

Comparative Study of Efficacy of 0.5% Ropivacaine and 0.25% Levobupivacaine when used in Transversus Abdominis Plane (TAP) Block for Post-Operative Analgesia in Lower Abdominal Surgeries

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Received: 04-02-2023 / Revised: 28-02-2023 / Accepted: 30-03-2023

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Conflict of interest: Nil

Abstract

Background: To assess the effectiveness of 0.25% Levobupivacaine and 0.5% Ropivacaine in the Transversus Abdominis Plane Block for Post Operative Analgesia in Lower Abdominal Surgery.

Methods: In this prospective, randomised, single-blind, controlled clinical trial, 60 ASA physical status I–II patients of either sex, older than 16 years old, with normal liver and renal functions, were scheduled for unilateral lower abdomen surgery. Using systematic random sampling, patients were assigned to either group L (n = 30) or group R (n = 30) to receive a TAP block with 0.25% levobupivacaine or 0.5% ropivacaine.

Results: In group L, the average age was 45.62±16.63 years, while in group R, it was 44.99±12.13 years. As hernias are more common in men, the majority of group L and group R members are men rather than women. The majority of inguinal hernia cases in our study were on the right side, which was more common than on the left in both groups. Open appendectomy is the least common of the surgical procedures in both categories. In groups L and R, the mean respiratory rates range from 13.99±0.95 beats per minute to 14.63±1.11 beats per minute and 13.96±0.75 beats per minute to 14.18±0.68 beats per minute, respectively.

The mean pulse rate varied between 72.64±5.80 beats per minute in group B and 71.2 ±4.26 beats per minute in group R. In groups L and R, the mean arterial pressure ranged from 84.4±11.99 mmHg to 90.01±11.9 mmHg and from 81.98±10.98 mmHg to 89.75±13.01mmHg, respectively. There was no statistically significant change (p>0.05). In group L, the average time was 418.5±48.55 minutes, and in group R, it was 2090±622.21 minutes. Statistics indicated that this difference between the two groups was present (p <0.05).

Conclusion: This study found that 0.5% Ropivacaine, when administered in Transversus Abdominis Plane (TAP) Block to give post-operative analgesia after lower abdominal procedures, offered longer duration of analgesia compared to 0.25% Levobupivacaine.

Keywords: Transversus Abdominis, Ropivacaine, Levobupivacaine, Post-Operative Analgesia, Lower Abdominal Surgeries.

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Introduction

After abdominal surgery, the abdominal wall often causes a lot of pain. If postoperative pain is not treated, even a relatively minor procedure like an inguinal herniorrhaphy may result in a risk of persistent pain in roughly 12% of patients, with clinically significant consequences on daily activities.[1] An opioid or an NSAID is typically prescribed for postoperative analgesia. The adverse effects of opioids include respiratory depression, emesis, decreased gastrointestinal motility, sedation, and a host of other conditions. Other negative effects of NSAIDs include renal impairment, gastrointestinal bleeding, and altered hemostasis. Although there are less systemic side effects when using a localised analgesic approach because of the medicines' peripheral site of action. As a result, localised analgesic method has become widely recognised as a crucial part of the postoperative analgesia regimen. One of these local blocks, TAPB, is rising in popularity.[2]

The Transversus Abdominis Plane Block (TAPB) is a surgical procedure that is carried out through the lumbar triangle of Petit, which is made up of the iliac crest inferiorly, the external oblique muscle posteriorly, and the latissimusdorsi anteriorly. The defect is typically visible 1 cm above the iliac crest in the midaxillary line.[3] The procedure is injecting local anaesthetic into the space between the internal oblique muscles and the transverses abdominis muscle (TAM). It permits local anaesthetic drug deposition above the TAM, sensory blocking the plexus of nerves supplying the skin and muscles of the lower abdominal wall. An opioid or an NSAID is typically prescribed for postoperative analgesia.[4]

The adverse effects of opioids include respiratory depression, emesis, decreased gastrointestinal motility, sedation, and a host of other conditions. Additionally, NSAIDs

can cause side effects such renal failure, gastrointestinal bleeding, and altered hemostasis. Although there are less systemic side effects when using a localised analgesic approach because of the medicines' peripheral site of action.[5] As a result, localised analgesic method has become widely recognised as a crucial part of the postoperative analgesia regimen. One of these local blocks, TAPB, is rising in popularity. When utilised in TAPB for unilateral lower abdominal procedures, the duration of postoperative analgesia provided by 0.25% Levobupivacaine and 0.5% Ropivacaine will be compared.

Material and Methods

This study was conducted at Madhubani Medical College and Hospital, Madhubani, Bihar from December 2019 to May 2020. In this prospective, randomised, single-blind, controlled clinical trial, 60 ASA physical status I–II patients of either sex, older than 16 years old, with normal liver and renal functions, were scheduled for unilateral lower abdomen surgery. This study excluded patients with a history of local anaesthetic sensitivity, poor liver function, infection at the injection site, or abnormal coagulation.

Using systematic random sampling, patients were assigned to either group L (n = 30) or group R (n = 30) to receive a TAP block with 0.25% levobupivacaine or 0.5% ropivacaine. Throughout, standard monitoring techniques such as arterial oxygen saturation, non-invasive blood pressure, and ECG were used. Intravenous Ranitidine and intravenous Ondansetron were used to premedicate the patients. 500 cc of Ringer Lactate were placed into the patients' systems. In a lateral posture without any table tilt, all patients underwent a conventional spinal anaesthesia using 3.0 ml of 0.5% hyperbaric Bupivacaine without any additives. The degree of pain relief obtained was documented. The block was evaluated using pinprick.

T6 was the desired height. Patients were watched throughout the operation. Hypotension was defined as a drop in systolic blood pressure of > 30% from baseline, and it was treated with Mephentermine 3 mg incremental doses and a 200 ml Ringer Lactate bolus. Bradycardia was defined as a heart rate of less than 60 beats per minute, and it was treated as such with 0.5 mg of intravenous atropine.

No patient received sedation or an analgesic during surgery. TAPB was carried out following surgery when the sensory level was lower than T10. The drug injection in the TAPB was concealed from the anesthesiologist who watched the patients in the PACU.

The patient was checked for pain, problems, and pulse, mean arterial pressure, every 15 minutes for the first hour, every 2 hours for the next 4, 8, 16, and 24 hours after surgery.

Results

Verbal reaction scores ranging from 0 to 4 were used to quantify pain.

At a verbal response score of 2 (i.e., fair pain reduction), the patient received injectable Diclofenac 75 mg as rescue analgesia. Movement of the ankle and knee joints revealed a motor block that was subsiding, and a pin prick on the opposite side of the block revealed a sensory block. The period from the TAPB injection to a pain score of 2 (i.e., fair pain alleviation) was regarded the duration of analgesia. Additionally, the patient was monitored for any additional postoperative issues including haemorrhage, flank fullness, etc.

The effectiveness of TAPB in postoperative analgesia and the relative efficacy of the two medicines were determined by utilising student 'T' test and chi square test after data were combined and analysed using SPSS version 12 at the conclusion of the study.

Table 1: Demographic Data of both groups

Age (Years)	Group L	Group R
<20	4(13.33%)	3(10%)
21-30	3(10%)	2(6.66%)
31-40	5(16.66%)	7(23.33%)
41-50	7(23.33%)	9(30%)
>50	11(36.66%)	9(30%)
Total	30(100%)	30(100%)
Mean	44.56	46.56
SD	16.62	14.22
Gender		
Male	25(83.33%)	26(86.66%)
Female	5(16.66%)	4(13.33%)
Total	30(100%)	30(100%)
Type of Surgery	Group L	Group R
Open appendicectomy	4	3
Left inguinal hernia	8	11
Right inguinal hernia	18	16
Total	30	30

By chi-square test, the difference in mean ages between the two groups was not statistically significant ($p>0.789$).

By chi square test, the difference in mean ages between the two groups was not statistically significant ($p>0.05$). In all groups, inguinal hernias on the right side predominate, more so than on the left. In both groups, open appendectomy is among the worst three.

Table 2: Respiratory rate in both groups

Time interval	Group L		Group R		t test	p value	Significance
	Mean	SD	Mean	S.D.			
0mins	16.09	1.19	16	1.09	0.2505	0.8036	NS
15mins	15.7	1.0	15.62	0.96	0.2959	0.7687	NS
30mins	15.74	1.39	15.9	1.08	0.2406	0.8110	NS
1hr	15.69	0.97	15.94	0.96	0.2935	0.7709	NS
2hrs	15.69	0.96	15.8	0.94	0.4514	0.6538	NS
4hrs	15.73	0.96	15.62	0.75	1.4977	0.1406	NS
8hrs	16.06	1.14	16	1.16	0.2732	0.7859	NS
16 hrs	15.8	1.09	15.67	0.89	0.3094	0.7587	NS
24 hrs	16.8	1.11	16.84	0.96	0.5908	0.5585	NS
48 hrs	15.7	0.96	15.99	1.11	0.5886	0.5991	NS

Variations in respiratory rate throughout time. The respiratory health of the two groups was comparable. In groups L and R, the mean respiratory rates range from 13.99 ± 0.95 beats per minute to 14.63 ± 1.11 beats per minute and 13.96 ± 0.75 beats per minute to 14.18 ± 0.68 beats per minute, respectively. ($p>0.05$) This was not statistically significant.

Table 3: Pulse rate in both groups

Time interval	Group L		Group R		t test	p value	Significance
	Mean	SD	Mean	S.D.			
0mins	73.16	4.06	73.64	3.79	0.20	0.8590	NS
15mins	73.4	4.01	73.72	3.89	0.1518	0.8805	NS
30mins	72.69	5.03	72.86	4.69	0.2708	0.7880	NS
1hr	74.0	3.99	73.4	4.01	0.0698	0.9458	NS
2hrs	73.64	3.68	72.4	3.98	0.0787	0.9396	NS
4hrs	74.9	4.69	73.19	4.66	0.0654	0.9482	NS
8hrs	73.9	4.01	73.04	3.98	0.1113	0.9118	NS
16hrs	73.01	3.77	73.01	3.98	0.113	0.9099	NS
24hrs	73.02	4.01	73.99	4.02	0.1072	0.9156	NS
48hrs	73.62	4.79	72.69	4.96	0.0000	1.004	NS

Mean pulse rate at various time intervals. The two groups were comparable with regard to cardiovascular status. The mean pulse rate was ranges from 72.46 ± 5.80 beats /minute to 71.2 ± 4.26 in group B and 70.65 ± 4.98 beats/minute to 73 beats/minute in group R. This is not statistically significant. ($p>0.05$).

Table 4: Mean arterial pressure in both groups.

Time interval	Group L		Group R		t test	p value	Significance
	Mean	SD	Mean	S.D.			
0mins	83.8	13.06	83.46	12.54	0.0726	0.9428	NS
15mins	84.10	13.43	84.25	12.02	0.0232	0.9818	NS
30mins	85.04	12.54	85.04	11.75	0.0369	0.9709	NS
1hr	86.12	13.01	86.61	12.60	0.0465	0.9636	NS
2hrs	86.01	12.69	86.65	12.41	0.001	1.05	NS
4hrs	88.1	11.96	87.41	11.65	0.3575	0.7225	NS
8hrs	88.0	12.40	87.04	12.01	0.0232	0.9818	NS
16hrs	88.9	12.69	87.42	12.04	0.1664	0.8689	NS
24hrs	87.54	11.73	86.84	11.14	0.0249	0.9802	NS
48hrs	90.0	12.84	88.27	12.27	0.1038	0.9179	NS

Mean arterial pressure at various time intervals in the two groups. The mean arterial pressure was ranges from 84.4 ± 11.99 mmHg to 90.01 ± 11.99 mm Hg in group L and in group R ranges from 81.98 ± 10.98 to 89.75 ± 13.01 . This difference was also not statistically significant. Hypotension or bradycardia were not observed in any of either group.

The number of patients who received a verbal rating score of 2 at various points after receiving TAPB with levobupivacaine and ropivacaine provides information regarding the length of the blockade and the point at which rescue analgesia was administered. Group L VRS 2 maximum patients are in the sixth hour, whereas those in group R are in the third-to-fifth hour.

Discussion

Analgesia is provided after abdominal surgery using the new, rapidly developing transverses abdominis plane (TAP) block of regional anaesthetic. The TAP, an anatomical gap between the internal oblique and transverses abdominis muscles, is the site of a single big bolus injection of local anaesthesia. Whether used as the primary anaesthetic or for pain management following general or spinal anaesthesia, TAP block dramatically lessens the discomfort associated with lower abdominal surgery. For

surgical procedures where parietal discomfort is a significant contributor to postoperative pain, using local anaesthetic drugs in TAPB is a quick and efficient analgesic method. The skin and muscles of the anterior abdominal wall of patients undergoing colonic resection surgery with a midline abdominal wall incision, six patients undergoing caesarean delivery, and patients undergoing radical prostatectomy have all been shown to respond exceptionally well to the local anaesthetic agents used in TAP block. Additionally, because there are fewer blood vessels in the TAP than in other peripheral nerve block operations, there is a lower possibility of systemic toxicity from the local anaesthetics, which may be brought on by blood vessel puncture. Another benefit for clinical usage of the method is its simplicity. The process in this study took about 4-5 minutes to complete. According to McDonnell *et al.*, [6], the amount of morphine that patients who underwent large bowel surgery with the TAP block that was carried out with 20 ml of 0.375% levobupivacaine, 10 ml injected to each side, needed during the postoperative 24 hours dropped by 70%.

According to McDonnell *et al.*, the TAP block performed with 0.75% ropivacaine 1.5 mg/kg (max. 150 mg) decreased the total dose of morphine administered by the IV-PCA to the patients who underwent

Caesarean section for 48 hours after the operation compared to the total dose of morphine administered to the controls. In our research, 0.5% ropivacaine was employed for both postoperative analgesia and hemodynamic monitoring. Without experiencing any pain, analgesia was maintained for 36 hours, and up until that point, hemodynamics were steady. Fifty women underwent bilateral TAP blocks with ropivacaine 0.5% (N = 25) vs a placebo (N = 25) in a research by Bhavna *et al.*[7] in 2012. In contrast to Bhavna *et al* trial, which lasted 24 hours, ours lasted 36 hours with 0.5% ropivacaine. Sixty patients (mean age 36.2±9.6 years) of either sex who underwent major gynaecological or surgical procedure were randomised to either receive standard care, including patient-controlled tramadol analgesia (n = 30), or to undergo TAP block (n = 30) with 20 ml of 0.375% levobupivacaine, according to Priyasharma *et al* [8] 2013 study.

The TAP block decreased pain levels on the Visual Analogue Scale at the highest time points (2, 4, 6, 12, 24 h), but not at all time points (36, 48 h) examined. Patients receiving TAP block had lower tramadol needs at 24 and 48 hours (210.05 ±20.5 vs. 320.05±10.6; P<0.01) and at first PCA tramadol request (in minutes), respectively, compared to the control group (178.5±45.6 vs. 23.5±3.8; P< 0.001). This study reveals that, when compared to opioids or other intravenous drugs, TAP is more effective at producing analgesia.

Levobupivacaine at a concentration of 0.25 percent was utilised in our trial to block the TAP, providing analgesia for 8 hours after surgery and reducing the need for intravenous analgesics. In a 2013 study, Sooyoung Cho, Youn-Jin Kim, Dong-Yeon Kim, and Soon-Sup Chung allocated forty-four patients undergoing appendectomy to either get conventional care (group II, n = 22) or a right sided-TAP block (group I, n = 22).

After inducing anaesthesia, all patients got normal anaesthetics, and the TAP block group underwent an ultrasound-guided right side TAP block using 20 mL of 0.5% levobupivacaine. When compared to the control group, the TAP block group with levobupivacaine dramatically decreased VNRS up to 12 hours after surgery.

At the conclusion of a procedure done under spinal anaesthesia, 20 ml of 0.5% ropivacaine, 0.25% bupivacaine, or saline were used to perform a unilateral TAPB on the surgical side. In the Bupivacaine group, the mean duration of analgesia was 420.6 minutes with an SD of +14.01, and in the Ropivacaine group, it was 2187 minutes with an SD of +1011.09, both of which were statistically significant.

Our study's analgesic duration and hemodynamic characteristics are comparable to those of the study mentioned above. While 0.5% Ropivacaine and 0.25% Levobupivacaine were employed in our investigation. Additionally, Nirajet *al.*[11] found that when 0.5% bupivacaine was combined with a TAP block during an open appendectomy, the need for morphine and pain levels decreased within the first 24 hours.

Levobupivacaine was employed in our investigation in place of bupivacaine with half the concentration of bupivacaine used in the previous study because the two drugs have similar sensory and motor qualities. For an elective caesarean delivery, 40 women were randomly assigned to undergo either local anaesthetic (n = 20) or saline (n = 20) TAP blocks in addition to a simple bupivacaine spinal block. When compared to controls, the local anaesthetic TAP block group's 24-hour morphine demand was much lower (26 mg±5 mg versus 63 mg±5 mg). (p<0.05) No statistical measurements were presented, despite the authors reporting reduced PONV, lower 24-hour VAS scores,

and higher satisfaction in the local anaesthetic TAP block group.

Conclusion

Thus, this study suggests that when utilised in TAPB to give post-operative analgesia following lower abdominal procedures, 0.5% Ropivacaine gave longer duration of analgesia compared to 0.25% Levobupivacaine.

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