

A Comparative Study of Injection 0.5% Bupivacaine and Injection 0.75% Ropivacaine for Their Duration of Anesthesia/Analgesia in Transversus Abdominis Plane Block for Unilateral Inguinal Hernia Repair under Ultrasound Guidance

S Selvamani¹, N Kannan², Mohammed Sadiq³

¹Professor, ²Associate Professor, ³Junior Resident, Department of Anesthesiology, Pain Medicine and Critical Care, Sree Balaji Medical College and Hospital, BIHER, Chennai, Tamil Nadu 600044, India.

Abstract

Background: The transversus abdominis plane block is a regional anesthesia technique first described in 2001. It is useful in procedures requiring nerve block in the anterior abdominal wall region from T6-L1. It was first used as a blind landmark technique. But more recently it has been performed under ultrasound guidance. TAP blocks are important because they can be used as an alternative analgesic solution in surgery. The purpose of our study was to evaluate effectiveness of TAP block to provide effective postoperative analgesia in patients undergoing inguinal hernia repair surgery. **Materials and Methods:** Our study was conducted in our institution under ultrasound guidance. Total 40 patients undergoing unilateral inguinal hernioplasty surgery under spinal anesthesia were included in the study. Patients were divided into 2 groups of 20 each. *Group B* - Patients receiving USG-TAP block at the end of surgery with 20 ml Inj. Bupivacaine 0.50% - 20 patients. *Group R* - Patients receiving USG-TAP block at the end of surgery with 20 ml Inj. Ropivacaine 0.75% - 20 patients. Patient monitored every two hours upto 24 hours postoperatively for pulse rate, BP, pain by VAS score and complications if any. Pain was assessed by visual analog score from 0 to 10. Recession of motor block noted by movement of ankle and knee joint. **Results:** The mean pain score on VAS in Group B and Group R was 4.75 and 4.89 respectively, 24 hours after surgery. The difference in the two groups was statistically insignificant (p - value > 0.05). VAS score was the same in both the groups at all the time in first 24 hours. **Conclusion:** About 15 ml of 0.5 % bupivacaine or 15 ml of 0.75 % ropivacaine for transverse abdominis plane block produces satisfactory and comparable sensory block, related to duration, analgesia and VAS score. The hemodynamics were stable in both the groups. The lower CNS and cardio toxicity of ropivacaine may help in reducing the risk to the patients. There was no much clinical difference in duration, dose of analgesia and VAS score among both the groups, when injected in equal volume for TAP block under ultrasound guidance. Ropivacaine has a potentially improved safety profile when compared with Bupivacaine.

Keywords: Transversus abdominis plane block; TAP block; Ropivacaine; Bupivacaine.

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Corresponding Author: N Kannan, Associate Professor, Department of Anesthesiology, Pain Medicine and Critical Care, Sree Balaji Medical College and Hospital, BIHER, Chennai, Tamil Nadu 600044, India.

E-mail: dhanvika@gmail

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Introduction

The abdominal wall forms a major source of pain following abdominal surgery. Even a small surgery like inguinal herniorrhaphy may be followed by risk of chronic pain in about 5–10% patients with significant effect on daily activities if postoperative analgesia is not taken care of. The usual trend is to prescribe an opioid or a NSAID for postoperative analgesia. The opioids have number of side effects like respiratory depression, emesis, reduction in gut motility, sedation etc. NSAIDs have certain side-effects like hemostasis alteration, renal dysfunction, gastrointestinal hemorrhage, etc. However, in regional analgesic technique, drugs have peripheral site of action and hence minimal systemic side-effects. Hence, regional anesthetic technique has gained wide spread importance in postoperative analgesia regimen. Transversus Abdominis Plane (TAP) block is one of such regional blocks. It provides analgesia after lower abdominal surgery particularly where parietal wall pain forms major component of pain. It is physician's duty to rescue the patients from surgical pain by the most possible mean. Now, postoperative pain control is generally best managed by anesthesiologists, because they offer regional anesthetic techniques as well as pharmacological expertise in analgesics.

Inguinal hernia repair surgery is one of the most common surgery performed in general population. Postoperative analgesia is essential to provide comfort and restoration of functions like breathing, cough, movement and communication effectively. Use of opioids and NSAIDs can result in significant adverse effects. Other techniques like rectus abdominis sheath block, paravertebral block, ilioinguinal/iliohypogastric block, local anesthetic infiltration etc. are also tested. Yet, these have disadvantages as they are not easy to perform, do not give adequate analgesia, do not produce long enough analgesic duration etc. The latest trend is the practice of two or more analgesic approach

simultaneously called multimodal analgesia. It can produce better pain control, reduce the individual dose of the agent and thereby lowers cost, low side effect and more therapeutic safety. Over recent years, Transversus Abdominis Plane (TAP) block became a part of multimodal analgesia.

TAP is a neuro fascial plane between the Internal Oblique (IO) and Transversus Abdominis (TA) muscle of the abdominal wall through which all sensory nerves supply the parietal peritoneum, skin and muscles of anterior abdominal wall. So, it is a novel approach to block these sensory nerves by injecting local anesthetic within the Transversus Abdominis Plane (TAP), termed as TAP block.¹ Because the sensory afferent nerves run between the abdominal muscles, these nerves can be blocked and postoperative pain can be managed. This has been found to be an effective method in colon surgery, cesarean section with midline incision and prostatectomy and it is also effective in managing pain following inguinal hernia surgeries. TAP block was first described by Rafi et al.² in 2001 and was further developed and tested by McDonnell et al. in 2004.³ Ultrasonography guided nerve blocks offer the advantage of real-time imaging of the needle and injection spread. Use of ultrasonography for placement of the needle and drug distribution can lower the risks associated with TAP block and increases the safety and effectiveness of the block particularly in obese patients.⁴

TAP block is easy to perform, technically simple, pharmacologically safe, effective and economically cheap. TAP block is a part of multimodal analgesic regimen and provides improved analgesia, decrease opioid consumption and its side-effects during postoperative period. McDonnell et al.^{5,6} demonstrated that the Transversus Abdominis Plane (TAP) block reduces morphine use after abdominal surgery, including cesarean delivery. He also stated that landmark based TAP block can be used successfully to provide postoperative pain relief after cesarean delivery.

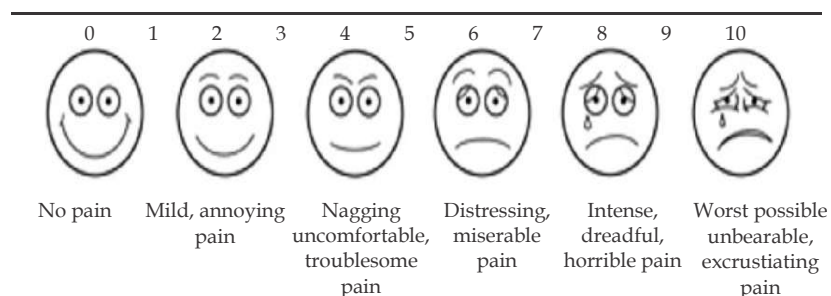


Fig. 1: VAS Score

Grade 0 (0-1): Good analgesia;

Grade 1 (1-4): moderate analgesia;

Grade 2 (4-7): mild analgesia;

Grade 3 (7-10): No analgesia.

Materials and Methods

Our study was conducted in our institution under ultrasound guidance. Total 40 patients undergoing unilateral inguinal hernioplasty surgery under spinal anesthesia were included in the study. Patients were divided into 2 groups of 20 each. *Group B* - Patients receiving USG - TAP block at the end of surgery with 20 ml Inj. Bupivacaine 0.50% - 20 patients. *Group R* - Patients receiving USG - TAP block at the end of surgery with 20 ml Inj. Ropivacaine 0.75% - 20 patients.

Inclusion Criteria

- i. Male & Female patients giving written and informed consent for the study;
- ii. ASA Grade I & II;
- iii. All patients of age group 20 to 65 years of age;
- iv. Patients undergoing unilateral inguinal hernia surgery under spinal anesthesia.

Exclusion Criteria

1. Patient refusal;
2. Bleeding disorders;
3. Allergy to local anesthetics;
4. Infection at local site of block;
5. Hemodynamic instability;
6. Contraindications for spinal anesthesia;
7. ASA III & above.

Materials Required

1. Ultrasound machine with a linear transducer (7-13 MHz);
2. Sterile gloves;
3. Ultrasound probe cover;
4. Antiseptic solution for skin disinfection;
5. Ultrasound gel;
6. 23-gauge spinal needle;
7. 20 ml syringe with injection tubing.

A written informed consent was obtained in each case in their vernacular language.

Methodology

After Ethical Committee approval, we investigated forty patients undergoing unilateral inguinal hernioplasty. The patients were randomized and allotted to two groups by computer generated tables to undergo TAP block with bupivacaine ($n = 20$) [Group B] vs ropivacaine ($n = 20$) [Group R].

Blinding was maintained as the person injecting the solution while giving TAP block was unaware of whether it is bupivacaine or ropivacaine as it was prepared by another person in operation theatre. As well as the person evaluating the VAS score was not knowing whether the subject had received bupivacaine or ropivacaine.

Consent and fasting status were confirmed. In the operation theatre, standard monitoring including ECG, noninvasive BP, pulse oximeter were attached. Peripheral line was taken with 18G IV cannula. As per the institutional protocol, patients were premedicated with intravenous ranitidine and intravenous ondansetron. All patients received standardized spinal anesthesia with 0.5% bupivacaine 3.5 ml in sitting position. Level of analgesia achieved noted. Block assessed by pin prick method. Patients monitored intraoperatively. Hypotension was taken as fall in systolic blood pressure > 20% of base line and treated with incremental doses of mepheneteramine 6 mg and bolus of 200 ml ringer lactate. No analgesic or sedation was given to patient intraoperatively. Vitals were monitored at 5, 10, 15, 30, 45, 60, 75, 90, 120... mints till the end of surgery. Any complications like bradycardia, hypotension were observed. At the end of surgery, Petits triangle was identified on the side of surgery and USG guided TAP block performed.

Results

Majority of the patients were in age group of 30-50 years in both the group. Both groups were comparable in terms of age, weight and height. The mean age in Group B and Group R was 39.73 years and 40.14 years respectively. There was no statistically significant difference in mean age ($p = 0.137$), The mean weight in Group B and Group R was 70.41 kg & 73.24 kg respectively. There was no statistically significant difference in mean weight ($p = 0.325$). The mean height in Group B and Group R was 163.54 cm and 164.25 cm respectively. There was no statistically significant difference in mean weight ($p = 0.128$).

Mean duration of surgery in Group B was 61.49

Table 1: Comparison of both groups in terms of age, weight and height

Characteristics	Group B	Group R	<i>p</i> - value
Age	39.73 ± 6.78 years	40.14 ± 7.25 years	0.137
Weight	70.41 ± 5.24 kg	73.24 ± 4.21 kg	0.325
Height	163.54 ± 3.1 cm	164.25 ± 3.2 cm	0.128

min and 61.58 min in Group R respectively. There was no statistically significant difference in total

duration required for surgery (*p* = 0.541).

Table 2: Mean duration of surgery

Mean Duration of Surgery	Group B	Group R	<i>p</i> - value
Duration of Surgery	61.49 ± 9.54 min	61.58 ± 8.21 min	0.541

The mean pain VAS Score in Group B and Group R was 0.03 and 0.05 respectively 30 minutes after surgery. The difference in the two groups was statistically insignificant (*p* - value > 0.05). The mean pain VAS Score in Group B and Group R was 0.23 and 0.35 respectively, 60 mins after surgery. The difference in the two groups was statistically insignificant (*p* - value > 0.05). The mean pain VAS Score in Group B and Group R was 0.32 and 0.34 respectively 2 hour after surgery. The difference in the two groups was statistically insignificant (*p* - value > 0.05). The mean pain VAS Score in Group B and Group R was 1.63 and 1.59 respectively 4 hrs after surgery. The difference in the two groups was statistically insignificant (*p* - value > 0.05). The mean pain VAS Score in Group B and Group R was 2.43 and 2.32 respectively 6 hours after surgery. The difference in the two groups was statistically

insignificant (*p* - value > 0.05). The mean pain VAS Score in Group B and Group R was 3.62 and 3.72 respectively 8 hours after surgery. The difference in the two groups was statistically insignificant (*p* - value > 0.05). The mean pain VAS Score in Group B and Group R was 4.12 and 4.16 respectively 12 hours after surgery. The difference in the two groups was statistically insignificant (*p* - value > 0.05). The mean pain VAS Score in Group B and Group R was 4.62 and 4.69 respectively, 18 hours after surgery. The difference in the two groups was statistically insignificant (*p* - value > 0.05). The mean pain score on VAS in Group B and Group R was 4.75 and 4.89 respectively, 24 hours after surgery. The difference in the two groups was statistically insignificant (*p* - value > 0.05). VAS score was the same in both the groups at all the time in first 24 hours.

Table 3: Mean VAS Score

Time Interval	Group B	Group R	<i>p</i> - value
0 Min	0.00	0.00	> 0.05
30 Min	0.03 ± 0.18	0.05 ± 0.6	> 0.05
60 Min	0.23 ± 0.43	0.35 ± 0.3	> 0.05
2 Hr	0.32 ± 0.64	0.34 ± 0.6	> 0.05
4 Hr	1.63 ± 0.45	1.59 ± 0.9	> 0.05
6 Hr	2.43 ± 0.5	2.32 ± 1.4	> 0.05
8 Hr	3.62 ± 0.45	3.72 ± 1.8	> 0.05
12 Hr	4.12 ± 0.91	4.16 ± 1.4	> 0.05
18 Hr	4.62 ± 0.62	4.69 ± 1.3	> 0.05
24 Hr	4.75 ± 0.56	4.89 ± 0.8	> 0.05

Discussion

Elective inguinal hernia repair is one of the most common surgical procedures performed. Adequate postoperative analgesia facilitates earlier patient mobilization and earlier fulfilment

of discharge criteria from postoperative wards. Pain after inguinal hernia repair is more pronounced in the first two postoperative days. Patients undergoing inguinal hernia repair commonly receive intravenous opioids for postoperative analgesia. However, systemic

opioids provide only static analgesia; but do not alleviate the dynamic component of pain. Dynamic analgesia is provided mainly by regional anesthetic techniques in the postoperative period. With the advent of truncal nerve blocks there seem to be an alternative to epidural analgesia to provide postoperative pain relief. However, failure rate is high in truncal nerve blocks in anatomic landmark based approaches. The most common approach to postoperative pain relief is multimodal using NSAIDs, opioids and local infiltration of local anesthetic. Opioids are effective for treatment of postoperative pain but can cause adverse effects such as nausea, vomiting, decreased gastrointestinal motility, respiratory depression and sedation which further increase the morbidity of the patient. Local infiltration does not relieve deep muscular pain and NSAID are nephrotoxic. Peripheral nerve blocks with local anesthetics are a method that may be used in inguinal hernia surgeries for pain management. Now-a-days, transverse abdominal plane blocks are being performed more commonly for such procedures. However, no uniform opinion exists between the choice of drugs to be used and it is still not extensively implemented due to the complications encountered during the procedure. In our study, we have compared the efficacy of two different drugs i.e., 0.5% bupivacaine and 0.75% ropivacaine in ultrasound-guided TAP blocks performed for patients undergoing unilateral inguinal hernioplasty.

Based on the observation and results obtained in our study involving 20 patients in each group, results of our study were discussed in detail by comparing with the obtained data and available evidence in the literature. Immediate pain relief by TAP block in the postoperative period has several implications in recovery of these patients, such as VAS score, reduced side effects of opioids and analgesics and better quality of analgesia.

Mean duration of surgery in Group B was 61.49 ± 9.54 min and Group R 61.58 ± 8.21 min. There was no statistically significant difference in total duration required for surgery in two groups ($p = 0.541$). There was no significant difference between the two groups with respect to the duration of surgery.

In patients under the bupivacaine group, 60% belonged ASA I & 40% to ASA II. In the ropivacaine group, 55% belonged to ASA I & 45% to ASA II. Thus, majority of the patients were of ASA I category and there was no statistically significant difference between both the groups.

The mean pain score on VAS in Group B at 0, 30 min, 60 min, 2 hr, 4 hrs, 6 hrs, 8 hrs, 12, 18 and 24 hrs were $0, 0.03 \pm 0.18, 0.23 \pm 0.43, 0.32 \pm 0.64, 1.63 \pm 0.45, 2.43 \pm 0.5, 3.62 \pm 0.45, 4.12 \pm 0.91, 4.62 \pm 0.62$ and 4.75 ± 0.56 respectively.

The mean pain score on VAS in Group R at 0, 30 min, 60 min, 2 hrs, 4 hrs, 6 hrs, 8 hrs, 12 hrs, 18 hrs and 24 hrs were $0, 0.05 \pm 0.6, 0.35 \pm 0.3, 0.34 \pm 0.6, 1.59 \pm 0.9, 2.32 \pm 1.4, 3.72 \pm 1.8, 4.16 \pm 1.4, 4.69 \pm 1.3$ and 4.89 ± 0.8 respectively. The difference in the two groups was statistically insignificant (p - value > 0.05). Thus, the mean pain VAS score was the same in both the groups at all the time in first 24 hours. This demonstrates that the US-TAP block in both groups provide same effect & prolonged analgesia in the initial postoperative period. This study very well correlates with the study of Siddiqui et al. who in his analysis of seven randomized, double-blinded studies of both blind and ultrasound guided TAP technique for postoperative analgesia in infraumbilical surgeries demonstrated average and significant reduction in IV PCA requirement as a part of multimodal analgesic regimen. He also demonstrated reduced VAS score both at rest and movement in the early postoperative period. He also found out there was reduced incidence of postoperative nausea, vomiting and sedation.

Conclusion

About 15 ml of 0.5 % bupivacaine or 15 ml of 0.75 % ropivacaine for transverse abdominis plane block produces satisfactory and comparable sensory block, related to duration, analgesia and VAS score. The lower CNS and cardio toxicity of ropivacaine may help in reducing the risk to the patients. There was no much clinical difference in duration, dose of analgesia and VAS score among both the groups, when injected in equal volume for TAP block under ultrasound guidance. Ropivacaine has a potentially improved safety profile when compared with Bupivacaine.

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