for post operative analgesia in lower abdominal surgery: A comparison of Bupivacaine and Ropivacaine. *International Journal of Science and Research (IJSR)*, volume 5 Issue 12, December 2016.
- 5) McDonnell JG, O'Donnell B, Curley G, Heffernan A, Power C, and Laffey JG. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: a prospective randomized controlled trial. *Anesthesia and Analgesia* Jan 2007; 104(1):193–197.
- 6) Carney J, McDonnell JG, Ochana A, Bhinder R, Laffey JG. The transversus abdominis plane block provides effective post-operative analgesia in patients undergoing total abdominal hysterectomy. *Anesth Analg.* Dec 2008; 107(6):2056–60.
- 7) Carney J, Finnerty O, Rauf J, Curley G, McDonnell JG, Laffey JG. Ipsilateral transversus abdominis plane block provides effective analgesia after appendectomy in children: a randomized controlled trial. *Anesth Analg.* Oct 2010; 111(4):998–1003.
- 8) Johns N, O'Neill S, Ventham NT, Barron F, Brady RR, Daniel T. Clinical effectiveness of transversus abdominis plane (TAP) block in abdominal surgery: a systematic review and meta-analysis. *Colorectal Dis.* Oct 2012; 14(10):635–42.
- 9) McDonnell J, O'Donnell B, Farrell T, Gough N, Tuite D, Power C, Laffey J. Transversus Abdominis Plane Block: A Cadaveric and Radiological Evaluation. *Regional Anesthesia and Pain Medicine.* Sep 2007; 32(5):399–404.
- 10) McDonnell JG, O'Donnell BD, Tuite D, et al. The regional abdominal field infiltration (R.A.F.I.) technique: computerized tomographic and anatomical identification of a novel approach to the transversus abdominis neuro-vascular fascial plane. *Anesthesiology.* 2004; 101:A899.
- 11) Atkinson RS, Rushman GB, Lee JA. A Synopsis of Anaesthesia. 10th edn, Bristol, Wright, 1987; 637–40.
- 12) Hebbard P, Fujiwara Y, Shibata Y et al. Ultrasound guided transversus abdominis plane block. *Anaesth Intensive Care.* 2007; 35:616–8.
- 13) Belavy D, Cowlshaw PJ, Howes M, Phillips F: Ultrasound guided transversus abdominis plane block for analgesia after Caesarean delivery. *Br J Anaesth.* 2009; 103(5):726–30.
- 14) Shibata Y, Sato Y, Fujiwara Y, Komatsu T. Transversus abdominis plane block. *Anesth Analg* 2007; 105:883.
- 15) Young MJ et al. Clinical implications of the transversus abdominis plane block in adults. *Anesthesiol Res Pract.* 2012; 2012.
- 16) Neha Fuladi, Shubhada Deshmukh, Anjali Bhure. Comparative study of Bupivacaine 0.25% versus Ropivacaine 0.5% in transversus abdominis plane block for post operative analgesia in lower abdominal surgeries: a randomised controlled trial. *Journal of Evolution of Medical and Dental sciences* 2014; 3(17):4569–76.
- 17) De Oliveria GS, Fitzgerald PC, Marcus RJ, Ahmad S, Mc Carthy RJ. A Dose – ranging study of the effect of transversus abdominis plane block on postoperative quality of recovery and analgesia after outpatient Laparoscopy. *Anesth Analg.* 2011; 113(5):1218–25.
- 18) Bharti N, 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.* Jun 2011; 112(6):1504–1508.
- 19) Salaria ON, Kannan M, Kerner B, Goldman H. A Rare Complication of a TAP Block Performed after Caesarean Delivery. *Case Rep Anesthesiol.* 2017:1072576.