

Outcome of 0.5% Ropivacaine Versus 0.25% Ropivacaine in USG Guided Transverse Abdominis Plane Block for Post-Operative Pain Relief in Below Umbilical Surgeries

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Abstract:

Background: After any surgery, pain is the most dreaded issue by an individual. The transverse abdominis plane (TAP) nerve block has recently become more popular for two reasons: the use of ultrasound to improve block placement and the desire to reduce the need for perioperative narcotics. Considering that postoperative pain following a cesarean section primarily arises from the abdominal incision, we hypothesized that incorporating a Transversus Abdominis Plane (TAP) block as part of a multimodal analgesic approach would effectively diminish the requirement for supplementary analgesics during 48 hrs after surgery (primary outcome), severity of pain and prolong the demand for first analgesic and improve patient satisfaction during postoperative period (secondary outcome). In this study we are comparing outcome of ropivacaine of 0.25% and 0.5% in USG guided TAP block for post op pain relief in below umbilicus surgeries.

Methods: A prospective Randomized Open Label study was conducted in 60 patients of ASA class 1 & 2 of either sex of more than 18 yrs age in GSVM medical college, Kanpur from January to October 2021. They were randomly divided into two groups of 30 each in which first group received 0.50% of ropivacaine for TAP block and 2nd group received 0.25% of ropivacaine. This study was approved by the Ethical Committee of the Faculty of GSVM medical college, with approval number EC/361/Nov/2022.

Results: In our study, duration of post-op pain relief in group 1 using 0.50% ropivacaine is more as compared to group 2. There is no statistically significant difference of quality of analgesia between two groups. In comparison of parameters (systolic and diastolic blood pressure, heart rate, respiratory rate, SpO₂) between two group before and after giving TAP block only systolic blood pressure shows statistically significant difference (<0.05%).

Conclusion: We hereby concluded with the help of this study and available literature that in USG guided TAP block for postop pain relief in below umbilical surgeries 0.50% ropivacaine is better than 0.25% ropivacaine.

Keywords: Ropivacaine, Transverse Abdominis Plane Block, Post-Operative Pain Relief, Below Umbilical Surgeries, USG guided TAP block.

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Introduction

After any surgery, pain is the most dreaded issue by an individual. A substantial component of pain experienced by patients after surgery is derived from abdominal wall incision. Even a relatively small operation such as inguinal herniorrhaphy may be followed by a risk of a chronic pain state in about 12% of patients with clinically significant effects on daily activities if postoperative pain is not taken care of. [1]

Various modalities have been used to manage postoperative pain like NSAIDs, Opioids, epidural block etc. Each of which has its own side-effects.

The opioids have number of side effects such as respiratory depression, emesis and reduction in motility of gut, sedation etc. [2] NSAIDs also have certain side effects like haemostasis alteration, renal dysfunction, gastrointestinal haemorrhage etc. The use of peripheral regional analgesic techniques in form of single injection or continuous infusion is gaining popularity for postoperative analgesia.

The transversus abdominis plane (TAP) nerve block was first described almost 20 years ago as a landmark-based technique for performing abdominal field blocks via the triangle of petit

approach. [3] The block entails depositing local anesthetic in the trans versus abdominis plane, located superficial to the trans versus abdominis and deep to the internal oblique, in the anterolateral abdomen. Its use in the setting of acute perioperative pain has been reviewed elsewhere, with applications in bariatric, gynecologic, colorectal, urologic, and caesarean section surgeries, among others. This article reviews the analgesic coverage associated with various techniques of TAP blocks and introduces its utility in the diagnosis and treatment of chronic abdominal pain.

The transversus abdominis plane block is a regional anesthesia technique that has recently become more popular for two reasons: the use of ultrasound to improve block placement and the desire to reduce the need for perioperative narcotics. It has been used in surgeries involving the anterior abdomen (e.g., colorectal surgery, caesarean section) as an effective and reliable technique to improve postoperative analgesia.

Pain after cesarean section is usually described as moderate to severe by most patients and failure to adequately treat may affect mother-baby bonding, care of baby, and breastfeeding. It may even risk the patients for thrombo-embolism as a result of immobility due to pain. The pain management should not only be adequate but also safe for the breastfeeding baby. Pain of cesarean section essentially has two components somatic (due to abdominal wall incision) and visceral (from the uterus). A substantial component of pain experienced by patients is derived from abdominal wall incision.

Systemic or neuraxial opioids are the mainstay for treating postoperative pain, as they are effective against both the components. However, they are associated with a number of undesirable side effects such as nausea, vomiting, pruritus, constipation, and respiratory depression. Nonsteroidal anti-inflammatory drug alone may be insufficient to treat postcesarean pain. Currently, multimodal analgesic technique involving abdominal nerve block with parenteral analgesics is becoming popular for these patients.

Transverse abdominis plane (TAP) block is a recently introduced regional technique that blocks abdominal wall neural afferents between T6 and L1 and thus can relieve pain associated with an abdominal incision. TAP is a neurovascular plane located between the internal oblique and transverse abdominis muscles and nerves supplying abdominal wall pass through this plane before supplying anterior abdominal wall. Therefore, if the local anesthetic is deposited in this space, myocutaneous sensory blockade results. Considering that postoperative pain following a

cesarean section primarily arises from the abdominal incision, we hypothesized that incorporating a Transversus Abdominis Plane (TAP) block as part of a multimodal analgesic approach would effectively diminish the requirement for supplementary analgesics during 48 hrs after surgery (primary outcome), severity of pain and prolong the demand for first analgesic and improve patient satisfaction during postoperative period (secondary outcome).

The present study aimed to assess outcome of 0.5% ropivacaine versus 0.25% ropivacaine in USG guided transverse abdominis plane block for postoperative pain relief in below umbilical surgeries.

Materials and Methods

The present prospective, randomized open label study was conducted in the Department of Anaesthesiology, GSVM Medical College and Associate LLRH Hospital, Kanpur from January 2021 to October 2021.

It was planned to conduct this study in 60 patients, the American Society of Anaesthesiologists (ASA) physical status Class I and II patients of either sex in the age group more than 18 years. Patients were randomly divided into two groups, each containing 30 patients according to computer generated numbers:

Group 1 – 30 patients received 0.50% of Ropivacaine concentration for TAP block.

Group 2- 30 patients received 0.25% of Ropivacaine concentration for TAP block.

Inclusion Criteria:

- Informed written consent for participation in study.
- Age >18 years.
- American Society of Anesthesiologists (ASA) physical status I–II.
- Below umbilical surgeries like LSCS, hysterectomy, inguinal hernia etc.

Exclusion Criteria

- Patient's refusal
- Contraindications to peripheral nerve or neuraxial blockade.
- Allergy to local anesthetics.
- American society of Anesthesiologist (ASA) physical status III

Procedure

After getting clearance from ethical committee of institute patients was taken in the study.

A written informed consent was taken from the patient after explaining the anaesthetic procedure in detail. All selected patients will undergo thorough pre anaesthetic check-up.

All patients will receive oral Alprazolam 0.5mg the night before surgery and was fasted as per standard NPO guidelines.

On the day of surgery Patient was taken to operation room, standard monitoring, including non-invasive blood pressure, Heart Rate, Oxygen saturation (SpO₂) and electrocardiography (ECG) was instituted and the baseline hemodynamic parameters (Systolic Blood Pressure, Diastolic Blood Pressure, Mean Arterial Pressure, Heart

Rate, Oxygen saturation) was recorded. Intravenous access was secured. Local anesthesia test dose was given. In this study we focused on lower abdominal surgeries mainly including hernia. We took two groups of patients each containing 30 patients. Total volume of drug given to both group is constant but concentration is different. In group 1 we gave 50ml of 0.50% of ropivacaine while in group 2 we gave 50ml of 0.25% of ropivacaine.

Landmark Technique

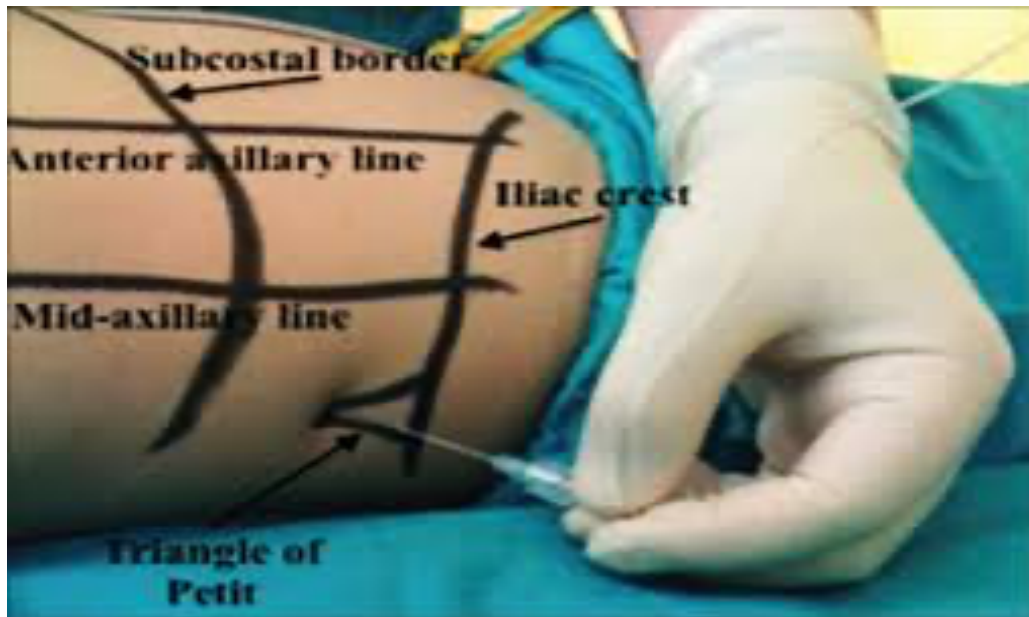


Figure 1: USG - guided technique

The transversus abdominis plane is the fascial plane superficial to the transversus abdominis muscle, the innermost muscular layer of the anterolateral abdominal wall. The upper fibrous anterior part of the muscle lies posterior to the rectus abdominis muscle and reaches the xiphoid process. The posterior aponeuroses of the transversus abdominis and internal oblique muscles fuse and attach to the thoracolumbar fascia (TLF). In the TAP, the intercostal, subcostal, and L1 segmental nerves communicate to form the upper and lower TAP plexuses, which innervate the anterolateral abdominal wall, including the parietal peritoneum. Therefore, TAP blockade requires anesthesia of the upper (also known as the subcostal or intercostal) TAP plexus, as well as the lower TAP plexus, located in the vicinity of the deep circumflex iliac artery. The subcostal approach to the TAP block ideally anesthetizes the intercostal nerves T6–T9 between the rectus abdominis sheath and the transversus abdominis muscle. The lateral TAP block in the midaxillary line between the thoracic cage and iliac crest as well as between the internal oblique and transversus abdominis muscles ideally should reach

intercostal nerves T10– T11 and the subcostal nerve T12. Of note, the umbilicus is innervated by intercostal nerve T10. The L1 segmental nerves in the TAP are not covered by the lateral TAP block and require an anterior TAP block medial to the anterior superior iliac spine. A posterior approach to block the TAP plexuses via the triangle of Petit has also been described. TAP blocks provide somatic analgesia of the abdominal wall including the parietal peritoneum.

Lateral TAP Block

For the lateral TAP block, a linear transducer is placed in the axial plane on the midaxillary line between the subcostal margin and the iliac crest (Figure -B). The three layers of abdominal wall muscles are visualized: external and internal oblique as well as the transversus abdominis muscles. The target is the fascial plane between the internal oblique and the transversus abdominis muscles. The needle is inserted in the anterior axillary line, and the needle tip is advanced until it reaches the fascial plane between the internal oblique and transversus abdominis muscles approximately in the midaxillary line.



B

Figure 2:

USG View –

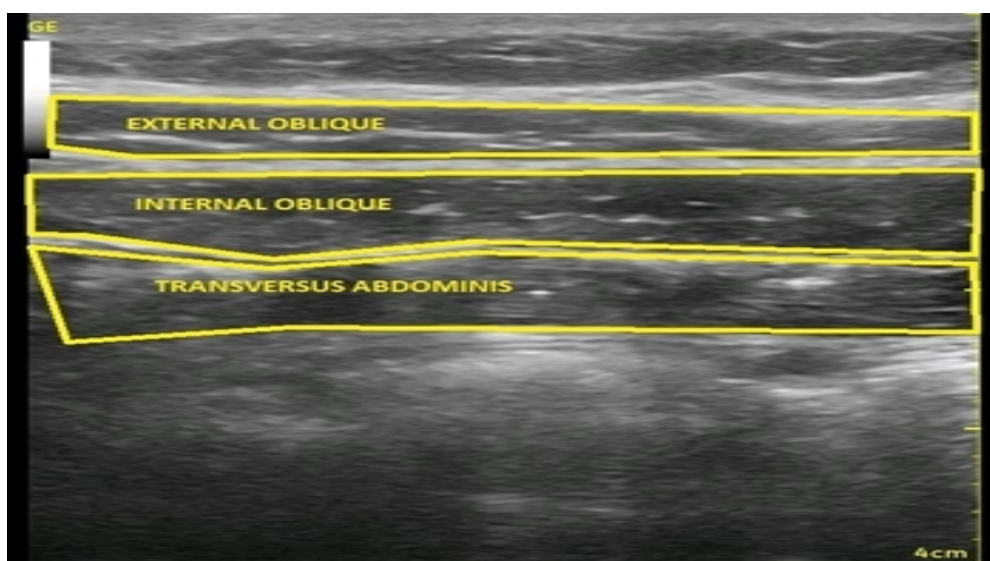
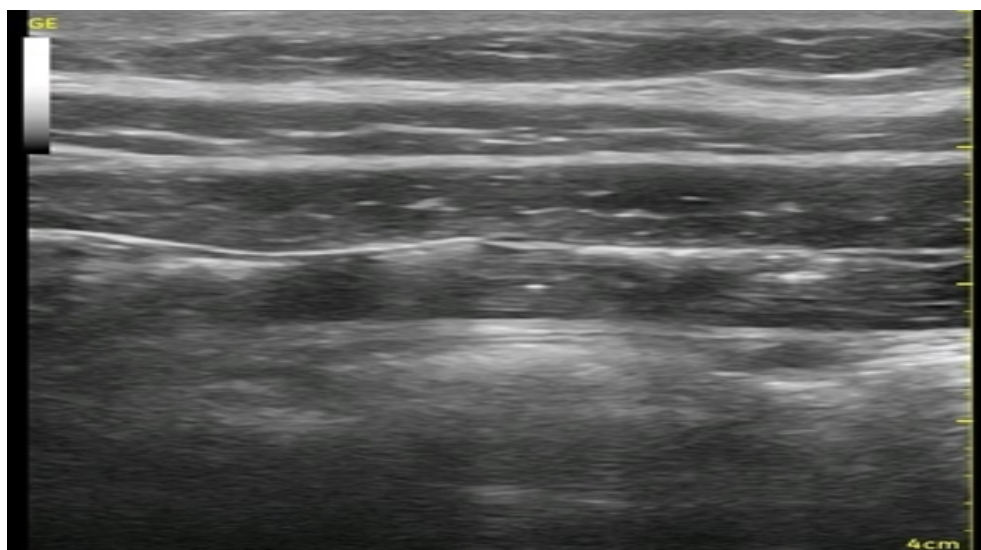


Figure 3:

Needle View



Figure 4:

After completion of surgery under spinal anaesthesia, we performed the USG-guided TAP block mainly through lateral approach under all aseptic condition. Pre and post vitals are noted. Then patients were shifted to post-operative room for observation. The duration between giving TAP block and pain experienced by the patients that requiring rescue analgesia was noted and compared between two groups.

The specificity of rescue analgesia was not done in this study. The quality of analgesia is noted through visual analogue score (VAS) and classified under excellent, good and average. Mainly our aim is to focused pain free duration between two group after giving TAP block of same drug with same volume

but different concentration. Presence of complications was noted.

Statistical Analysis

The data were collected and entered in master chart in Microsoft Excel Sheet. Statistical analysis was performed using SPSS software. The significant difference of mean between the groups were calculated using paired t test for testing the significant difference within the group, unpaired t test used for testing significant difference between two groups and Chi square test used to find out the association between the two groups. P values <0.05 were considered significant.

Result

Table 1: Comparison of Parameters before and after giving 0.5% Ropivacaine

Parameter	Before	After	t	P	Inference
SYS	126.00 + 15.97	121.53 + 12.39	3.14	<0.05	Significant
DIAST	78.66 + 10.32	76.46 + 8.06	1.58	>0.05	Non-significant
HR	80.33 + 12.90	80 + 8.46	0.18	>0.05	Non-significant
RR	14.93 + 1.25	14.93 + 1.14	0	0	Non-calculable
SpO ₂	98.86 + 0.43	98.9 + 0.30	0.44	>0.05	Non-Significant

Table 1 depicts the changes observed in the parameters before and after providing analgesia in group 1 (0.5% Ropivacaine). Systolic blood pressure reduced significantly (p<0.05) after giving analgesia from 126.00±15.97 mmHg to 121.53±12.39 mmHg. Diastolic blood pressure showed non-significant changes (p>0.05) after giving analgesia. There were no significant changes in the heart rate and SpO₂ after giving analgesics.

Table 2: Comparison of Parameters before and after giving 0.25% Ropivacaine

Parameter	Before	After	T	P	Inference
SYS	128.73 + 15.96	124.40 + 14.16	2.36	<0.05	Significant
DIAS	79.53 + 11.66	77.8 + 9.60	1.4	>0.05	Non-significant
HR	78.73 + 10.80	78.46 + 7.55	0.16	>0.05	Non-significant
RR	14.66 + 0.95	14.80 + 1.12	1.43	>0.05	Non-significant
SPO ₂	98.73 + 0.58	98.83 + 0.37	0.9	>0.05	Non-significant

Table 2 shows the changes observed in the parameters before and after providing analgesia in group 2 (0.25% Ropivacaine). Systolic blood pressure reduced significantly ($p < 0.05$) after giving analgesia from 128.73 ± 15.96 mmHg to 124.40 ± 14.16 mmHg. There were no significant changes observed in other parameters.

Table 3: Comparison of Quality of analgesia between both groups

	Group 1	Percentage	Group 2	Percentage
Excellent	26	86.66%	20	66.66%
Good	3	10%	8	26.66%
Average	1	3.33%	2	6.66%

Table 4: Comparison of VAS Score between both groups

Severity of Pain	Group 1	Percentage	Group 2	Percentage
0 (No Pain)	12	40%	11	36.66%
1-3 (Mild Pain)	17	56.66%	17	56.66%
4-6 (Moderate Pain)	1	3.33%	2	6.66%
7-10 (Severe Pain)	0		0	

Table 5: Age Distribution

	Group 1	Percentage	Group 2	Percentage
0-30 Yrs	5	16.66%	9	30%
30-40 Yrs	5	16.66%	5	16.66%
40-50 Yrs	2	6.66%	3	10%
50-60 Yrs	10	33.33%	6	20%
60-70 Yrs	4	13.33%	4	13.33%
>70 Yrs	4	13.33%	3	10%

Table 6: Comparison of Duration of Analgesia in both groups

	Group 1	Group 2
Duration	10.3±2.66	8.48±1.51
T	3.25	
P	0.001872 (P<0.0001)	
Inference	Highly Significant	
F	3.1	
P	0.003196	

Duration of post-op pain relief in group 1 using 0.50% ropivacaine is more as compared with group 2 with 0.25% ropivacaine. The mean time duration of post-op analgesia in group 1 is 10.3hrs while in group 2 is 8.48 hrs. The p value is =0.001872 (<0.0001) which is highly significant.

There is no statistically significant difference of quality of analgesia between two group (>0.05). In comparison of parameters (systolic and diastolic blood pressure, heartrate, respiratory rate, SpO₂) between two group before and after giving TAP block only systolic blood pressure shows statistically significant difference (<0.05%). No adverse reaction is noted in both groups.

Discussion

Transverse abdominis plane (TAP) block is a regional technique that blocks abdominal wall neural afferents between T6 and L1 and thus can relieve pain associated with an abdominal incision.

TAP is a neurovascular plane located between the internal oblique and transverse abdominis muscles and nerves supplying abdominal wall pass through

this plane before supplying anterior abdominal wall.

Therefore, if the local anesthetic is deposited in this space, myocutaneous sensory blockade results. Moeschler SM et al. [24] in their study on cadavers, in which they injected different volumes of contrast in TAP and they concluded that the increased volume of the injected contrast would increase the cranio-caudal spread and would reach iliohypogastric nerve, and intercostals nerve which increase the incidence of success rate of the TAP block and they suggested that 15 ml of LA may be the optimal volume of LA to provide adequate TAP block. The extent of contrast spread, in a cranial to caudal direction, demonstrated a correlation with increasing volume of injection. For a 5 mL injection, the spread extended approximately one vertebral level (from end plate to end plate), while it covered two vertebral levels for the 10-, 15-, and 20-mL injections. However, the degree of injectate spread might differ between live patients and cadavers. In our study the volume was increased to 50 to compensate for the possible intramuscular spread of LA. Mohammad Sadiq Malla et al, [19]

shows that postoperative VAS pain scores were significantly reduced at all-time intervals in TAP block group when compared with conventional analgesia group. Neeta Verma et. al., [18] in their study shows similar result that TAP block other than being the main anaesthetic technique for lower abdominal surgery, also provides good post-operative analgesia with minimal post-operative analgesic requirement with less haemodynamic variations.

In our study we compared two different concentrations of ropivacaine with constant volume in both groups, used in USG-guided TAP block to see if different concentration of local anaesthetic would make a difference in terms of postoperative analgesia. We see that duration of analgesia is more in 0.5% ropivacaine group and patients are more hemodynamically stable in this group as compared to 0.25% ropivacaine group. So, our study shows better hemodynamic stability with more duration of analgesia with 0.5% ropivacaine.

Similar study was done by Yinglan Su et.al. [5] who concluded that 0.5% ropivacaine is optimally effective with least side effects and the use of ultrasound-guided regional anesthesia with ropivacaine as an anesthetic is safe and effective in inguinal hernia repair for elderly patients.

This coincides with prospective, randomized, double blind study by Abdul Jalil et. al. [4] on 56 parturients scheduled for appendectomy under general anesthesia and they received TAP block with ropivacaine 0.2% in one group and ropivacaine 0.5% in the other group at the end of the surgery and they found that both concentrations provided comparable postoperative analgesia. Srivastava et. al. [23] in their randomized double-blind study on 62 pregnant women scheduled for cesarean delivery to assess the role of TAP block as a component of multimodal postoperative analgesia and they found that pain score significantly decreased after the TAP block at all study times during rest and movement and also decreased consumption of tramadol in parturients through patient-controlled analgesia.

The same things also happened in our study that post-operative analgesia dependency reduced after TAP block and provide a better pain free period. McDonnell et.al. [22], evaluated the effectiveness of TAP block with ropivacaine for postoperative analgesia in cesarean delivery performed under spinal anesthesia, and they found that TAP block significantly decreased the pain score and 48 h morphine consumption.

In our study the mean duration of analgesia for 0.5% ropivacaine is more and no adverse reaction are seen. A similar study by Mankikar et. al., [6] on TAP block with ropivacaine compared with normal saline reduced post-operative VAS at 24 h ($P =$

0.004918) and time for rescue analgesia prolonged from 4.1 to 9.53 h in the study group. USG-guided TAP block after caesarean section reduces the analgesic requirement in the first 24 h. Rao V Kadam et.al. [17] also stated that TAP block is a promising technique for postoperative analgesia in major abdominal surgeries.

They demonstrated lower pain scores in the TAP group with reduced fentanyl requirement. A similar study of Mishra et. al., [16] stated that TAP block has got potential to substitute the use of intravenous opioid analgesics and hence to avoid its complications. They also explain that the use of ultrasound guidance improves the outcome because of better localization of the plane for blockade.

Conclusion

Duration of post-op pain relief in group 1 using 0.50% ropivacaine is more as compared with group 2 with 0.25% ropivacaine. The mean time duration of post-op analgesia in group 1 is 10.3hrs while in group2 is 8.48hrs. The p value is =0.001872(<0.0001) which is highly significant. We hereby concluded with the help of this study and available literature that in USG guided TAP block for post-op pain relief in below umbilical surgeries 0.50% ropivacaine is better than 0.25% ropivacaine.

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