



Ultrasound-guided Posterior Transversus Abdominis Plane Block versus Epidural Analgesia for Postoperative Pain Relief in Lower Abdominal Surgeries

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Background: Among the regional anesthesia techniques used for postoperative analgesia for lower abdominal surgeries, epidural analgesia (EA) has been the gold standard and time-tested technique, but complications and contraindications for the same warrant the need for other equally good analgesic techniques. **Aim:** The present study compared posterior transversus abdominis plane (TAP) block to EA for postoperative analgesic efficacy in patients undergoing lower abdominal surgeries. **Methods:** Prospective, observational study in patients undergoing lower abdominal surgeries under general anesthesia. Patients received ultrasound-guided (USG) 20 ml 0.2% ropivacaine each side in TAP block (Group A, $n = 50$) or 10 ml of 0.2% ropivacaine was administered in epidural (Group B; $n = 50$) before extubation. The Visual analog scale (VAS) score, hemodynamic parameters, and ill effects were recorded. **Results:** The blood pressure was significantly lower in first 6 h of block in Group B. VAS score was significantly lower in Group A in first 6 h of surgery. It was observed that a significantly higher number of patients in the Group B required rescue analgesic and at higher dosages. Postoperative nausea and vomiting were found in 32% of Group B and 22% of Group A patients. **Conclusion:** TAP block has almost no complications, keeps the patient more hemodynamically stable, and offers a better early postoperative analgesia when compared to EA in patients undergoing lower abdominal surgeries.

Key words: Transversus abdominis plane block, epidural analgesia, postoperative analgesia, ropivacaine, visual analogue score, ultrasound

INTRODUCTION

Since time immemorial, the pain has remained the most significant issue making patients to seek medical consultation. In the postoperative period, potent analgesia is required not only to bear the surgical stress but also helps in early ambulation and thereby limits many complications such as lung atelectasis and deep vein thrombosis.¹⁻⁴

Abdominal surgeries patient complains of significant pain, especially in the postoperative period.⁵ Opioids are the foremost commonly used analgesics, which provide analgesia but at the cost of some side effects.⁶ Among the regional anesthesia techniques, epidural analgesia (EA) has been the gold standard and time-tested technique, but complications and contraindications for the same warrant the need for

other equally good analgesic techniques.⁷ Hence, we tried to compare EA with a truncal block-transversus abdominis plane (TAP) Block.⁸

Other anesthesia techniques give analgesia to the skin and muscles of the anterior abdominal wall. TAP block, introduced by Rafi in 2004, is a simple, easy to perform, and safer procedure in which the drug is deposited into the TAP.⁹ With the availability of ultrasound, the exact localization of the plane and also the accuracy of drug deposition have improved. Unlike EA, TAP block relieves only from the somatic component of pain and not the visceral pain.^{10,11} Within the present scenario, the truncal blocks play a key role in providing multimodal

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dimension to perioperative analgesia and specifically in postoperative pain control, which is at the center of a debate about the implementation of enhanced recovery after surgery pathways worldwide. The primary outcome was to compare the efficacy of ultrasound-guided (USG) posterior TAP block versus EA for postoperative pain relief by studying the visual analog score (VAS) for pain till 12 h after surgery. Secondary outcomes included supplementary analgesia required and notice hemodynamic changes in the first 12 h postoperatively and any major complications of either method.

MATERIALS AND METHODS

After receiving approval from the Hospital Ethics Committee (700/36/UC/3A dt 28 Nov 2015 INHS Asvini Mumbai, India), this observational study was carried out in a tertiary care hospital over a period of 22 months from November 2015 to September 2017. Adult patients, age >18 years, in the American Society of Anesthesiologists Grade I, II, and III undergoing elective lower abdominal surgeries such as total hysterectomy, appendectomy, colon surgery under general anesthesia (GA) were included in the study after obtaining written informed consent. Patients of age >80 years, on chronic opioid usage, with allergies to local anesthetics and/or with significant coexisting diseases were excluded from the study. The patients were premedicated with injection Glycopyrrolate 4 mcg/kg; injection Ondansetron 0.05–0.15 mg/kg; injection Midazolam 0.5–2 mg and injection Fentanyl 2 mcg/kg; Induction of GA was done with injection Thiopental 3–5 mg/kg and muscle relaxant used for orotracheal intubation were injection atracurium 0.4–0.5 mg/kg (loading dose) and 0.08–0.1 mg/kg (maintenance dose). The inhalational anesthetic agent used was sevoflurane with oxygen and nitrous oxide for maintenance. Depth of anesthesia was monitored primarily through minimum alveolar concentration (MAC) value, being maintained at 0.8–0.9 MAC. Secondly, the vital parameters such as heart rate (HR), respiratory rate (RR), and noninvasive blood pressure (NIBP) were used as surrogates for maintaining an adequate depth of anesthesia. During the study period before extubation using consecutive sampling, patients fulfilling study protocol were given USG 20 ml 0.2% ropivacaine in TAP block on each side by one of the four experienced anesthetists ($n = 50$ Group A), and the alternate patient was positioned in lateral decubitus position, epidural catheter was placed at thoracolumbar level (T12–L1), and test dose of 2 ml of 2% Lignocaine with 1:200,000 epinephrine followed by 10 ml of 0.2% ropivacaine was administered before extubation ($n = 50$, Group B) as epidural anesthesia. Baseline readings of the HR, RR, NIBP, pulse oximetry (SpO₂) were recorded. After completion of the surgery, patients were observed in the postoperative recovery area for hemodynamics.

During the postoperative recovery period, the severity of pain was recorded by the visual analog scale (VAS score (from 0 to 10) at a regular interval. Postoperative HR, blood pressure, pulse oximetry (SpO₂), and VAS for pain were recorded.¹² Intravenous injection tramadol 50 mg was the rescue analgesic used postoperatively.

Statistics

SPSS software 20.0 (statistical analysis in social science, Chicago, Illinois) Used for statistical analysis. Considering a confidence level of 95% and a confidence interval of 10, the number of patients in our study to achieve statistical significance is 96. Hence, a sample size of 100 patients of either sex was considered adequate, and the patients were allocated by simple randomization to both the groups of 50 each. The association between qualitative variables was assessed by the Chi-square test. Quantitative data were represented using Mean $\pm$ standard deviation. Qualitative data were represented in the form of frequency and percentage in the table. Comparison among the study groups was done with the help of an unpaired *t*-test as per the results of the normality test. Association among the study groups was assessed with the help of ANOVA and Chi-Square test. “*P*” <0.05 is considered as statistically significant.

RESULTS

The efficacy of USG TAP and Epidural block was studied as postoperative analgesia for lower abdominal surgeries in 100 patients. From an entire of 118 patients listed for surgery, 12 patients were excluded, and eight patients refused to participate. The basal patient characteristics were equivalent in both groups [Table 1]. The majority of the patients in both the groups were in the age group of 41–50 years.

In cardiorespiratory variables, baseline hemodynamics were comparable in both the study arms [Table 2]. The HR was comparable in both groups at all time intervals [Table 2].

Table 1: Demographic profile and baseline clinical characteristics (expressed as mean $\pm$ SD or as expressed otherwise) of patients in both the groups

Patient data	Mean $\pm$ SD		<i>P</i>
	Group A ($n=50$)	Group B ($n=50$)	
Age (years)	48.3 $\pm$ 14.31	47.6 $\pm$ 8.19	0.76
Weight (kg)	63.4 $\pm$ 9.49	64.5 $\pm$ 10.75	0.58
ASA (I/II/III)	18/24/08	13/32/05	
Sex (male/female)	21/29	2/48	
Duration of surgery	89.2 $\pm$ 33.06	112.50 $\pm$ 45.83	0.004

SD=Standard deviation; ASA=American Society of Anesthesiology

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The systolic blood pressure (SBP) and diastolic blood pressure (DBP) were significantly lower in first 6 h of block in Group B [Table 2]. VAS score was significantly lower in Group A in first 6 h of surgery [Table 2 and Figure 1]. There was no failure rate for TAP block, and the failure rate for the EA with catheter insertion was 12% in first attempt, but in the end, catheters were inserted in all patients. It was observed that a significantly higher number of patients in the Group B required rescue analgesic and at higher dosages. Fifteen (30%) patients in the Group A required 50 mg of tramadol while

1 (2%) patient required 100 mg of Tramadol [Table 3]. Twenty (40%) patients in Group B required 50 mg of tramadol while 22 (44%) and 3 (6%) patients required 100 mg and 200 mg of tramadol, respectively. Postoperative nausea and vomiting were found in 32% of Group B and 22% of Group A patients.

DISCUSSION

In patients undergoing lower abdominal surgeries, the primary pain is due to the incision made at the abdominal wall followed by visceral pain.¹³ There are multimodal methods of achieving postoperative analgesia such as EA, local infiltration at wound sites, systemic opioids, and truncal blocks. EA continues to be the traditional way and provides excellent analgesia. However, it is often associated with hemodynamic disturbances like hypotension. With the introduction of ultrasound in the armamentarium of anesthesiologist at operation theater, TAP blocks have gained popularity.¹⁴ Ultrasound facilitates an exact localization of the plane and gives better visualization and deposition of the local anesthetics. TAP block acts on thoracic nerves 9–12, ilioinguinal and iliohypogastric nerve (L1-L2). It provides adequate somatic analgesia in infra umbilical surgeries like lower segment cesarean section, total abdominal hysterectomy, colonic resection.¹⁵ Various studies have suggested that TAP block provides equipotent and safer analgesia as compared to

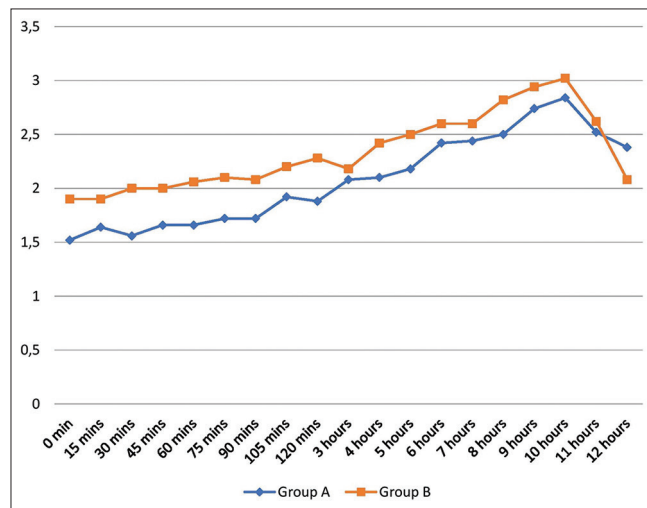


Figure 1: Comparison of visual analogue score at various time interval

Table 2: Hemodynamic parameters and visual analog scale (VAS) score at different time intervals (values expressed as mean±standard deviation or number) during the observation period in two groups

Value	Group	T1	T2	T3	T4	T5	T6	T7
HR	A	72.92±7.64	73.32±7.65	73.16±8.53	73.68±7.63	73.20±6.26	75.44±7.18	74.22±6.24
	B	75.64±7.70	72.34±8.75	71.50±6.46	71.72±6.86	72.36±6.09	74.58±8.50	72.98±5.57
	P	0.07	0.55	0.27	0.17	0.49	0.58	0.29
SBP	A	125.60±13.33	125.64±10.39	124.84±9.68	125.08±9.17	125.96±8.15	125.06±8.05	124.96±7.41
	B	130.44±13.06	112.04±9.90	114.00±7.98	117.08±8.18	121.26±6.49	123.28±6.70	124.16±6.15
	P	0.06	0.0001	0.0001	0.0001	0.001	0.23	0.55
DBP	A	79.30±8.50	79.34±8.09	78.86±7.33	78.84±7.05	79.34±6.73	80.00±5.64	79.76±5.11
	B	81.06±8.97	70.52±6.85	72.14±6.29	73.66±5.18	76.46±5.14	77.54±5.82	77.40±5.48
	P	0.31	0.0001	0.0001	0.0001	0.01	0.034	0.028
SpO ₂	A	98.16±1.30	98.16±1.22	98.04±1.32	97.88±1.26	97.84±1.22	97.72±1.14	97.68±1.17
	B	98.38±1.12	98.16±1.09	98.10±1.22	98.02±1.02	97.72±1.18	97.82±1.21	98.02±1.16
	P	0.36	1.00	0.81	0.54	0.61	0.67	0.14
VAS score	A	-	1.56±0.61	1.66±0.66	1.88±0.72	2.42±0.88	2.84±0.89	2.38±0.57
	B	-	2.00±0.73	2.06±0.74	2.28±0.60	2.60±0.93	3.02±1.24	2.08±0.63
	P		0.001	0.005	0.003	0.32	0.40	0.01

T1=Baseline (before block); T2=30 min after successful block; T3=60 min after block; T4=2 h in the postoperative period; T5=6 h in the postoperative period; T6=10 h in the postoperative period; T7=12 h in the postoperative period; HR=Heart rate; BP=Blood pressure; SBP=Systolic BP; DBP=Diastolic BP; VAS=Visual Analog Scale score; SpO₂=Pulse oximetry

Table 3: Distribution of patients according to requirement of rescue analgesic

Tramadol (mg)	Group A, n (%)	Group B, n (%)
50	15 (30)	20 (40)
100	1 (2)	22 (44)
200	0	3 (6)
No requirement	34 (68)	5 (10)
Total	50 (100)	50 (100)

systemic opioids. A study by Ranjit and Shrestha¹⁶ comparing TAP block with local infiltration at the wound site in patients undergoing gynecological surgeries concluded that TAP block provided more effective analgesia than local infiltration.

Our study showed that SBP and DBP levels were significantly lower in Group B as compared to the other study arm. Similarly, in some studies, the author reported significantly lower blood pressures in the epidural group than in the TAP block group with the associated finding of no statistically significant difference in HR and SPO2 between both the study arms which confers to the findings of our study.¹⁷

Our study revealed that the VAS score was significantly higher in Group B in the first 6 h. It also showed that TAP block significantly reduced early postoperative pain when compared to EA using ropivacaine (0.2%) as the anesthetic agent. In a similar study by Rao Kadam *et al.*,¹⁸ patients in the epidural group received 8–15 ml of ropivacaine 0.2% and the TAP block group a bolus dose of 20 ml of ropivacaine 0.375% bilaterally. This was rationale for the volume of 0.2% Ropivacaine chosen for our study. A prospective randomized trial by Sinha *et al.*¹⁹ on comparison of USG TAP block with equivalent doses of bupivacaine and ropivacaine suggested that ropivacaine provided better analgesia during the immediate postoperative period. This was the rationale behind preferring ropivacaine as the choice of drug in our study. It was observed that a significantly higher number of patients in Group B required rescue analgesic and at higher dosages. Various randomized trials have been performed comparing the analgesic efficacy of epidural and TAP for abdominal surgeries, with none being able to definitively conclude the superiority of one over the other.⁸ Prabhu *et al.*²⁰ single-blind prospective randomized control study evaluating the effectiveness of the TAP block for postoperative pain reported that patients in the TAP group had reduced mean morphine requirement (5.40 mg vs. 9.40 mg) in 24 h period and was found to be statistically significant. Consumption of morphine was significantly lower during the immediate postoperative period (0–6 h). Iyer *et al.*²¹ prospective randomized study comparing the analgesic efficacy of both techniques reported total paracetamol consumption over 48 h was found to be

comparable in both groups. However, it was found that all patients in the TAP group eventually required paracetamol while 5 out of the 36 patients in the epidural group did not need any rescue analgesia at all. The overall requirement of rescue analgesia (Inj. Tramadol) was significantly lower in the epidural group than in the TAP block group, with very few patients in the epidural group even requiring tramadol. On the contrary, our study revealed that rescue analgesic requirement is significantly reduced by USG single shot posterior TAP block when compared to EA while using 0.2% ropivacaine as the anesthetic agent. In comparison to the previous study where the requirement of rescue analgesia was noted till 48 h postoperatively, we followed up till 12 h only. TAP block blocks the somatic component but does not block the visceral component of the pain. Hence beyond 12 h, the effect of TAP block would have reduced, leading to an overall increase in the requirement of rescue analgesia. The incidence of nausea and vomiting was more in Group B as compared to Group A; however, this difference was statistically not significant as per the Chi-square test. Thus, our study aligns with the studies quoted, showing a minimal reduction in the incidence of nausea vomiting in the TAP block group with respect to the epidural analgesia group which is, however statistically not significant.

There were some limitations in this study. The mean duration of surgery was longer in Group B. Longer duration of surgery could have contributed to increased VAS score in Group B. The rationale could be the greater time taken to perform epidural catheter placement as compared to TAP block. However, further analysis into the type of lower abdominal surgeries and the skill level of the surgeon is required to justify it. There was a lack of masking of the intervention, and the majority of the patients were clinically stable, thus limiting the application of the findings on clinically unstable patients with comorbidities. Furthermore, there was a female dominant patient load in our study sample which had been strictly randomized into two groups for this analytical study. A larger sample size and a double-blinded study would have prevented this bias. In this study, only early (till first 12 h) postoperative analgesia has been studied since it decides the early ambulation, faster alimentation, and overall speedy recovery.

CONCLUSION

TAP block is an essential part of the postoperative analgesia armamentarium. It is easy to perform, even with minimal resources, and thus, it is an effective modality of perioperative analgesia in a developing country like India. To conclude, it has been suggested that TAP block has almost no complications, keeps the patient hemodynamically stable, and offers a good

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early postoperative analgesia (till 12 h) when compared to a more accepted modality like EA. However, larger studies may be required to further establish these findings.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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