*Original Research Article*

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# Comparing the Postoperative Analgesic Effect of Subcostal Transverse Abdominis Plane Block and Intraperitoneal Installation using Ropivacaine in Laparoscopic Cholecystectomy Patients

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**Abstract**

*Background:* Laparoscopic cholecystectomy is one of the most common ambulatory elective procedures. Surgical pain derives significantly from the incisions made in the anterior abdominal wall. Nerve supplying the anterior abdominal wall are derived from T6-L1 afferent nerve which course through the neurofascial plane between the internal oblique and transversus abdominis muscle. The subcostal transverse abdominis plane (TAP) block is better suited for upper abdominal surgery [T7-T11] in relieving postoperative pain. *Materials and Methods:* 60 patients were randomly allocated into any one of two groups of 30 patients each, by means of computer-generated randomization. Group A patients received bilateral subcoastal TAP block with Ropivacaine 0.25% 40 ml injected under ultrasound guidance. Group B patients received intraperitoneal installation of Ropivacaine 0.25% 40 ml through laparoscopic instrument before laparoscopic port closure. *Results:* Resting VAS scores were significantly lower in group A than B at 4 hr (p=0.003), 8 hr (p=0.001), 12 hr (p=0.001) and 24 hr (0.001) after the operation. Deep inspiration VAS scores were significantly lower in group A than B at 4 hr (p=0.003), 8 hr (p=0.001), 12 hr (p=0.001) and 24 hr (<0.001) after the operation. Both static and dynamic pain were accompanied by lower analgesic requirement in the subcostal TAP block. *Conclusion:* Ultrasound guided subcostal TAP block is one of the most effective supplemental techniques as part of the multimodal post-operative analgesic regimen.

**Keywords:** Subcostal block; Analgesia; Intraperitoneal; Laproscopy; Ropivacaine.

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## Introduction

Laparoscopic cholecystectomy is considered to be a minimally invasive surgical procedure with lower perioperative pain scores compared with open procedures, it is associated with significant levels of postoperative pain [1]. Pain experienced following laparoscopic cholecystectomy derives significantly from the incisions made in the anterior abdominal wall [2] which has segmental innervation

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provided by nociceptor afferents in the transversus abdominis fascial plane between the internal oblique and transversus abdominis muscles [3]. Usually, standard general anaesthetic is given to patients undergoing laparoscopic cholecystectomy with port-site infiltration of local anaesthetic and supplementary opioid analgesia [1].

Transversus abdominis plane (TAP) block is a regional anaesthetic technique that blocks neural afferents of the anterolateral abdominal wall. With the aid of ultrasound (US) or anatomical landmark guidance, local anaesthetic is injected into the transversus abdominis fascial plane, where the nerves from T6 to L1 are located [4]. Thus, the transversus abdominis plane (TAP) block has been shown to reduce postoperative opioid use in elective abdominal surgery [5], including open appendicectomy [6], laparotomy [7], caesarean section [8], and laparoscopic cholecystectomy. However, the efficacy of the TAP block is reportedly only reliable in providing analgesia below the umbilicus [3].

The ultrasound-guided subcostal transversus abdominis (STA) block is a recently described variation on the TAP block which produces reliable unilateral supraumbilical analgesia. Intraperitoneal administration of local anesthetic has proven to be effective in the relief of postoperative pain, nausea and vomiting after laparoscopic operations [9].

The present study was designed to evaluate the effect of transversus abdominis plane (TAP) block in the postoperative period in patients undergoing laparoscopic cholecystectomy.

## Materials and Methods

The study was conducted in Bangalore medical college and research institute super speciality hospital and approved by ethical committee. Written informed consent was taken from 60 patients (30 in each group) ASA I/II adults (18 years to 65 years old) patients listed for elective laparoscopic cholecystectomy. Patients allergic to local anesthetic agents, skin conditions precluding the block, preoperative chronic dependence upon opioid medication, history of coagulopathy and patient refusal for participation in the study were excluded from the study.

Patients were blinded to the treatment group, as was the anesthetist involved in postoperative data collection. After shifting the patient to operation theatre monitors connected, baseline vitals are noted and premedicated with Inj.Glycopyrollate 0.2 mg, Inj. Midazolam 0.05 mg/kg body weight and inj. Fentanyl 2 mcg/kg body weight. Preoxygenated with 100% O2 for 3 minutes. Patients in each group will be induced with inj. Propofol 2 mg/kg body weight, inj. Vecuronium 0.1 mg/kg body weight. With TOF count 0, under direct laryngoscopy intubated with 7 0r 7.5 mm ID (females) 8 or 8.5 mm ID (males) cuffed endotracheal tubes and tube is secured after confirming bilateral air entry. Anaesthesia will be maintained with Oxygen/Air/ Isoflurane mixture with MAC of 1.

TAP block was performed after the completion of laparoscopic surgery, 60 patients were included in the study. They were allocated into any one of two groups of 30 patients each, by means of computer-generated randomization. Under strict aseptic precaution group A Patients receives bilateral Subcoastal TAP block with Ropivacaine 0.25% 20 ml on each side under the guidance of ultrasound, Whereas group B Patients receives intraperitoneal Ropivacaine 0.25% installation 40ml through laparoscopic instrument before laparoscopic port closure.

The volume and dose of local anesthetic did not differ between the groups. The Subcoastal TAP block was performed by one of two anesthetists with expertise in ultrasound-guided blocks, whereas intraperitoneal infiltration was performed by the surgeon. The block was performed under ultrasound guidance (Sonosite M Turbo high frequency linear probe). The probe was placed in the midline of the abdomen 2 cm below the xiphisternum and moved right laterally along the subcostal margin to the anterior axillary line.

The transversus abdominis muscle was identified lying beneath and extending lateral to the rectus abdominis muscle. A 100-mm, 22-G Stimuplex block needle was then guided, in plane, to a point just inferior to the right costal margin at the anterior axillary line such that the tip lay between the transversus abdominis and internal oblique muscle within the neurovascular fascial plane. Following aspiration 0.25% Ropivacaine was deposited within the plane. Intra peritoneal infiltration was performed postoperatively in the usual manner using the same quantities and the dose of local anaesthetic.

Postoperatively, patients were transferred to the recovery unit. Recovery nursing staff, who were blinded to the group intervention, were however told that the patients had received local anaesthetic for patient safety purposes. All the patients will receive inj.paracetamol 1 gm and if patients complains of pain Inj. Tramadol 50 mg will

be given as rescue analgesia. Outcome data were collected by a other anaesthetist who was blind to the treatment group of individual patients. The quality of analgesia was determined by comparing visual pain analog scores (VPAS) postoperatively.

*Statistical software:* The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

## Results

Patient data and details of both study group are shown in (Table 1). No statistical differences were found in relation to age, weight, and sex.

**Table 1:** Patient characteristics.

| | Group A | Group B | p value |
|---|---|---|---|
| Age | 38.37 | 42.27 | 0.249 |
| Sex | | | |
| Male | 46.7 | 63.3 | 0.299 |
| Female | 53.3 | 36.7 | |
| Weight | 62.3 | 61.53 | 0.771 |

The means of HR (Heart rate) changes among the studied groups were comparable at all times monitored as shown in (Fig. 1).

The means of MAP (Mean arterial Pressure) changes among the studied groups were comparable at all times as shown in (Fig. 2).

Ultrasound guided TAP block and intraperitoneal installation was possible in all cases. No case of blood aspiration during performance of TAP blocks was observed. All patients were prescribed regular paracetamol 1 gm for postoperative pain relief. Pain scores were recorded hourly for the first 24 h using a visual analogue scale at rest (RVAS) and during deep inspiration (DVAS).

*Duration of analgesia*

Duration of analgesia is prolonged in Group I 997 min ± 570.83 min than Group II 534 min ± 532.50 min. P value - 0.004 statistically significant

RVAS scores were significantly lower in group I than II at 4 hr (p=0.003), 8 hr (p=0.001), 12 hr (p=0.001) and 24 hr (0.001) after the operation. (Fig. 3)

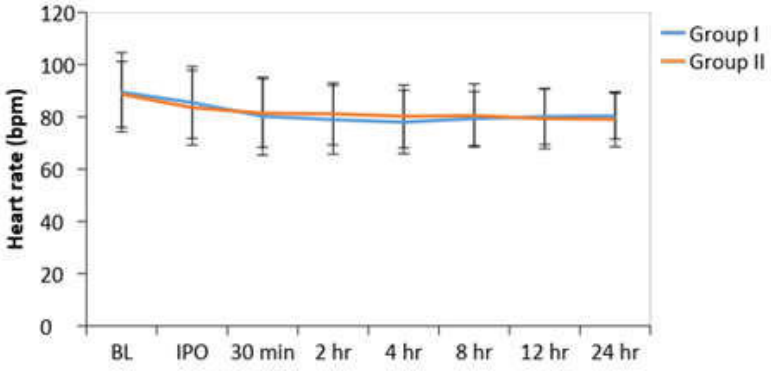


**Fig. 1:** Comparison of Heart rate (bpm) in two groups of patients studied.

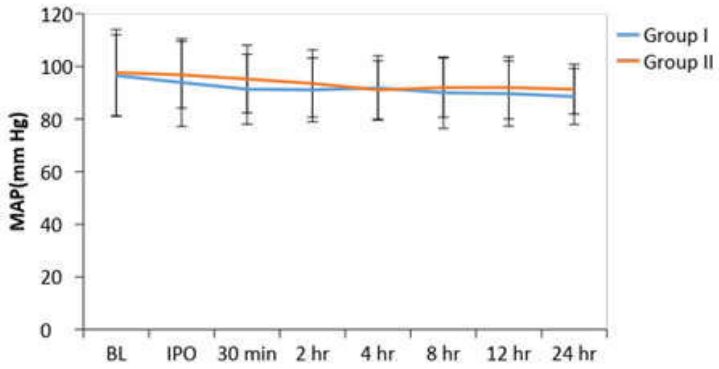


**Fig. 2:** Comparison of MAP (mm Hg) in two groups of patients studied.

DVAS scores were significantly lower in group I than II at 4 hr (P=0.003), 8 hr (P=0.001), 12 hr (P=0.001) and 24 hr (<0.001) after the operation. (Figure 4)

Lower pain scores were accompanied by lower analgesic requirement in the subcostal TAP block.

In group I, only 12 patients required rescue analgesia compared to 23 patients from group II, clinically significant P=0.004**. (Table 2, Figure 5)

Overall, Group I patients required a significantly lower amount of rescue analgesia compared with Group II as shown in (Figure 6).

Postoperative nausea, number of patients vomiting, were not significantly different between groups. (Figure 7).

**Table 2:** Rescue analgesia time in two groups of patients studied.

| Rescue analgesia | Group I (n=30) | Group II (n=30) | Total (n=60) |
|---|---|---|---|
| No | 18(60%) | 7(23.3%) | 25(41.7%) |
| Yes | 12(40%) | 23(76.7%) | 35(58.3%) |
| 30 min | 1(3.3%) | 3(10%) | 4(6.7%) |
| 2nd hour | 3(10%) | 5(16.7%) | 8(13.3%) |
| 4th hour | 3(10%) | 11(36.7%) | 14(23.3%) |
| 8th hour | 3(10%) | 2(6.7%) | 5(8.3%) |
| 12th hour | 2(6.7%) | 2(6.7%) | 4(6.7%) |

P=0.004**, Significant, Chi-Square test

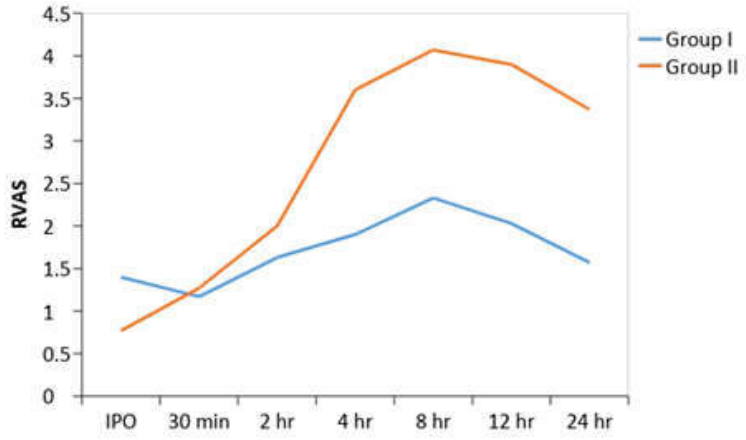


**Fig. 3:** Comparison of RVAS in two groups of patients studied.

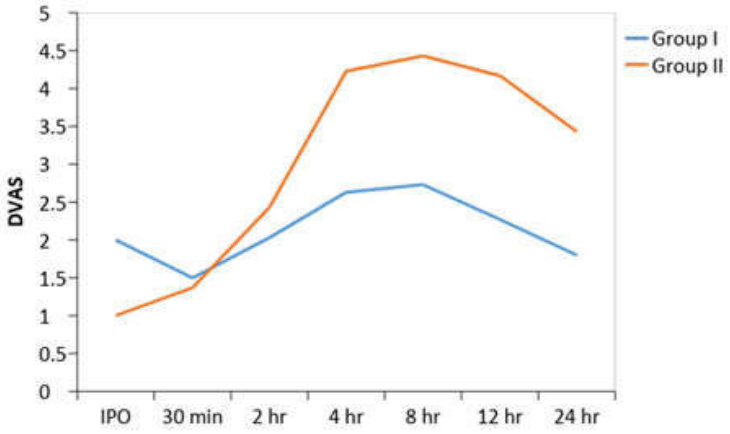


**Fig. 4:** Comparison of DVAS in two groups of patients studied

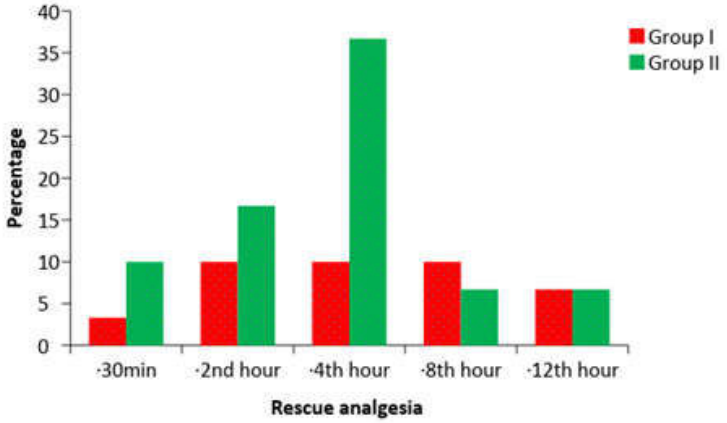


**Fig. 5:** Rescue analgesia time in two groups of patients studied

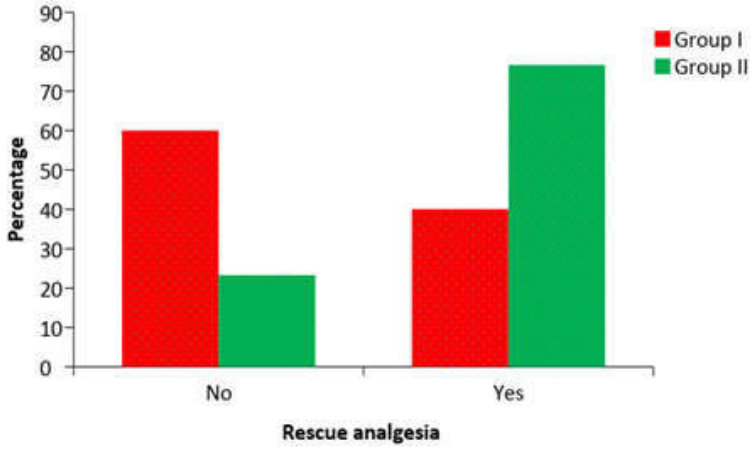


**Fig. 6:** Rescue analgesia requirement

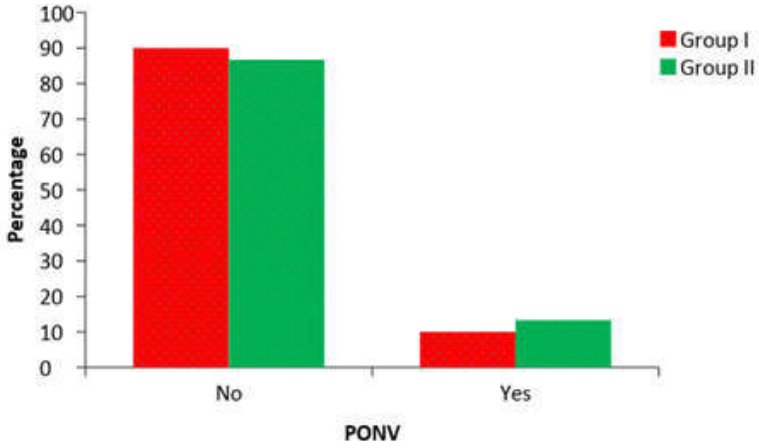


**Fig. 7:** Incidence of PONV in two groups of patients studied

## Discussion

The TAP block has been described as an effective regional anaesthetic method for various surgical procedures. An adequate post-operative pain control provides low morbidity rates, reduces the severity of endocrine and metabolic response due to the surgery and shortens the recovery period [7,10]. Opioid sparing methods such as regional blocks, use of nonsteroidal anti-inflammatory drugs, dexmedetomidine, and ketamine have been used in various other surgeries for reducing unwanted side effects of opioids that interfere with postoperative recovery and early discharge [11].

Regional anesthesia is a popular and proven method to decrease the postoperative opioid requirement [12]. over the last decade, the ectiveness of TAP block for post-operative pain control complementary to the general anesthesia has been demonstrated in many studies [10].

Laparoscopic cholecystectomy is one of the most common ambulatory elective outpatient procedures. As for any surgery, postoperative pain and nausea/vomiting may increase the length of hospital stay after the procedure. The pain intensity is shown to be the most severe in the initial 24–48 h, with incisional pain as a major component [13].

TAP block provides sensory analgesia for T10 to L1 dermatomes and umbilicus is always supplied by T10 dermatome. A bilateral TAP block is thus expected to provide adequate intra- and post-operative analgesia for this surgery, which would lead to early recovery [12].

In our study hemodynamic parameters like Heart rate, mean arterial pressure were comparable in both the groups. Duration of analgesia is prolonged in subcostal TAP block compared to intraperitoneal installation. Resting VAS score and VAS scores during deep inspiration were significantly lower in group I Patients who receives bilateral Subcoastal TAP block with Ropivacaine 0.25% 20 ml on each side under the guidance of ultrasound when compared to group B Patients who receives intraperitoneal Ropivacaine 0.25% installation 40 ml through laparoscopic instrument before laparoscopic port closure after the operation. Similarly, several previous studies have shown that intraperitoneal installation only decrease immediate postoperative pain scores (in PACU) compared to TAP block.

According to systematic review and meta-analysis done by guo q et al., TAP block had lower VAS pain scores at rest and on movement at 8 and 24 hour postoperatively, but no significant difference was found at 1 hour compared with wound infiltration [14].

A Randomized Clinical Trial done by Petersen PL et al., showed that patients who received TAP block in addition to a basic analgesic regimen with acetaminophen and ibuprofen after laparoscopic cholecystectomy had reduced pain scores (AUC/24 h) while coughing as well as reduced morphine consumption in the first 2 postoperative hours, but these reductions were rather small [4]. The demonstrated analgesic efficacy of TAP block in our study is consistent with prior studies that demonstrate reduction in rescue analgesic requirement and reduced pain scores following TAP block.

Overall, Group A patients required a significantly lower amount of rescue analgesia in the form of tramodal 50 mg compared with Group B. This shows better postoperative analgesia with TAP block than intraperitoneal infiltration. The improved quality of the postoperative analgesia associated with TAP block further supports a growing body of evidence that TAP block is superior to installation techniques.

The incidence of postoperative nausea and vomiting were not statistically significant between TAP block and intraperitoneal installation in most included studies. Furthermore, no serious complications were reported in two groups.

*Limitations*

1. TAP blocks are adjunctive techniques for analgesia. They do not adequately provide anaesthesia for surgery as it provides no visceral anaesthesia or analgesia.
2. These are fascial plane techniques, and rely on the deposition of large volumes of local anaesthetic to anaesthetise multiple small abdominal wall nerves. Maximum local anaesthetic doses must be calculated to avoid the effects of systemic toxicity

*Future research direction*

- Need to administer preoperatively, benefitting the patients.
- Need to determine analgesic duration of single shot block and the role of continuous catheter infusion techniques
- Need to determine if single shot block or continuous infusion offers comparable analgesia to epidurals.

## Conclusion

Ultrasound guided subcostal TAP block is one of the safest, easiest and the most e-ective supplemental techniques as part of the multimodal post-operative analgesic regimen in patients undergoing laparoscopic cholecystectomy when compared to intraperitoneal installation. Furthermore, it effectively reduces rescue analgesic requirement in elective laparoscopic cholecystectomy and reduces the burden of these patients on recovery services.

*Conflict of interest:* NIL

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