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Research Paper

# Effectiveness of thoracic paravertebral and intercostal nerve blocks as a part of postoperative analgesia in patients undergoing open cholecystectomy under general anesthesia in Addis Ababa, Ethiopia: A prospective cohort study, 2018

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ABSTRACT

*Background:* Postoperative pain after open cholecystectomy is associated with severe pain. Ineffective post-cholecystectomy pain management can cause shallow breathing, atelectasis, retention of secretion, and infection of respiratory system. This study asses' analgesic effectiveness of thoracic paravertebral nerve block (TPVB) and intercostal nerve block (ICB) for open cholecystectomy postoperative pain management.

*Methodology:* An institutional based prospective cohort study was conducted in selected hospitals. Using systematic random sampling technique, seventy-eight (78) patients that underwent open cholecystectomy under general anesthesia and fulfilled the inclusion criteria were selected. Based on the responsible anesthetist's postoperative pain management plan, patients were divided into three groups. Patients who received TPVB at the end of surgery represent TPVB group and those patients that received ICB at the end of surgery grouped as ICB group. Patients who did not receive any regional block for post-operative pain management considered as the non-block group.

*Result:* The postoperative NRS score at rest and on coughing were significantly lowered in TPVB and ICB group compared to non-block group with p value < 0.001. Time to first analgesic request was significantly longer in TPVB and ICB compared to non-block with p value < 0.001. The total analgesic consumption in the first 24 h was lower in TPVB and ICB.

*Conclusion:* Both TPVB and ICB are effective analgesic techniques for open cholecystectomy with longer and potent postoperative analgesia. During coughing the thoracic paravertebral block recorded lesser pain score than intercostal block. Based on our study we recommend TPVB and ICB for post-operative analgesia for open cholecystectomy.



## 1. Introduction

Open cholecystectomy is a frequently performed procedure in developing countries either because of lack of laparoscopic equipment or expertise. Postoperative pain management after open cholecystectomy can result in substantial opioid consumption with significant side effects such as hypoventilation, sedation, gastric dysmotility, nausea and vomiting. Detecting and managing these side effects can be limited in understaffed post-operative wards [1–5].

Although it would seem rational to apply thoracic paravertebral and intercostal nerve blocks following open cholecystectomy, literature compared the two techniques on patients following thoracotomy and mastectomy. We wished to fill this gap in the literature, and hypothesized that; thoracic paravertebral nerve block would be as effective as intercostal nerve block in post-operative pain management after open cholecystectomy.

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The primary outcome of this study is to compare pain score by NRS at rest and coughing/movement between the non-block group, thoracic paravertebral nerve block (TPVB) group and the intercostal nerve block (ICB) group. The secondary outcomes are to compare time to first analgesic request and total analgesic consumption over the first 24 h following open cholecystectomy.

## 2. Methodology

### 2.1. Study design and patients

An institutional-based prospective observational cohort study was conducted from November 30, 2017 to May 30, 2018 in Addis Ababa, the capital city of Ethiopia. The city has 12 government hospitals out of which two hospitals (Menelik II referral hospital and Empress Zewditu Memorial Hospital) selected by simple random sampling. Ethical clearance was obtained from the Addis Ababa University ethical clearance committee before the start of the study. A research registry at www.researchregistry.com registered this study with Research Registry UIN: researchregistry4710. For permission of data collection, the responsible authorities in the Hospitals and Addis Ababa Heath Bureau received official support letter. Verbal and written informed consent was obtained from each participant. This study is reported in line with the STROCSS criteria [6]. Patients with ASA physical status I and II, age >18 and BMI <30 kg/m$^2$ that underwent elective open cholecystectomy under general anesthesia were included in the study.

Pregnant woman, patient that remain intubated and admitted to ICU, wound site infiltration, patients under chronic treatment with opioids, induction with ketamine, TPVB and ICB given before induction, TPVB with one-injection techniques, failed block, patients with contraindication to regional anesthesia and obese patient (BMI; >30 kg/m$^2$) were excluded from the study.

In the study site postoperative pain management for open cholecystectomy are done by Intra Venous (IV) analgesic (systemic analgesia) or regional anesthesia with either TPVB or ICB depending on the choice and decision of the anesthetist in charge. On patient arrival to the operative theater, Heart Rate (HR), noninvasive blood pressure (NIBP), and $SPO_2$ have been recorded before induction of general anesthesia. General anesthesia were induced with fentanyl (100 mcg), thiopental (3–5 mg/kg) or Propofol (2–2.5 mg/kg) and Suxamethonium (2 mg/kg) to facilitate tracheal intubation. All patients were ventilated artificially with positive pressure ventilation, and inhalation anesthetic agent were used for maintenance of anesthesia.

Since our University did not yet allow RCT, the patients were not randomized. Rather, patients were classified as TPVB group (n = 26), ICB group (n = 26) and non-block group (n = 26) based on the responsible anesthetists' decision for postoperative pain management at the end of skin closure. Patients who did not receive any regional block for postoperative pain management are considered the non-block group (control group).

The technique used for Thoracic Paravertebral nerve block (TPVB) in this study is the multiple injection technique at the T7-T9 level. Patients were positioned in left-lateral position and 15 ml of 0.25% bupivacaine injected at a point 2.5 cm lateral to the midline. Multiple injection technique under ribs were also used in our study for *Intercostal nerve block* (*ICB*). The patients were positioned in the lateral decubitus position after skin closure and needle insertion points are marked at the level of T7-T11 (insertion site) 6–8 cm away from the midline. Following negative aspiration for blood or air, 3 mL of local anesthetic per intercostal nerve were given unilaterally using 0.25% bupivacaine.

### 2.2. Sample size

The primary endpoint of our study is to compare pain severity score between groups at rest and coughing/movement for 24 h using numeric rating scale (NRS), time to first analgesic request and total analgesic consumption after the surgery. Sample size estimation was done based on the results of a similar study done by Fentie et al. [7] and B. Pourseidi et al. [8] and calculated by a priori power analysis (G Power version 3.01). Since both study used different way of data summarization (mean and median), we used Hozo et al. for estimating mean and variance from median and interquartile range.

Controlling for the probability of a Type I error at alpha = 0.017 (the alpha level was reduced using a Bonferroni correction, 0.05/3 = 0.017, to allow for comparisons of both groups with the control group),a sample of 27 subject per group would have 80% power to detect a difference on 11 point NRS pain scale. The calculated sample size was 69; by adding 10% attrition rate and assuming balanced design the total sample size become 78.

After situational analysis for open cholecystectomy procedures, proportional sampling design implemented in the selected two government hospitals. Data was collected from two patients among every three patients that underwent open cholecystectomy. By random start, every selected participant after then placed to either group based on their post-operative pain management. This continues until the desired sample in each groups were achieved (Fig. 1).

### 2.3. Data collection

After providing training for data collectors, data was collected using pretested questionnaires with multiple close-ended questions. Patients scheduled for elective cholecystectomy that fulfilled inclusion criteria were thoroughly assessed before surgery following informed consent. On the morning of the surgery, data collectors instruct the patient on how to self-report pain using the eleven point NRS score 0 to 10. Anesthetist in charge filled intraoperative variables and the other data collectors who are unaware of group allocation collected the remaining postoperative data.

On arrival to the recovery room, data collectors follow every patients until they respond to verbal stimuli and able to answer question. After that, pinprick sensation at the upper abdomen was used to assess and test the sensory block. Failed block was declared if there is no sensory block on surgical side after 20 min.

The scale consists of horizontal lines ranging from 0 (no pain) to 10 (worst imaginable pain). Patients were asked to report their pain based on 11 point NRS score as soon as they fully respond to verbal command. The pain intensity was rated as mild (NRS: 0–3), moderate (NRS: 4–6), and severe (NRS: 7–10) (Fig. 2). The NRS score was recorded at recovery after the patient was fully awake from anesthesia (0 h) and then every six hours for the postoperative period up to 24 h. The pain score was assessed during a quiet breathing period or at rest (static NRS) and after voluntary cough (dynamic NRS). The time to the first analgesic request was recorded from patient chart after admission to recovery and total analgesic consumption of each patient were recorded. At the time of pain evaluation, the heart rate, the mean arterial blood pressure, respiratory rate, and $SPO_2$ were recorded. Any postoperative adverse events such as nausea, vomiting, shivering, hypotension, bradycardia, and respiratory complications were recorded and informed for treatment.

### 2.4. Operational definition

*Numerical pain rating scale* (*NRS*): is a valid is a method of pain assessment where patients are asked to score their pain ratings on a

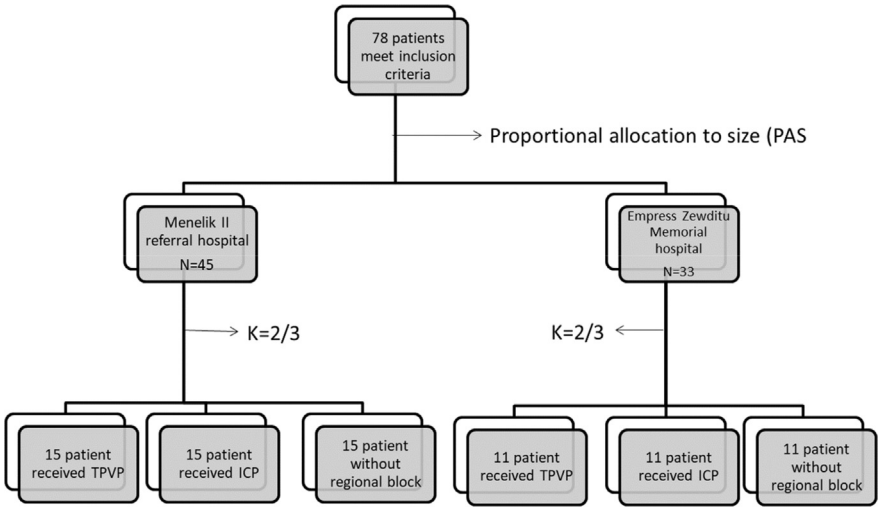


**Fig. 1.** Proportional allocation and enrollment chart for patients scheduled for cholecystectomy.

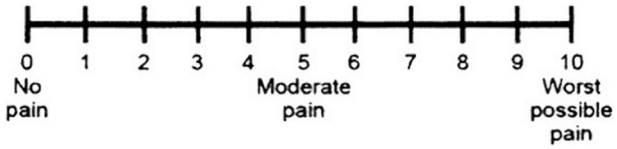


**Fig. 2.** Numerical pain rating scale (NRS), adopted from the National Initiative on Pain Control™ (NIPC™).

scale of 0–10, corresponding to current, best, and worst pain experienced over the 24 h. The median value will be used to represent patient's level of pain [9] (Fig. 2).

*Time to first analgesia request*: a time in minutes from the end of surgery to a first time analgesia were given.

*Total post-operative analgesia consumption*: total dose and type of medication given in mg within the first 24 h starting from admission to recovery room.

*Total intraoperative analgesic consumption*: type and dose of medication given in mg from induction of anesthesia up to admission to recovery room.

*Right censored*: defined as patient not requesting analgesia during study period

*Failed block*: defined as when the patients perceive pinprick sensation at T7-T10 dermatome (upper abdomen) on unilateral region after 20 min after procedure.

### 2.5. Data analysis and interpretation

Data were entered into Epi-info 7 and transported to SPSS V 22 for analysis. The data were tested for normality using histogram and Shapiro–Wilk normality test, homogeneity of variance by Levene's test for normally distributed, and ANOVA for mean difference of ranked data for non-normally distributed variable. Normally distributed and continuous data were analyzed using one way analysis of variance (ANOVA) with post hoc analysis for multiple test and non-normally distributed data were analyzed using kuruska-walih H rank test. Time to first analgesic request was analyzed using Life table, log rank Kaplan–Meier survival curves and cox-regression for covariates.

The comparisons of categorical variable were analyzed using Pearson chi-square test or Fisher's exact test with post hoc as required. Data are presented as mean ± SD for symmetric data and median ± IQR for asymmetric data. Categorical data are presented as numbers and frequencies (percentages). P-values <0.05 will be considered statistically significant.

## 3. Results

### 3.1. Demographic and perioperative characteristics

During the study period, 78 patients were included for final analysis based on whether they received TPVB (Thoracic paravertebral block) or ICB (Intercostal nerve block) at the end of surgery for postoperative analgesia and those without nerve block during postoperative period as unexposed group.

The demographic patient-characteristic data collected, including age, gender, BMI and ASA status were comparable between the three groups. Majority of the study participant were female owing to the higher incidence of cholilithiasis in female but there is no statistical difference between the three groups (Table 1).

The median (IQR) analgesic consumption during induction and intraoperative period, duration of surgery and intraoperative blood loss was comparable between the three groups with P value greater than 0.05 as shown in Table 2.

### 3.2. Postoperative numeric pain rating scale at rest and movement

A kruskal Wallis test revealed a significant difference in NRS score at both Rest ($H = 24.65$ (2, $N = 78$), $p < 0.001$, $\eta 2 = 0.47$) and

**Table 1**
Socio demographic characteristics of patients who underwent open cholecystectomy.

| Variable | TPVB (N = 26) | ICB (n = 26) | NON BLOCK (n = 26) | P-value |
|---|---|---|---|---|
| Age (years) | 36.2 ± 1.2 | 37.3 ± 1.3 | 37.8 ± 1.18 | 0.77 |
| Sex (M/F) | | | | 0.22 |
| o Male | 0 (0%) | 3 (3.8%) | 2 (2.6%) | |
| o Female | 26 (33.3%) | 23 (29.5) | 24 (30.8%) | |
| BMI | 24.6 ± 1.8 | 24.6 ± 2.7 | 25.9 ± 2.6 | 0.08 |
| ASA status | | | | 0.20 |
| o ASA I (n, %) | 24 (30.8%) | 19 (24%) | 22 (28.2%) | |
| o ASA II (n, %) | 2 (2.5%) | 7 (9%) | 4 (5%) | |
| Previous surgery | | | | 0.80 |
| o Yes | 5 (6.4%) | 3 (3.8%) | 5 (6.4%) | |
| o No | 21 (26.9%) | 23 (29.5%) | 21 (26.9%) | |

Value are presented as: Mean + SD, Median (IQR), Number (%), One way ANOVA test, Kuruska-walih H rank test, chi-square test and $p < 0.05$ is statistically significant.

**Table 2**
Perioperative characteristics of patients who underwent open cholecystectomy.

| | TPVB n = 26 | ICB | Non-block | P value |
|---|---|---|---|---|
| Induction agent | | | | 0.08 |
| Propofol | 21 (26.9%) | 14 (17.9%) | 20 (25.6%) | |
| Thiopental | 5 (6.4%) | 12 (15.4%) | 6 (7.7%) | |
| Analgesia during induction (mg) | | | | |
| Tramadol IV | 100 (100–100) | 100 (100–100) | 100 (100–100) | 0.99 |
| Diclofenac IM | 75 (75–75) | 75 (75–75) | 75 (75–75) | 0.35 |
| Surgeon experience | | | | 0.31 |
| Resident (n, %) | 26 (33.3%) | 25 (32.1%) | 23 (29.5%) | |
| Senior (n, %) | 0 (0%) | 1 (1.3%) | 3 (3.8%) | |
| Estimated intraoperative blood loss (ml) | 65 (73–50) | 55 (50–80) | 70 (60–93) | 0.18 |
| Duration of surgery (minutes) | 50 (40–60) | 59 (50–63) | 55 (40–60) | 0.42 |
| Duration of anesthesia (minutes) | 50 (50–70) | 60 (59–70) | 62.5 (50–70) | 0.59 |
| Estimated intraoperative fluid balance (ml) | 1000 (1000–1200) | 1000 (1000–1200) | 1000 (1000–1200) | 0.48 |
| Intraoperative diclofenac IM (mg) | 75 (75–75) | 62.5 (50–75) | 75 (75–75) | 0.53 |

Value are presented as: Mean + SD, Median (IQR), Number (%), One way ANOVA test, Kuruska-walih H rank test, chi-square test and $p < 0.05$ is statistically significant.

on coughing ($H = 28.31$ (2, N = 78), $p < 0.001$, $\eta 2 = 0.49$) in the TPVB, ICB and non-block groups. The proportion of variability in ranked NRS score at rest and coughing accounted for by the TPVB and ICB was 0.47 & 0.49, indicating a strong relationship between TPVB &ICB and change in NRS score respectively. Post hoc analysis shows significant reduction in NRS score between TPVB and non-block at rest with adjusted p value < 0.001 and on coughing adjusted p value < 0.001. . Post hoc analysis also shows reduction in NRS score between ICB and non-block with adjusted p value < 0.01 at rest and adjusted p value < 0.05 at 0 h, 6 h and 12 h on coughing. However, significant difference between TPVB and ICB in NRS score was detected at 12 h, 18 h, and 24 h on coughing (Figs. 3 and 4).

### 3.3. Time to first analgesia request and total analgesia consumption between groups

Kaplan-Meier curve for the first analgesic request with the patient not receiving any analgesics after 24 h. censored to the right is presented in Fig. 3. Significant difference between these curves (log −rank test) were obtained between TPVB group and ICB group ($p = 0.005$), TPVB group and non-block group ($p < 0.001$) and ICB and non-block group ($p < 0.001$). Particularly the patient in the TPVB group had significantly longer time to first analgesic request compared to ICB and non-block group, [median time: 18 h, 95% CI: 14.59–21.40 versus 6 h 95% CI: 3.7–8.2] ($p = 0.005$). On the contrary, most of the patients on the non-block group required analgesia in recovery room (Fig. 5).

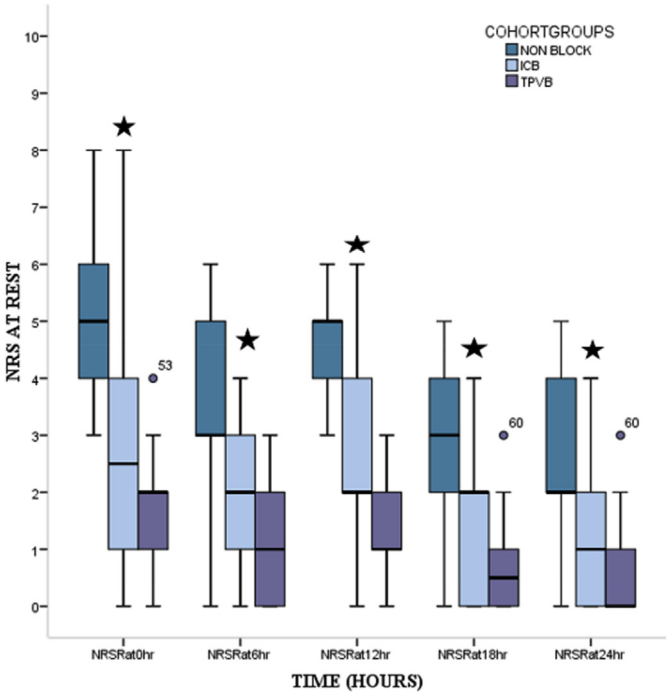


**Fig. 3.** Postoperative pain using 11 point NRS score (0–10) at rest. ★ Significant difference between groups ($P < 0.05$).

Life table showed cumulative proportion of patient not requesting analgesia at time of 6 h after admission to recovery in the non-block group was 4% compared to 50% and 85% in ICB and TPVB group respectively.

A cox proportional hazards model for time to first analgesic request adjusted for covariate (study group, sex, age, BMI, and previous surgery) were done. In univariate analysis presence of all covariate have no significant association with time to first analgesic request except the exposure status (TPVB and ICB). Average hazard ratio for TPVB ($p < 0.001$, hazard ratio [HR] = 0.11, 95% [CI, 0.056–0.22] and for ICB $p < 0.001$, hazard ratio [HR] = 0.23, 95% CI, 0.12–0.42).

### 3.4. Comparison of cumulative postoperative analgesia consumption between groups

By using kruskal Wallis test the total tramadol and diclofenac consumption was significantly different between groups ($H = 27.7$ (2.N = 78), $p < 0.001$, $\eta 2 = 0.36$) and ($H = 8.09$ (2.N = 78), $p = 0.017$, $\eta 2 = 0.1$) respectively. The proportion of variation in median of total tramadol and diclofenac consumption explained by TPVB& ICB was 0.36 and 0.1, indicating a strong and medium effect size respectively. Post hoc comparison showed there is no statistically significant difference in total analgesic consumption between TPVB and ICB group (Table 3).

Cumulative tramadol consumption at various time intervals between groups was significantly different. In a post hoc analysis, we compare cumulative tramadol and diclofenac consumption between TPVB vs. ICB, TPVB vs. Non-block and ICB vs. Non-block. There was significant difference in tramadol consumption between TPVB and ICB at 6 h with adjusted $p = 0.04$. However, there was no statistically significant difference in cumulative diclofenac consumption between TPVB and ICB at all-time interval for 24 h (Fig. 6).

### 3.5. Incidence of postoperative complication

The incidence of nausea and vomiting over 24 h is 28.2%. The proportions of patients with nausea and vomiting is lower in

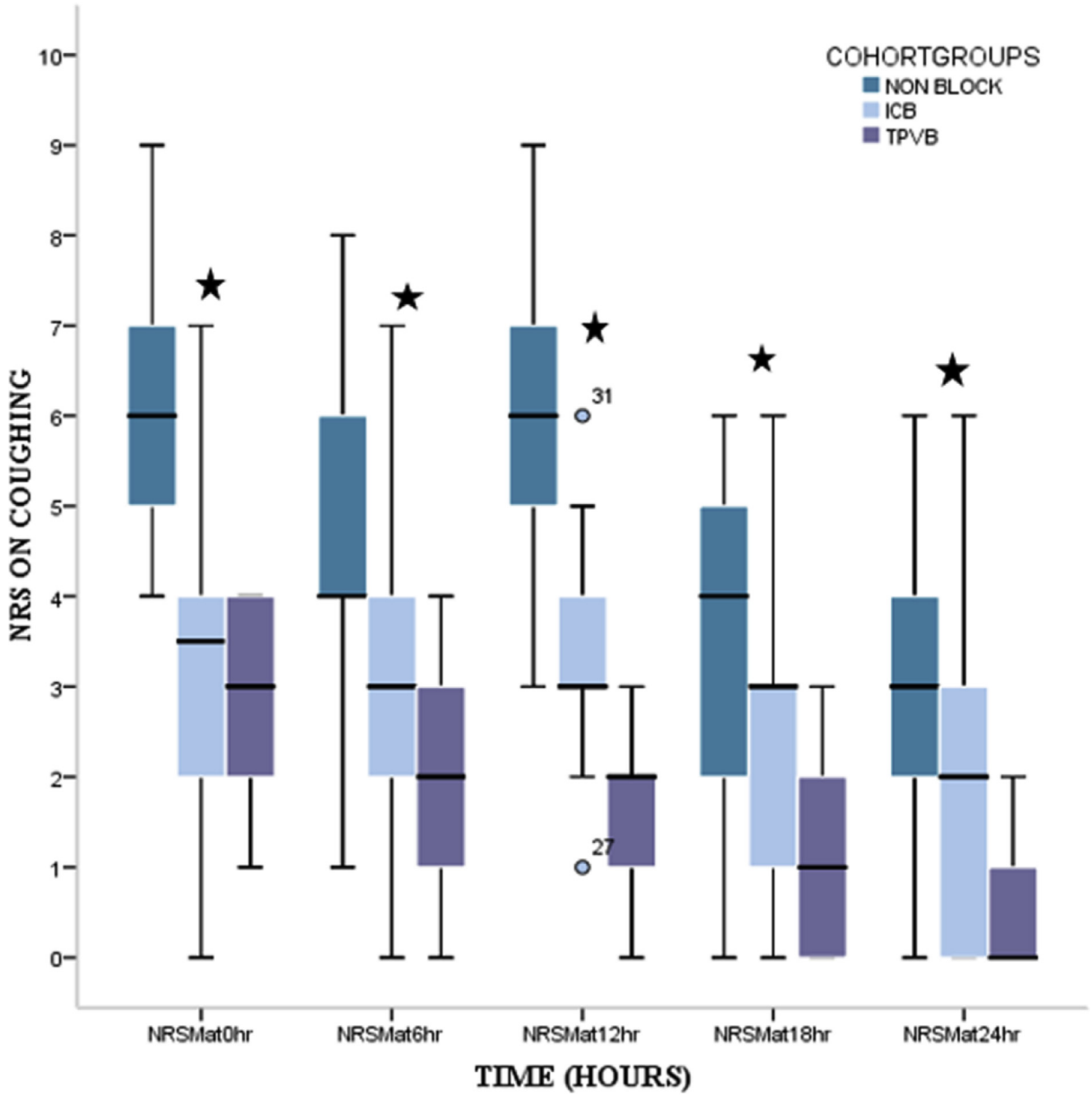


**Fig. 4.** Postoperative pain using 11 point NRS score (0–10) on coughing. ★ Significant difference between groups ($P < 0.05$).

TPVB (6.3%) and in ICB (7.7%) groups compared to non-block group (16.7%) with an $X^2$ (2, N = 78) = 10.003, P = 0.007, $\varphi_c = 0.358$. The incidence of hypotension did not differ between groups Fig. 7.

## 4. Discussion

Our result showed that, TPVB and ICB significantly decrease postoperative pain, reduce total analgesic consumption, and prolong the median time to first analgesic request in postoperative period after open cholecystectomy.

This study showed that both paravertebral and intercostal nerve block provide similar level of pain at rest and show significant difference at 12 h between groups. In addition, pain score on coughing/movement were significantly lower in paravertebral block group at 12 h, 18 h, and 24 h postoperatively. This can be explained by the fact that intercostal block is superficial block that control pain from surgical site, while TPVB successfully blocks the somatic and visceral pain. During the period somatic pain decreases in intensity while the visceral pain is intense, TPVB becomes more beneficial to the patient.

The median (interquartile range) NRS score of TPVB group during immediate postoperative period in our case was [2 (1–2)], which was comparable to study in Egypt 1.4 ± 0.5 and 1.9 ± 0.5 VAS in 3 h and 6 h respectively [10]. This finding was also comparable with previous studies where TPVB and ICB decreased the postoperative pain, analgesic requirements and prolong time to first analgesic request in open cholecystectomy, renal surgery and thoracoscopic surgery [11,12].

This study demonstrates that ICB decreases pain intensity for first 6 h and analgesic consumption for up to 24 h during postoperative period. This result was in line with a study by Ilyas M et al. in Pakistan on 2012, which compared intercostal nerve block with local wound infiltration, that showed lower VAS score at rest in

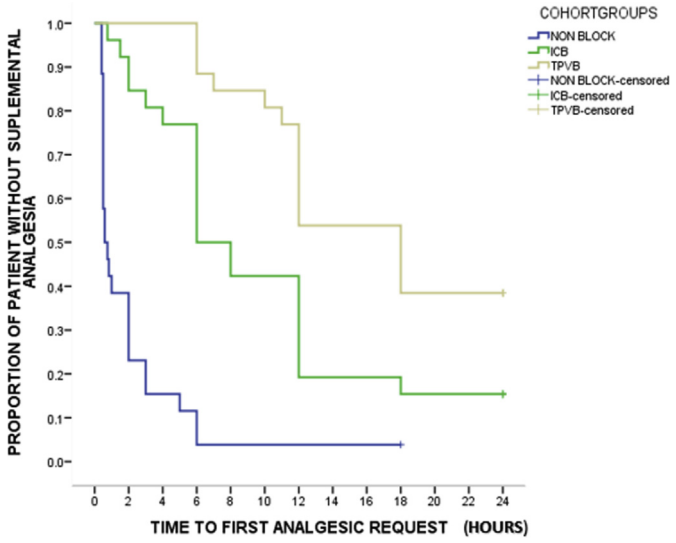


**Fig. 5.** Kaplan Meier survival plot for time to first analgesic request after TPVB, ICB and non-block groups.

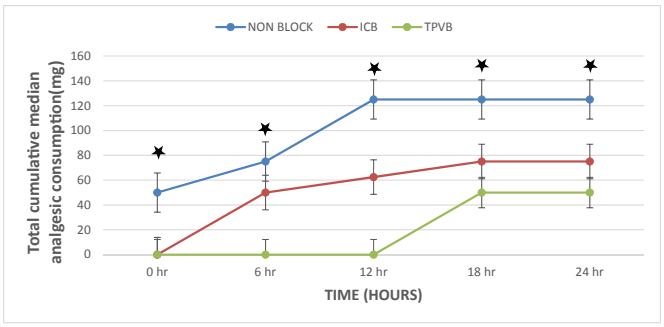


**Fig. 6.** Cumulative tramadol and diclofenac dose after open cholecystectomy in patient receiving TPVB, ICB, and non-block groups. ★ Significant difference between groups ($P < 0.05$).

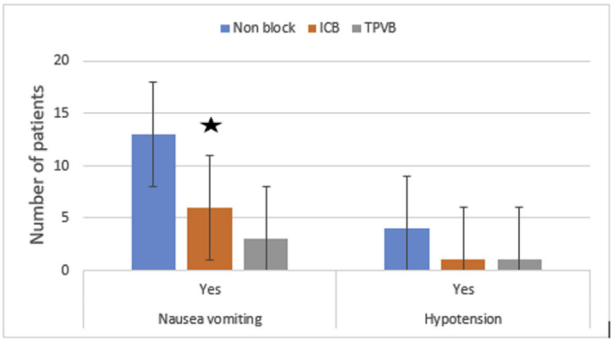


**Fig. 7.** Incidence of postoperative nausea vomiting and hypotension. ★ Significant difference between groups ($P < 0.05$).

intercostal group [13]. Moreover, previous studies that have examined the analgesic effects of conventional ICB in patient undergoing open cholecystectomy, percutaneous nepherolithotomy, breast surgery and Nuss procedure reported comparable results [14–16].

In this study, the median time for the first analgesic request by Kaplan Meier analysis was significantly prolonged in the TPVB group, median time: 18 h, 95% CI: [14.59–21.40] versus ICB group, median time: 6 h 95% CI: [3.7–8.2] ($p = 0.005$). A study done by Ruqaya M et al., with a mean time to first analgesic request after paravertebral block for upper abdominal surgery was comparable with our study (18.83 ± 4.75 h) [17]. This finding was also supported by other studies [18,19]. However, a study conducted by Fentie DY showed that, time to first analgesic request after TPVB was reported with a median of 120 min. This could be due to the difference in technique of paravertebral block (single-injection TPVB), study design or hospital pain management protocol [7].

In our study, the median time to first analgesic request after ICB for cholecystectomy was 6 h with 95% CI: [3.7–8.2] ($p = 0.005$) in contrary to Angral R.et al. in which the time to first analgesic request was 9.45 ± 4.44 h. This might be due to the difference in local anesthesia drug concentration and the surgical procedure (laparoscopic cholecystectomy vs. open cholecystectomy). Another study done by P.hugh et al. reported that time to first analgesic request after ICB was 225 min. One reason for this difference in the duration of time compared to our study may be due to the technique used for ICB (single interspace intercostal block vs. multiple injection intercostal block) [20].

Moreover, we found that the total amount of analgesic consumption over the 24-h postoperative period was lower. The median tramadol and diclofenac consumption was 0 (0–50) mg and 0 (0–75) mg respectively in the TPVB group. The median tramadol and diclofenac consumption was 50 (0–50) mg and 75 (0–75) mg respectively in the ICB group. This result was contrary to previous study conducted by Fentie et al. in which paravertebral block group total tramadol consumption were 200 (100), this might be due to short duration of analgesia compared to the present study [7].

The current study has certain limitations including the inability to use ultrasound-guided blockade, lack of control over the confounding factor like incision size, bupivacaine dose/kg, and participation of different anesthetists and surgeons. In addition, one potential study design drawback is the shorter duration of postoperative follow up.

**Table 3**
Comparison Cumulative postoperative Tramadol and Diclofenac consumption.

| | Time interval | 0 h | 6 h | 12 h | 18 h | 24 h |
|---|---|---|---|---|---|---|
| Tramadol consumption | TPVB | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–50) | 0 (0–50) |
| | ICB | 0 (0–0) | 0 (0–50) | 0 (0–50) | 0 (0–50) | 50 (0–50) |
| | Non-block | 0 (0–50) | 50 (50–100) | 50 (50–100) | 50 (50–100) | 50 (50–100) |
| | P value | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Diclofenac consumption | TPVB | 0 (0–0) | 0 (0–0) | 0 (0–19) | 0 (0–75) | 0 (0–75) |
| | ICB | 0 (0–0) | 0 (0–0) | 0 (0–75) | 75 (0–75) | 75 (0–75) |
| | Non-block | 0 (0–19) | 0 (0–75) | 75 (0–75) | 75 (0–75) | 75 (0–75) |
| | P value | 0.032 | 0.079 | 0.04 | 0.029 | 0.022 |

Value are presented as: Median (IQR), Kuruska-walih H rank test.

## 5. Conclusion

We concluded that multiple injection techniques of the thoracic paravertebral block and intercostal nerve block are effective analgesic technique for open cholecystectomy surgery. This study showed reduced postoperative pain and total analgesic dose requirements after TPVB& ICB. The Thoracic paravertebral block is more effective analgesic on movment/coughing with longer postoperative analgesia request time than the intercostal nerve block. The authors therefore, support the two techniques are a valuable alternative to each other for open cholecystectomy postoperative pain management as part of multimodal analgesia.

## 6. Ethical approval

Ethical clearance was obtained from the Addis Ababa University ethical clearance committee.

## 7. Funding

The study was funded by Addis Ababa University.

## 8. Author contribution

**Bedru Jemal (M.Sc.):** This author helped on substantial intellectual contributions to conception, design, and acquisition of data, analysis, and interpretation of data as well as on preparing the manuscript to this study.

**Misrak W/yohanes (M.Sc.):** have made substantial contributions to conception, design, analysis and interpretation of data and participated in the critical review and editing of the manuscript drafts for scientific merit and depth.

**Tewoderos Shitemaw (MPH, M.Sc.):** has been involved in analysis, interpretation of data and drafting the manuscript and revising it critically for important intellectual contents.

**Nugusu Ayalew (M.Sc.)**: have made substantial contributions on the analysis and interpretation of data and participated in the critical review and editing of the manuscript drafts for scientific merit and depth.

**Zemedu awoke (M.Sc.)**: have made substantial contributions to conception, design and participated in the critical review and editing of the manuscript drafts for scientific merit and depth.

**Sileshi Abiy (M.Sc.)**: have made substantial contributions to analysis and interpretation of data.

## 9. Conflict of interest statement

Nothing to declare.

## 10. Guarantor

The lead author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

## 11. Research Registration Number

Not required.

## 12. Availability of data and material

Trained data collectors collected the data used in this study and authors are willing to share the data upon request from peer researchers.

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## Abbreviations

| | |
|---|---|
| ASA | American Society of Anesthesiologists |
| DBP | Diastolic Blood Pressure |
| GA | General Anesthesia |
| ICB | Intercostal nerve block |
| MAP | Mean arterial pressure |
| NRS | Numerical Rating Scale |
| PAS | proportional allocation size |
| TPVB | Thoracic Paravertebral block |
| SA | Spinal Anesthesia |
| SBP | Systolic Blood Pressure |
| SPSS | Statistical Package for Social Sciences |
| TPVB | Thoracic paravertebral block |
| VAS | Visual Analogue scale |

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijso.2019.04.001.

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