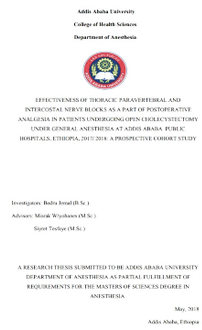
Addis Ababa University

College of Health Sciences

Department of Anesthesia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EFFECTIVENESS OF THORACIC PARAVERTEBRAL AND INTERCOSTAL NERVE BLOCKS AS A PART OF POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING OPEN CHOLECYSTECTOMY UNDER GENERAL ANESTHESIA AT ADDIS ABABA PUBLIC HOSPITALS, ETHIOPIA, 2017/ 2018: A PROSPECTIVE COHORT STUDY

Investigators: Bedru Jemal (B.Sc.)
Advisors: Misrak W/yohanes (M.Sc.)
Siyret Tesfaye (M.Sc.)

A RESEARCH THESIS SUBMITTED TO BE ADDIS ABABA UNIVERSITY DEPARTMENT OF ANESTHESIA AS PARTIAL FULFILLMENT OF REQUIREMENTS FOR THE MASTERS OF SCIENCES DEGREE IN ANESTHESIA

May, 2018

Addis Ababa, Ethiopia

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Thesis

For

Master of Science degree in Anaesthesia

TITLE

Effectiveness of thoracic paravertebral and intercostal nerve blocks as a part of postoperative analgesia in patients undergoing open cholecystectomy under general anesthesia.

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ABSTRACT

Background: Postoperative pain after open cholecystectomy is associated with severe pain. Paravertebral and intercostal block are effective alternative to the gold standard epidural anesthesia for postoperative pain management. Ineffective post cholecystectomy pain management can cause shallow breathing, atelectasis, retention of secretion, and infection of respiratory system. This increase the incidence morbidity, delayed recovery, and hospital stay.

Objective: The aim of this study was to asses' analgesic effectiveness of thoracic paravertebral nerve block (TPVB) and intercostal nerve block (ICB) for management of post cholecystectomy pain as part of postoperative pain management in Addis Ababa hospitals.

Methodology: An institutional based prospective cohort study was conducted on 78 patients who fulfill inclusion criteria for open cholecystectomy under general anesthesia. Patients in TPVB group (n=26) received paravertebral block with 0.25% on T7-9, ICB group (n=26) received intercostal nerve block T7-11 while the non-block group (n=26) received no regional nerve block postoperatively for analgesia. Study participants were selected by systematic random sampling technique after proportional allocation to the study hospitals. Data collection methods include preoperative chart review, intraoperative observation and postoperative patient interview starting from recovery room every 6^{th} hours for 24 hours postoperatively. Comparisons of numerical variables between study groups were done using Kruskal Wallis, ANOVA and chi square test. Kruskal wallis with post hoc analysis were used to compare pain score and cumulative analgesic consumption over time and Kaplan Meier survival analysis were used to compare time to first analgesic request using log rank test. Significance was determined at P value <0.05.

Result: The postoperative numerical pain rating scale (NRS) score at rest and on coughing were significantly lowered in TPVB and ICB group compared to non-block group with ((H=24.65(2, N=78), p<0.001, $\eta 2$=0.47) and (H=28.31(2, N=78), p<0.001, $\eta 2$=0.49) respectively. Time to first analgesic request analgesic request was significantly longer TPVB and ICB compared to non-block with p value <0.001. Particularly the patient in the TPVB Group, median time: 18 hour, 95% CI: [14.59- 21.40] had significantly longer time to first analgesic request compared to ICB group median time: 6 hour 95% CI: [3.7 - 8.2] (p=0.005). The total analgesic consumption in the first 24h was lower in TPVB and ICB.

Conclusion and Recommendation: Both TPVB and ICB are effective analgesic techniques for open cholecystectomy with longer and potent postoperative analgesia. However during coughing, thoracic paravertebral block were better than intercostal block. Based on these we recommend use of TPVB and ICB with 0.25% bupivacaine alternatively for post-operative analgesia.

Key words: paravertebral block, intercostal block, and open cholecystectomy

Acronyms

ASA - American Society of Anesthesiologists

BMI- Body Mass Index

CI- Confidence Interval

DBP- Diastolic Blood Pressure

GA – General Anesthesia

ICB- Intercostal nerve block

KG- Kilogram

MAP- Mean arterial pressure

MG- Milligram

NRS- Numerical Rating Scale

PAS- proportional allocation size

SA- Spinal Anesthesia

SBP – Systolic Blood Pressure

SPSS- Statistical Package for Social Sciences

TPVB- Paravertebral block

TPVB- Thoracic paravertebral block

VAS – Visual Analogue scale

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Chapter one: Introduction

1.1 Background information

Gallstone disease is one of the most common problems affecting the digestive tract with prevalence of from 11% to 36% and there are not many studies of gallbladder disease in Africa but frequency is estimated in sub-Saharan Africa were 5%. Retrospective review of gallstone disease in Tikur Anbesa hospital Addis Ababa Ethiopia in period of 1995-99 was undertaken in 747 patients surgically treated for gallstone disease and 99% of case was treated by open cholecystectomy(1).

Open cholecystectomy is a frequently performed procedure for symptomatic cholelithiasis, especially in developing countries either because of lack of laparoscopic equipment or expertise. However, laparoscopic cholecystectomy remains the gold standard procedure for symptomatic gallstones due to short operative time, early mobilization, less postoperative pain, fast recovery, short hospital stay and early return to work(2).

Management of acute post-operative pain has received keen attention in recent years with considerable concurrent advancement in the field. Despite this advancement, post-operative pain continues to be a challenging and is often inadequately treated, leading to patient anxiety, stress, and dissatisfaction. Inadequately treated pain can lead to detrimental physiological effects and may have psychological, economic, and social adverse effects. However, by using evidence-based management it could be possible to improve the treatment of pain. These efforts are of utmost importance as effective pain relief is a powerful technique to modify surgical stress responses, thereby leading to an improved outcome(3).

Many upper abdominal surgeries including cholecystectomy lead to severe postoperative pain, which if treated inadequately, can cause shallow breathing, atelectasis, retention of secretions and lack of cooperation in physiotherapy. This increases the incidence of post-operative morbidity and leads to delayed recovery(4).

Cholecystectomy surgeries commonly performed under general anesthesia. There are different approaches for open cholecystectomy: the midline incision and right subcostal or Kocher’s incision of which the right subcostal incision is widely practiced. This preference is based on good exposure to the surgical site but the incision size is very large and it involves significant muscle cutting in the subcostal area, which results in severe postoperative pain and impaired diaphragmatic function giving rise to impaired pulmonary function after open cholecystectomy (5).

Pain following open cholecystectomy surgery comprises both incisional pain and visceral pain, which results in substantial amounts of opioid consumption. Despite opioid use, moderate-to-severe pain with coughing and mobilization continues to remain high in the first 72 hours after surgery, even though with improvement after 24 hours. In addition, use of opioids may result in significant side effects such as hypoventilation, sedation, gastric dysmotility, and nausea and vomiting, which can worsen patient recovery. Regional

anesthesia and analgesia can be used to significantly reduce postoperative pain scores, pulmonary complication, and early mobilization and spare the use of systemic opioids(6, 7).

Accumulated evidence reveals that thoracic paravertebral blocks (TPVBs) and intercostal nerve block can provide high-quality analgesia for patients undergoing many types of operations, including patients with thoracoabdominal procedure and chronic pain with minimal complications. Paravertebral Block (TPVB) is a regional anesthetic technique resulting in ipsilateral somatic and sympathetic nerve blockade in multiple contiguous dermatomes above and below the site of injection(8).

Paravertebral blockade (TPVB) is achieved by placement of local anaesthetics around the nerve bundles as they arise from their corresponding intervertebral foramina. The other regional anesthesia used for cholecystectomy is posterior Intercostal nerve block which produces discrete band like segmental anesthesia in the chosen levels (9).

The advantages of TPVB& ICNBs include technical simplicity, good analgesia, an opioid-sparing effect, improved pulmonary mechanics, facilitate early recovery after major surgery, reduced central nervous system (CNS) depression, and avoidance of urinary retention(10) .

1.2 Statement of the problem

Pain has both sensory and emotional components that interact to produce an overall pain experience. Unrelieved pain after surgery can interfere with sleep and physical functioning and can negatively affect patient wellbeing on multiple levels .Good pain control is important to prevent negative outcomes such as hypertension, myocardial ischemia, arrhythmias, respiratory impairments, ileus and poor wound healings. In addition to the significant personal suffering and social burden that result, considerable financial expense is incurred, both directly in extra healthcare costs and indirectly as a result of absenteeism, lost production and welfare payments(11, 12).

Uncontrolled acute pain is associated with the development of chronic pain with reduction of in quality of life.

Thoracic and upper abdominal surgeries are known to be associated with a high incidence of postoperative pain, pulmonary atelectasis and pulmonary infections. After upper abdominal surgery, pulmonary complications occur in 30 to 75% of patients. Cholecystectomy is one of the upper abdominal incisions lead to severe pain, which if treated inadequately, can cause shallow breathing, atelectasis, retention of secretions and lack of cooperation in physiotherapy and optimal pain management is needed to reduce morbidity, mortality, improve patient outcomes, and reduce hospital costs(13).

Despite years of advances in pain management, the mainstay of postoperative pain therapy in many settings is still systemic opioids and NSAID. All opioids have significant side effects that limit their use and NSAID are not adequate for surgical pain management as a single agent. The most common side effect is respiratory depression that could result in hypoxia and respiratory arrest, In addition, nausea, vomiting, pruritus, and reduction in bowel motility leading to ileus and constipation are also side effects of these medications(14).

World health organization(WHO) analgesic ladder also recommends use of peripheral nerve block as a parts of multimodal analgesia system in the perioperative period which decreases cost and side effect of opioids.(15).

Therefore, TPVB and INB are technically simple and routinely practiced in our setup. This can be the solution for increasing the quality of postoperative pain management. So that the aim of this study was to asses analgesic effectiveness of TPVB and INB in patient undergoing open cholecystectomy under general anesthesia.

1.3 Justification of the study

A single drug or a single technique cannot achieve optimal pain relief allowing normal physiologic function without imposing additional risks on the patients. While use of TPVB and ICB support the principle of multimodal analgesia where a variety of analgesic medication and technique that target different mechanism of action in peripheral and central nervous system might have additive or synergistic effect and more effective pain relief compared to single modality intervention. Managing the moderate to severe postoperative pain of cholecystectomy with administration of opioids and non-opioid analgesic is not adequate and exaggerate the side effect of opioid, beside this in our setup the environment is not suitable to manage postoperative pain in ward by opioids due to limitation of monitoring in the ward.

Currently most of the cholecystectomies are done by laparoscopic approach; however, open cholecystectomy is common in our setup, which involves significant muscle cutting resulting in moderate to severe postoperative pain. Even though epidural anesthesia is one of alternative pain management the supply of epidural kit are costly and limited in Ethiopia especially here in our study area. Even if they are accessible, it may not be affordable for most patients. However, there is evidence suggesting that TPVB and ICB are comparable to epidural anesthesia in terms of controlling postoperative pain.

While the benefits of paravertebral block (TPVB) and intercostal nerve block (ICB) on pain after thoracotomy and mastectomy have been demonstrated, not enough investigations on comparison of TPVB and ICB on pain after open cholecystectomy have been conducted, beside this level of innervation and pain intensity is different. Thoracic paravertebral nerve and intercostal nerve block is routinely performed as part of multimodal analgesia for open cholecystectomy in our setup.

Therefore, the choice between TPVB and INB for post-cholecystectomy pain control with regard to pain severity, duration of analgesia & analgesia consumption needs investigation for better practice of perioperative pain control and patient care. In addition, in a resource-limited area like ours investigating the best choice between the two techniques for pain relief has a paramount importance. Although TPVB & ICB are said to be effective no similar study to the specific case have been investigated. In general, if, they are found to be effective to use as either alternative technique or one over other should be recommended practice for management of post cholecystectomy pain. We hope that further comparative studies with similar design would have an impact on the future standard practice of postoperative analgesia in this setup.

Chapter two: Literature review

Severe pain after surgery remains a major problem, occurring in 20–40% of patients. Despite numerous published studies, the degree of pain following many types of surgery in everyday clinical practice is unknown(16). Many patients experience pain in the postoperative period despite the use of potent techniques such as patient-controlled analgesia, epidural analgesia, and regional anesthesia(17).

Despite all research efforts to improve acute postoperative pain management still up to 30% of operated patients show pain scores higher than 3 on a visual analog scale (VAS) of 10(18). A study conducted by prashant K .et al found that the prevalence of postoperative pain after intraabdominal surgery was 84.17%, 92.5% and 96.66% at fifth post-operative hour, second and third postoperative day respectively(19).

A number of studies have been addressed analgesia for open cholecystectomy including epidural, TPVB, intercostal nerve block, wound infiltration and opioid based management (6, 10, 20).

2.1 Intercostal nerve block

A study in Iran on 2007 by Pourseidi et al showed analgesic efficacy of intercostal nerve block for laparoscopic Cholecystectomy in terms of decreased pain severity score 33.55±0.43 VAS Compared to 41.63±0.17 in control group which uses standard technique in the first 24 hour ($p<0.02$). The same study didn't show statistically significant difference in terms of postoperative pethidine consumption with 25±0mg in intercostal group and 25 ±4.56 in control (10).

A recent study in Spain on 2012 conducted by Vizcarra-Román et al stated that Intercostal nerve block for emergency cholecystectomy reduces immediate postoperative pain but Visual Analog Scale for Pain results was similar in intercostal groups and control which use standard treatment($p>0.05$). Rescue tramadol requirement was lower in the intercostal nerve block group12% compared to control group 79% ($p<0.0001$)(21).

On the other hand, study by Madist P et al on 1998 on comparison of intercostal nerve block with patient with patient controlled analgesia (PCA) versus PCA reveals that post-operative pain score were better in INB plus PCA group compared with PCA group thought study period, but the difference was not significant. The total morphine consumption over the 48 h study period was significantly higher PCA group ($p<0.05$)(22) .

Study which compare intercostal nerve bock with bupivacaine versus papaveretum alone for post cholecystectomy pain relief by Ross WB et al conclude that Patients in papaveretum group have required analgesic request sooner. However total papaveretum consumption in postoperative period was not significant difference between groups and also both group have experienced similar degree of pain in postoperative period(23).

A randomized study comparing intraplural administration of bupivacaine vs intercostal nerve block for cholecystectomy which is done by Blake DW et al on 1989 states that both types of

local anaesthesia produced lower pain scores compared to pethidine alone (P < 0.05) with 25% of intercostal nerve blocks and 63% of interpleural catheters requiring no pethidine in the following three hours after operation (24).

A study by *Ilyas M et al* in Pakistan on 2012 which compare intercostal nerve block with local wound infiltration showed lower VAS score 21.2±07.11 in intercostal compared to 27.0±08.80 in local wound infiltration(p<0.05)(25).

Angral R.et al study done India compares intercostal nerve block vs local instillation of bupivacaine vs intravenous butorphanol found that VAS score at 24 hr in intercostal nerve block (ICB) is less (0.96+/-1.17) compared to local instillation (1.76+/-1.16) and intravenous butorphanol (1.56 +/-1.04) p=0.002. The time to first analgesic request is longer in ICB (9.45+4.44hr) compared to local instillation (6.54=4.63hr) and intravenous butorphanol (5.04+1.75hr) P=0.0000.the mean analgesic consumption is least in ICB group(0.88) compared to local installation (1.4) and intravenous butorphanol (2.08) P<0.005(26).

2.2 Paravertebral block

A randomized study in Australia in 1989 by Bigler.D et al compare TPVB and thoracic epidural anesthesia in terms of pain score were significantly higher in TPVB group as well as postoperative morphine consumption is higher in TPVB group(p<0.05) and conclude that continuous paravertebral bupivacaine infusion used here was insufficient as the only analgesic after cholecystectomy(27).

On the other hand Study done on 2011 by Paleczny J et al conclude the efficacy of paravertebral block for open cholecystectomy during the first 72 h after surgery, the mean pain score was significantly lower in patients of paravertebral group compared to control group which received standard opioid general anesthesia (p<0.005). PONV were more frequent in control group (60% vs 33%, p=ns) and were observed earlier (p=0.0007)(28, 29).

A Randomized Study in Pennsylvaniaon on 2015 by Visoiu M et al reveals the efficacy of bilateral paravertebral block versus incisional local anesthetics for laparoscopic cholecystectomy. Mean VAS at 24 hours' were greater in the TPVB group (42.18, SD ±28.73) compared with the port infiltration group (29.98, SD ±25.91, P = 0.045). The intraoperative fentanyl requirement (ng/kg/min) was lower in the TPVB group compared to the port infiltration group (12.81 vs 16.57, P = 0.007) (30).

A randomized clinical trial study on 2004 by Naja MZ et al found that mean VAS score were significantly less with paravertebral 0.40 +/- 0.86 compared with control who received standard general anesthesia 1.19 +/- 1.16 (P < 0.05). The number of patients consuming supplemental analgesics was significantly less (P < 0.05) with active compared with control, at 6 h, at 12 h, at 24 h and at 36 h. More patients were free from nausea (P < 0.05) with active compared with control at 6 h and at 12 h (31, 32).

A randomized control trail study done in India on 2016 by Das k.et al determine efficacy of continuous thoracic paravertebral block compared to standard treatment by systemic analgesia group for post-operative pain relief in patients undergoing open cholecystectomy and

paravertebral analgesia group caused a significant reduction in VAS scores during rest and coughing (static and dynamic pain) at all points of observation and postoperative patient controlled fentanyl consumption as compared to the control group (P<0.05) and however, there was no significant difference in VAS scores during rest between the two groups at 0 hr(13, 33).

Agarwal et al on 2012 in India found lower mean VAS score at rest 3.64 ±+1.57 in TPVB with bupivacaine compared to 5.68±1.34 in control group with standard treatment (p<0.001). Mean VAS score is also lower in study group during coughing 5.24±1.5 compared to 7.04±1.24 in control group (p<0.001).the postoperative morphine consumption in the TPVB group was significantly less 16.80±3.37 mg compared to 27.24±5.08 mg in the control group (P<0.001)(8).

On the other hand randomized control trial study in Iran on 2014 by Hashemi, et al determine effect of bupivacaine with/without fentanyl in paravertebral nerve block for laparoscopic cholecystectomy found that Pain score at rest was similar in TPVB with bupivacaine and placebo and TPVB with bupivacaine plus fentanyl there were no significant differences (P > 0.05). But in hour-24 patients, the case group significantly reported higher pain score compared to patients in the control group (p=0.003). Patients in the placebo group significantly received more total dose of morphine 6.1±4.9 in comparison with patients in the case group 4.1±2.4 (P = 0.0001). Postoperative nausea and vomiting were reported in 29 of all patients which is similar in both group(5).

Another study in Egypt on 2015 by Ealdaba A. and colleagues found that there was a significant decrease VAS at all-time points in the values of paravertebral group compared with the continuous wound catheter and control group which use placebo (p=0.001), postoperative analgesic consumption (paracetamol and ketorolac) was significantly less in continuous wound catheter groups 438.5 ± 99.8 and 17 ± 3.4 and paravertebral 58.6 ± 10.5 and 5 ± 1.2 compared with the control group 1742 ± 250.6 59 ± 12.3(p=0.001) (12).

A study done in Ethiopia ,by Fentie et al assess efficacy of single-injection unilateral thoracic paravertebral block for post open cholecystectomy pain relief and conclude the pain intensity at rest and while coughing (movement) reported with the 24hr NRS score was significantly lower 4(3-6) and 4(4-7) respectively in the paravertebral group as compared with the control group 5(5-7) and 6(5-7.5) respectively(P=0.005).The median (25th–75th percentiles) cumulative morphine consumption, in the paravertebral group was 0 mg (0–2) compared to 2.5 mg (2–4) in the control group, with P-value of 0.001.

The total tramadol consumption was significantly lower in the TPVB group 200 mg (150.00–250) than the control 300 mg (200 350), with P-value of 0.003 and first analgesic request time were significantly higher in the TPVB group at 120 minutes (60–120) than in the control group at 30 minutes (27.5–30), P-value <0.05(29).Specific to our study area there are not enough studies done which assess efficacy of TPVB vs INB for open cholecystectomy especially in Ethiopia(34, 35).

Research hypothesis

Pain intensity scale are different in patient who receive paravertebral and intercostal nerve block compared to those who receive standard general anesthesia with systemic analgesia technique for postoperative pain management.

HO: There is no significant difference in NRS, time to first analgesic request and total analgesic consumption between groups.

HA: There is significant difference in NRS, time to first analgesic request and total analgesic consumption between groups

Chapter three: Objective of the study

3.1 General objective:

To asses analgesic effectiveness of thoracic paravertebral nerve block (TPVB) and intercostal nerve block (ICB) for management of post cholecystectomy pain at rest and coughing as part of multimodal analgesia in Addis Ababa public hospitals from November 30, 2017 to May 30, 2018

3.2 Specific objective:

To compare pain score by NRS among groups at rest

To compare pain score by NRS among groups on coughing/movement

To compare time to first analgesic request in groups

To compare total analgesic consumption among groups over 24 hours.

Chapter four: Methodology

4.1 Study area: This study was conducted in menelik II and Empress Zewditu Memorial Hospitals, the public hospitals in Addis Ababa, capital of Ethiopia. With an area of 527 square kilometers and 10 sub cities, it is the largest city in the country. The city has 12 government hospitals. Menelik II referral hospital was established in 1910 in Addis Ababa. Since its renovation as referral hospital, it has been serving as referral hospital and giving service in both outpatient and inpatient basis for different department in Ethiopia. Empress Zewditu Memorial Hospitals located in Kirkos sub city woreda 08. This hospital was built, owned and operated by the Seventh - day Adventist Church, but was nationalized during the Derg regime in 1976. The hospital is named after Empress Zewditu, the cousin and predecessor on the throne of Emperor Haile Selassie. Today both hospitals are operated by Addis Ababa health bureau.

4.2 Study design and period: An institutional-based prospective cohort study was employed from November 30, 2017 to May 30, 2018.

4.3 Population

4.3.1 Source population: All elective patient admitted to surgical ward to underwent open cholecystectomy in the five governmental hospitals found in Addis Ababa.

4.3.2 Study population: Elective patients having gallstone who underwent open cholecystectomy in menelik II and Empress Zewditu Memorial Hospital during study period.

4.4 Study variables:

4.4.1 Dependent variable:

- NRS score at rest and coughing/movement
- Time to first analgesic request
- Total postoperative Analgesia consumption in 24 hours

4.4.2 Independent variables:

- Exposure status(To TPVB and ICB)
- Socio demographic characteristics: age, sex, weight ,height and BMI
- Type of incision (Kocher(subcostal), midline incision)
- Types of gallstone (cholilithiasis ,Acute Cholecystitis and Chronic Cholecystitis)
- Duration of surgery and duration of anesthesia in minutes
- Intraoperative fluid balance
- Estimated intraoperative blood loss
- Preoperative pain status
- History of previous surgery
- ASA physical status
- Postoperative hemodynamic status

4.5 Operational definition

Postoperative pain: the presence of pain in the postoperative period was defined as a patient as having pain and any pain score other than zero starting from recovery within 24 hours.

Numerical pain rating scale (NRS): is a valid method of pain assessment where patients are asked to score their pain ratings on a scale of 0–10, corresponding to current, best, and worst pain experienced over the 24 hours. The median value will be used to represent patient's level of pain(36).

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 hour starting from admission to recovery room.

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

Right censored: defined as patient not requesting analgesia until the end of study period.

Post-operative nausea and vomiting: when a patients experience at least one episode of either nausea or vomiting within 24 hours.

Preemptive analgesia: is defined as analgesia initiated 24 h before induction of anesthesia.

Fully awake: is defined as when the patient respond to verbal stimuli and able to answer question in recovery room within 30 minutes.

Delayed recovery: defined as when the patient is unable to respond verbal stimuli and answer question for greater than 30 minute after admission to recovery room.

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

Incomplete data: is defined when more than two observation is missed during the study period.

Hypotension: a decrease in systolic blood pressure by 20% or more from baseline after TPVB and ICB.

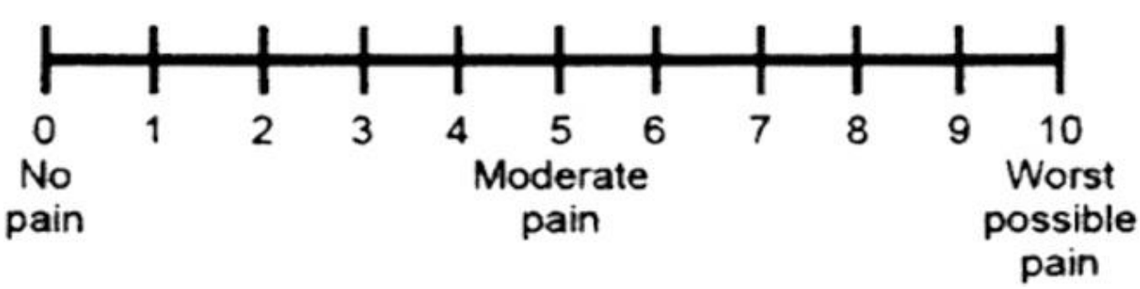

Figure 2: Adopted from the National Initiative on Pain Control™ (NIPC™) (36).

4.6 Exclusion and Inclusion criteria:

4.6.1 Exclusive criteria:

Age less than 18, pregnant mother, patient who took preemptive analgesia ,open cholecystectomy under epidural anesthesia, patient remain intubated and admitted to ICU, delayed recovery, sedated patient during postoperative period, wound site infiltration patients under chronic treatment with opioids, induction with ketamine, TPVB and ICB given before induction ,failed block, patients with contraindication to regional anesthesia, obese patient (BMI; >30 kg/m^2), Psychiatry patient was excluded from the study.

4.6.2 Inclusion criteria:

ASA physical status I and II patients who fulfil eligibility criteria and undergone elective open cholecystectomy under general anaesthesia were included in the study.

4.7 Sample size and sampling technique

The primary endpoint of our study were to compare pain severity by numeric rating scale (NRS) score between groups at rest and coughing/movement for 24 hours, time to first analgesic request and total analgesic consumption after the surgery. Sample size estimation based on largest sample size were used and calculated by using a priori power analysis (G Power version 3.01) based on the results of a similar study performed by Fentie et al (34) and B. Pourseidi et al (10) by taking 24 h pain scores (means pain score of 3.35, 4.16 and 3.5) and the common pooled standard deviation would be 0.8. Since both study use different way of data summarization one is mean and the others is by median so that 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 was 78.

From five governmental hospitals in Addis Ababa that are site for MSc Anesthesia program, two hospitals were selected by simple random sampling. While proportional sampling design was implemented in selected two governmental hospitals in Addis Ababa, Ethiopia in order to asses' analgesic effectiveness of TPVB and ICB for open cholecystectomy under general anesthesia. After allocating cholecystectomy from the 2-selected government hospitals by proportional allocation to size (PAS) the study unit were determined from 120 patients estimated to undergo cholecystectomy in both hospital during study period, 78 participants were recruited with the probability of about 65%. By considering the consecutive patients scheduled for cholecystectomy data collection were made on 2 patients for every 3 patients who underwent open cholecystectomy. One number selected by lottery method used for exclusion and selection made on the rest of numbers in both groups until the required sample size is reached.

4.71 Sampling procedure

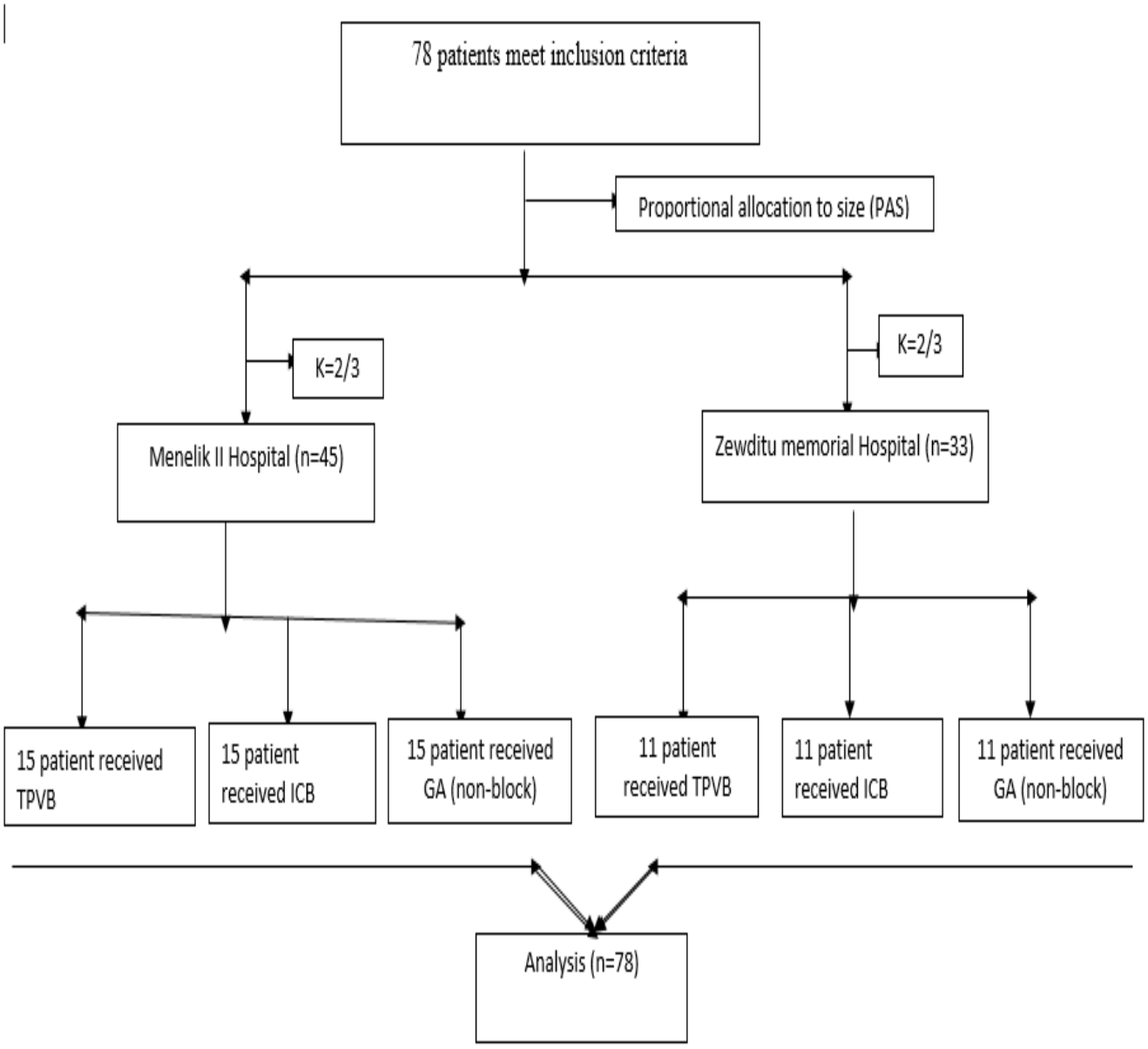

Figure 1 proportional allocation and enrollment chart for patients scheduled for cholecystectomy

4.8 Data collection technique and patients

After providing training for data collectors, data was collected using pretested questionnaires with multiple close-ended questions on respondents. Patients scheduled for elective cholecystectomy who fulfill inclusion criteria and volunteer to take part in the study was thoroughly assessed before surgery by history taking, and chart review following informed consent. On the morning of the surgery data collector, instruct the patient on how to self-report pain using the eleven point NRS score 0 to 10. Sociodemographic and intraoperative variables was filled by anesthetist in charge and the remaining postoperative data was collected by the other data collector who is unaware of group allocation.

On arrival of the patients to the operative theater, and after application of the routine hospital monitoring protocol, HR, noninvasive blood pressure, and SPO2 has been recorded before induction of general anesthesia. All study patients received standard pre- and intraoperative monitoring. General anesthesia was induced with tramadol (100mg), diclofenac (75mg), thiopental (3–5 mg/kg) or Propofol (2-2.5mg/kg) and tracheal intubation was facilitated with suxamethonium (2 mg/kg). All patients were artificially ventilated, and the inhalation anesthetic agent achieved maintenance of anesthesia. During intraoperative period HR, NIBP (SBP and DBP), SPO2, RR, and intraoperative analgesic consumption was recorded after induction and at the end of surgery.

In both study hospital MSc anesthesia trainee have periodic rotation and they are well exposed for regional anesthesia for postoperative pain management as a part of multimodal analgesia .At the end of surgery, most of MSc anesthesia trainee give regional anesthesia for postoperative pain management. In study hospital postoperative pain management for open cholecystectomy are done by either TPVB or ICB depending the decision of anesthetist in charge. TPVB is usually done with one-injection techniques and multiple injection techniques but we only include multiple injection technique in our study but ICB is performed with multiple injection technique under ribs.

Paravertebral nerve block technique: at the T7-T9 level, paravertebral block has been performed by MSc anesthesia trainee in charge with the patient in the left-side lateral position a point 2.5cm lateral to the midline is marked. Following aseptic preparation of the skin, with 22-gauge needle introduced 2.5cm lateral from the top of the desired vertebral body in search of the

transverse process. After the transverse process is contacted, at a 15° to 60° angle, the needle is then walk off the transverse process and advancing 1cm, thereafter, 15ml of 0.25% bupivacaine has been injected at desired point.

Intercostal nerve block (INB) technique: After cleaning the skin with an antiseptic solution, the fingers of the palpating hand should straddle the insertion site at the inferior border of the rib and fix the skin to avoid unwanted skin movement. A 22-gauge needle is attached to a syringe containing local anesthetic is advanced at an angle of approximately 20° cephalad to the skin with the patients in the lateral decubitus position. After contact with the rib while maintaining the same angle of insertion, the needle walked off the inferior border of the rib as the skin allowed to return to its initial position. Then the needle advanced 3 mm below the inferior margin of the rib, with the goal of placing the tip in the space containing the neurovascular. Following negative aspiration for blood or air, 3 mL of local anesthetic per intercostal nerve given unilateral INB using 0.25% bupivacaine 6 to 8cm away from midline at the level of T7-T11 and the needle withdrawn. The process is repeated for the remaining levels of blockade.

Conventional general anesthesia: After monitoring is applied and baseline vital sign has been recorded, anesthesia is induced with injection of hypnotic agent and analgesia intravenously. Tracheal intubation has been facilitated with muscle relaxant and anesthesia is maintained with volatile anesthetic agent (VAA). VAA is discontinued after surgical closure and non-depolarizing muscle relaxant reversed by using neostigmine and atropine and patient is extubated after fully reversed from muscle relaxant and admitted to recovery room for follow up.

On arrival to the recovery room and after the patient respond to verbal stimuli and able to answer question, Sensory block was assessed and tested by pinprick sensation at the upper abdomen bilaterally after 20 minute following administration of the block. Failed block was declared if there is no sensory block on surgical side after 20 minute. Postoperative pain was assessed in all groups using a NRS for pain assessment.

The scale consists of horizontal lines ranging from 0 (no pain) to 10 (worst imaginable pain). Asked to report their pain based on 11 point NRS score as soon as patient fully respond to verbal command. The pain intensity was rated as mild (NRS: 0–3), moderate (NRS: 4–6), and severe (NRS: 7–10). The NRS score were recorded at recovery after the patient is fully awake from anesthesia (0hrs) and then every two hours for the first six hours and every six hours for the

remaining postoperative period until 24hr. 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 request was recorded from patient chart after admission to recovery and total analgesic consumption of each patient was recorded. At the times of pain evaluation, the heart rate, the mean arterial blood pressure, respiratory rate, and SPO2 were be recorded. Any postoperative adverse events such as nausea, vomiting, shivering, hypotension, bradycardia, and respiratory complications were recorded and informed for treatment.

4.10 Data quality control

To assure the reliability and validity of the data, questionnaires were pretested on 5% of the sample size before actual data collection. Training and orientation about the objectives and relevance of the study, each items included in the study tools and the whole process of data collection were provided for data collectors and supervisors. Informed consent was obtained from the patients. During data collection, regular supervision and follow up were undertaken. A supervisor was check each questionnaire daily with further cross check by principal investigator for completeness and consistency of data. Incomplete data were not enter on database prepared on Epi-info. Data clean up and crosschecking of missing data was done before analysis on SPSS.

4.11 Data analysis and interpretation

Data were entered into Epi-info 7 and exported to SPSS V 22 for analysis. The data were tested for normality using histogram and Shapiro–Wilk normality test (age, weight and BMI; p value >0.05) and homogeneity of variance by Levene's test for normally distributed (age, weight and BMI; p value >0.05) and ANOVA for mean difference of ranked data for non-normally distributed variable (NRS score ,analgesic consumption, height, analgesia during induction ,estimated intraoperative blood loss duration of surgery ,duration of anaesthesia and estimated intraoperative fluid balance and intraoperative analgesia ; p value >0.05). 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. Data were presented as mean ±SD for normally distributed, median ± IQR for no

normally distributed and categorical data were presented as numbers and frequencies (percentages). P-values <0.05 will be considered statistically significant.

4.12 Ethical consideration

Ethical clearance was obtained from the department ethical clearance committee before the start of the study. Official support letter was written to Hospitals and Addis Ababa Heath Bureau and permission for data collection were sought from the responsible authorities. The purposes and the importance of the study were explained and verbal as well as written informed consent was obtained from each participant. Confidentiality was maintained at all levels of the study by avoiding identifiers and using codes to identify patients. The participant's involvement in the study were on a voluntary basis, participants who are not willing to participate in the study and those who wish to quit their participation at any stage were informed and allowed to do so without any restrictions.

4.13 Dissemination plan

The research will be presented for the entire department of anesthesia staff. It will also be presented at the annual research conference. The research will be submitted to journals for publication.

Chapter Five: Results

5.1 Demographic and perioperative Characteristics

During the study period, a total of 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 of block during postoperative period as unexposed group.

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

Table 1: Socio demographic characteristics of patients who underwent open cholecystectomy in Addis Ababa Hospitals, Ethiopia, 2017/18, 2017/18

	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
Male	0(0%)	3(3.8%)	2(2.6%)	
Female	26(33.3%)	23(29.5)	24(30.8%)	
Weight(kg)*	65.6±1.1	67.5±1.14	69.8±1.12	0.18
Height(cm)**	165(10)	166(10)	165(7)	0.33
BMI(kg/m$^{2)}$*	24.6±1.8	24.6±2.7	25.9±2.6	0.08
ASA status				0.20
ASA I (n, %)	24(30.8%)	19(24)	22(28.2%)	
ASA II (n, %)	2(2.5%)	7(9%)	4(5%)	
Previous surgery				0.80
Yes	5(6.4%)	3(3.8%)	5(6.4%)	
No	21(26.9%)	23(29.5%)	21(26.9%)	

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

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

Table 2: Perioperative characteristics of patients who underwent open cholecystectomy in Addis Ababa Hospitals, Ethiopia, 2017/182017/18

	TPVB n=26	ICB n=26	Non-block n=26	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(0)	100(0)	100(0)	1.00
Diclofenac IM	75(0)	75(0)	75(0)	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(23)	55(30)	70(33)	0.18
Duration of surgery (minutes)	50(20)	59(13)	55(20)	0.42
Duration of anesthesia (minutes)	50(20)	60(11)	62.5(20)	0.59
Estimated intraoperative fluid balance(ml)	1000(200)	1000(200)	1000(200)	0.48
Intraoperative analgesia(mg)	75(0)	62.5(25)	75(0)	0.53

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

5.12 Comparison of Postoperative Numeric Pain Rating scale at Rest and Movement/coughing

A kruskal Wallis test revealed a significant reductions in NRS score at Rest (H=24.65(2, N=78), p<0.001, η2=0.47) in the TPVB and ICB groups with the presence of non-block group. The proportion of variability in ranked NRS score at rest accounted by the TPVB and ICB was 0.47, indicating a fairly 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 between ICB and non-block with adjusted p value <0.01 at rest.

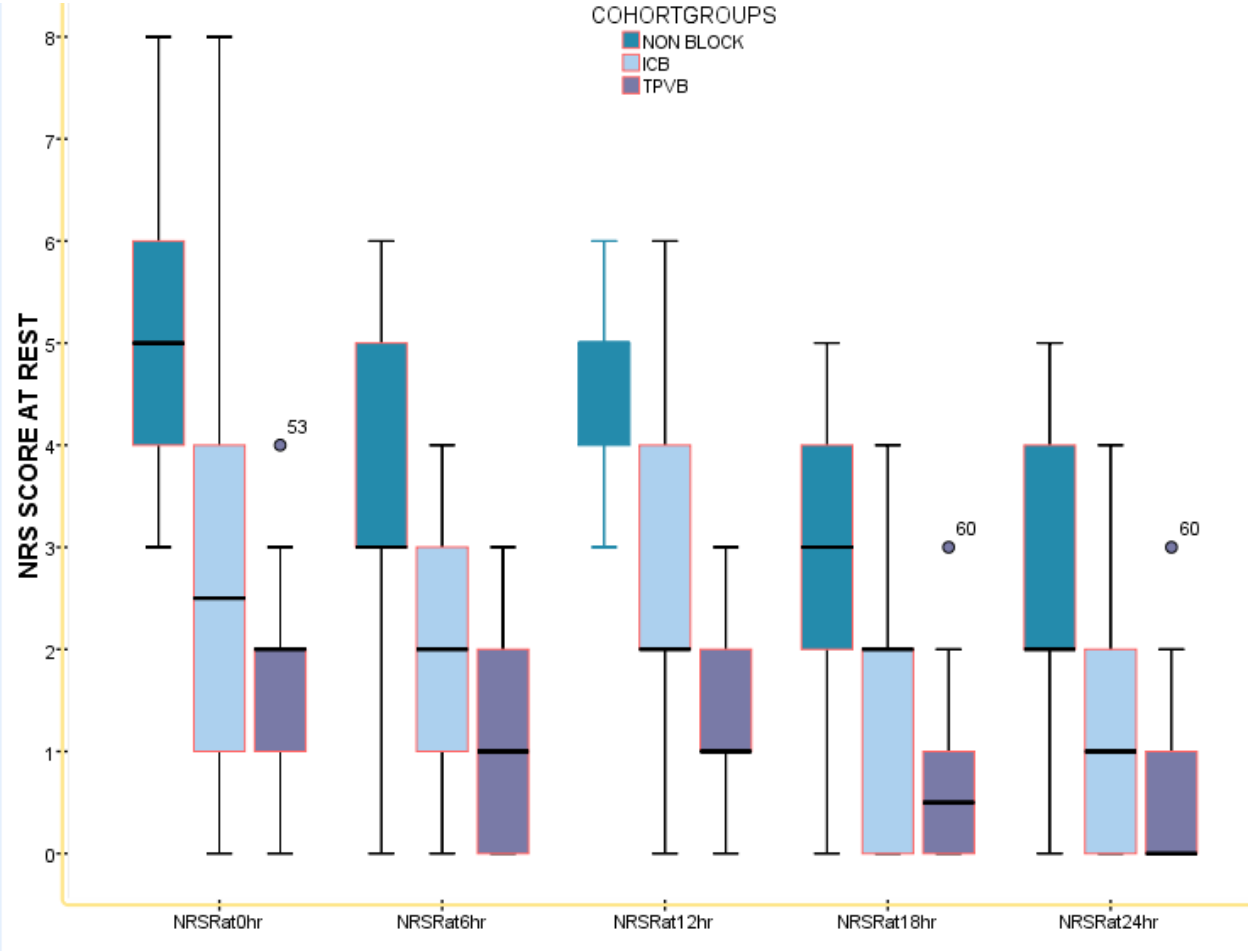

Figure 2: Comparison of postoperative pain using 11 point NRS score (0-10) at rest

A kruskal Wallis test revealed a significant reductions in NRS score on coughing (H=28.31(2, N=78), p<0.001, η2=0.49) in the TPVB and ICB groups with the presence of non-block group. The proportion of variability in ranked NRS score coughing accounted for by the TPVB and ICB

was 0.49, indicating a fairly 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 on coughing with adjusted p value <0.001 and between ICB and non-block with adjusted p value <0.05 at 0h, 6h and 12h on coughing. However significant difference between TPVB and ICB was at 12h, 18h and 24h on coughing.

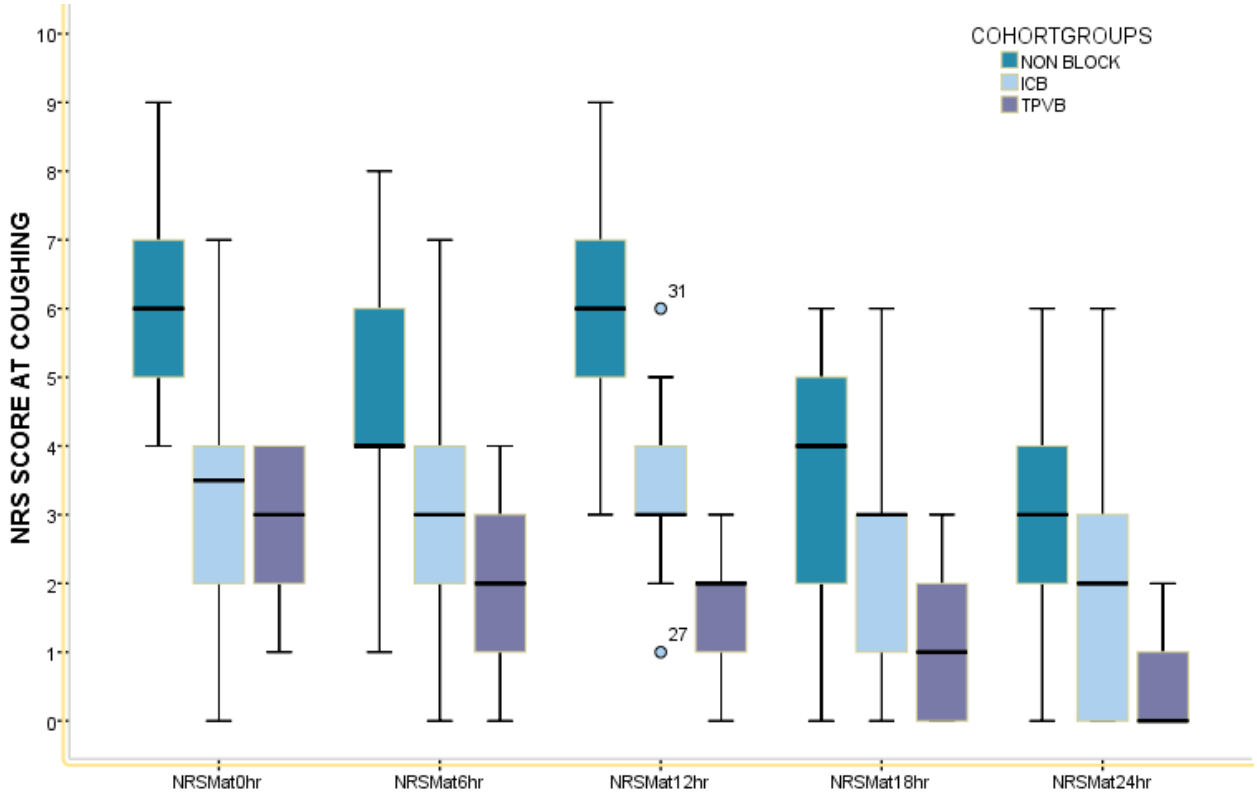

Figure 3: Comparison of postoperative pain using 11 point NRS score (0-10) on coughing

5.13 Comparison of time to first analgesia request and total analgesia consumption among groups

Kaplan-Meier curve for the first analgesic request with the patient not receiving any analgesics after 24 h censored to the right presented in figure 3. Significant difference between these curves (log –rank test) were obtained between TPVB group vs ICB group (p =0.005), TPVB group vs non-block group (p<0.001) and ICB vs non-block group (p<0.001). Particularly the patient in the TPVB Group, median time: 18 hour, 95% CI: [14.59- 21.40] had significantly longer time to first

analgesic request compared to ICB group median time: 6 hour 95% CI: [3.7 - 8.2] (p=0.005). On other hand most of the non-block group required analgesia in recovery room.

Cumulative proportion of patient not requesting analgesia at time of 6h after surgery in the non-block group was 4% compared to 50% and 85% in ICB and TPVB group respectively.

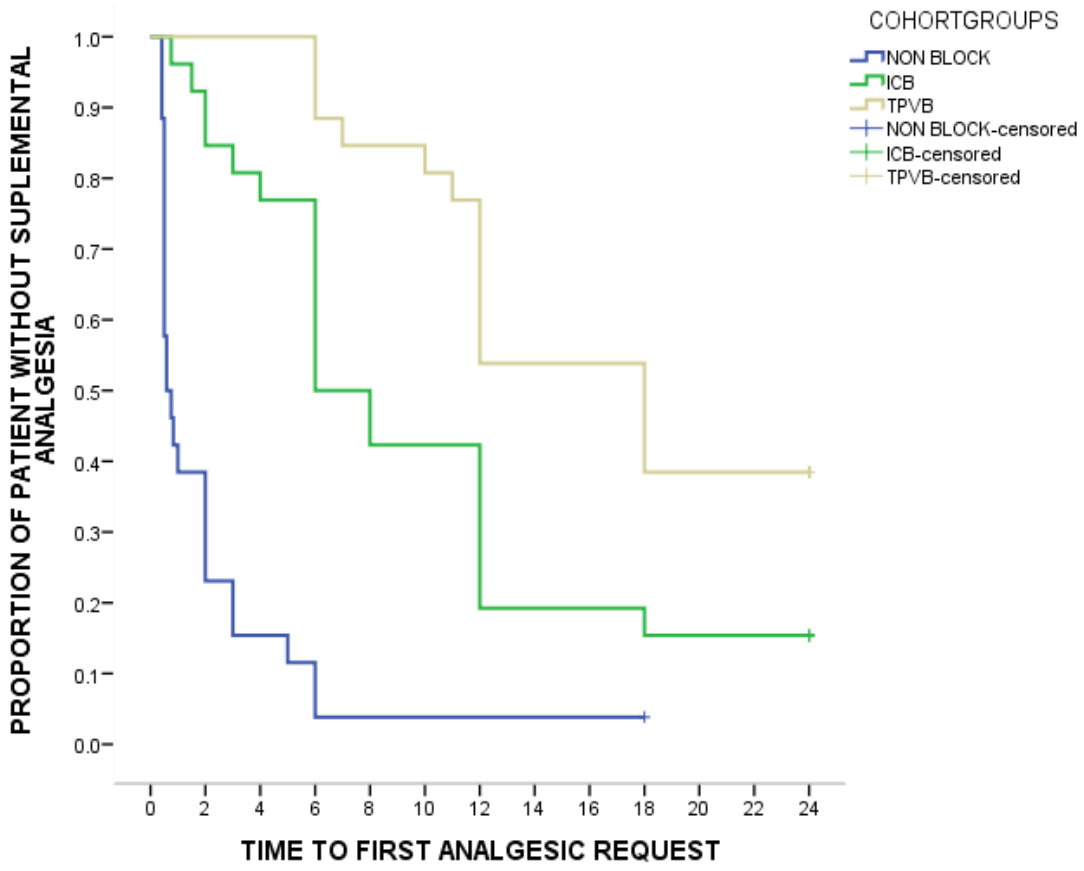

Figure 4 Kaplan Meier survival plot for time to first analgesic request after TPVB, ICB and non-block groups

A cox proportional hazards model for time to first analgesic request adjusted for covariate (study group, sex, age, BMI, and previous surgery) .In univariate analysis presence of all covariate have no significant association with time to first analgesic request except the exposure status (TPVB and ICB).In TPVB group 89% of patient don't request analgesia during the 24 hours compared to ICB groups where 77% of patient don't request analgesia during 24 hours. 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).

5.14 Comparison of cumulative analgesia consumption among 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, η2=0.36) and (H=8.09(2.N=78), p= 0.017, η2=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 compression showed there is no statistically significant difference in total analgesic consumption between TPVB and ICB group.

Table 3: Comparison Cumulative median tramadol and diclofenac consumption at each time point in Addis Ababa Hospitals, Ethiopia, 2017/182017/18

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

Value are presented as: =Median (IQR), kuruska-Walih H rank test

Cumulative tramadol consumption over different time interval between groups were different significantly. In a post hoc analysis, we compare cumulative tramadol and diclofenac consumption between TPVB vs ICB, TVB vs Non-block and ICB vs Non-block and there is significant difference in tramadol consumption between TPVB and ICB at 6h with adjusted p=0.042 and there is no statistically significant difference in cumulative diclofenac consumption between TPVB and ICB at all-time interval for 24h (table 3).

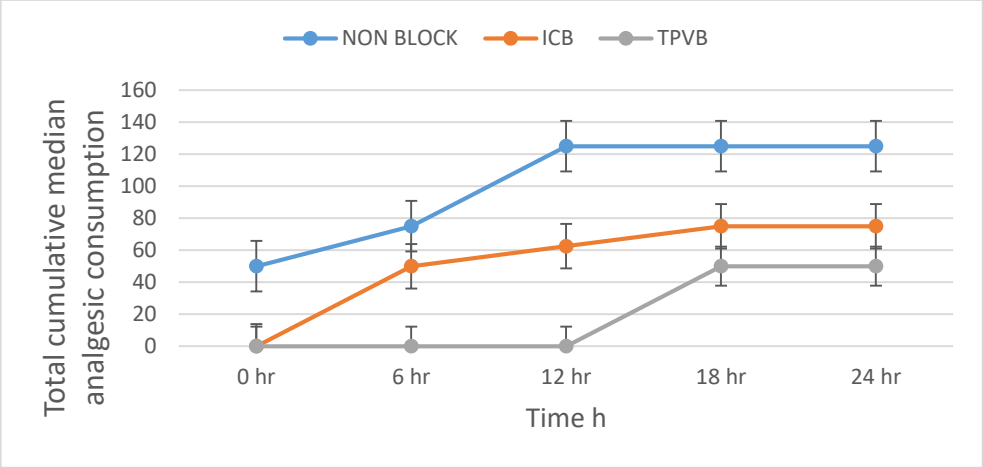

Figure 5 Cumulative tramadol and diclofenac dose after open cholecystectomy in patient receiving TPVB, ICB, and non-block groups.

5.15 Incidence of postoperative complication

The incidence of nausea and vomiting over 24 hours is 28.2%. The proportions of patients with nausea and vomiting is lower (6.3%) in TPVB and (7.7%) in ICB groups compared to non-block group which is 16.7% with an X^2 (2, N=78) =10.003, P=0.007, φ_c = 0.358. The incidence of hypotension and desaturation did not differ between groups.

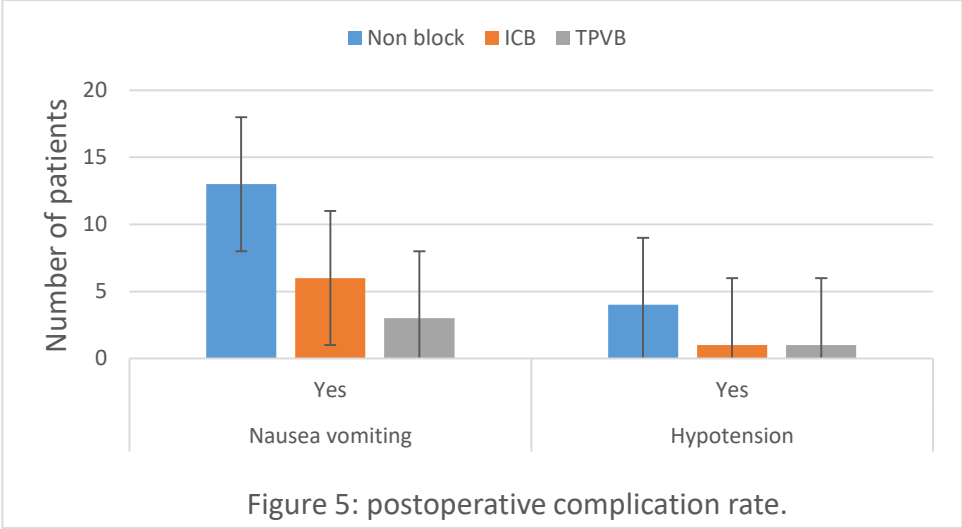

Figure 5: postoperative complication rate.

Figure 6: Incidence of postoperative nausea vomiting and hypotension

Chapter Six: Discussion

Several methods can be used for pain relief after open cholecystectomy. The systemic use of narcotics or anti-inflammatory drugs administered either alone or in combination do not often result in satisfactory pain relief(7) . Regional analgesia for pain management has been reported extensively for pain control after thoracotomy, breast surgery and abdominal procedure. However, regional analgesia in open cholecystectomy has not received similar interest in the literature(33).

Although most application of TPVB and ICB has focused on breast surgery and thoracic surgery, its potentially useful technique in abdominal surgery as well. The abdominal wall is innervated by lower thoracoabdominal nerve (T6—T12), anesthesia and analgesia can be provided by TPVB and ICB performed at theses level.

Postoperative pain can be problematic, specifically after upper abdominal surgeries hence it can lead to complications such as atelectasis, pneumonia, and also prolonged hospital stay, and thus it increases cost.

Various confounding factors such as Sociodemographic and perioperative variable may contribute to postoperative pain severity and, if these factors were not correctly taken into account, may result in variation in the severity of pain.

In our study, these confounding factors such as age, gender, duration of anesthesia and surgery and intraoperative analgesia were all comparable between the groups and patients with wound site infiltration, induction with ketamine and BMI >30kg/m^2 had been excluded from the study; thus, the difference in pain severity, time to first analgesic request and analgesic consumption between groups was likely due to TPVB and ICB in exposure groups.

In our study, TPVB and ICB significantly decrease postoperative pain, reduced total analgesic consumption, and prolonged the median time to first analgesic request in postoperative period after open cholecystectomy.

We found that paravertebral and intercostal nerve block provide similar level of pain at rest except at 12 h where there is significant difference between groups. However, pain score on coughing were lower in paravertebral block group with the difference being significant on 12h, 18h, and 24h this can explained by the fact that intercostal block is superficial block that can control pain from surgical site, while TPVB successfully block the somatic and visceral pain. By the time, the somatic pain decrease in intensity while visceral pain continue for more time that is when TPVB become more beneficial to patient.

The median(interquartile range) NRS score of TPVB group during immediate postoperative period in our case was 2(1) which was comparable to study in Egypt 1.4±0.5 and 1.9±0.5 VAS in 3 h and 6h respectively(29) . 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 and renal surgery(37, 38). A study by Ilyas M et al in Pakistan on 2012, which compare intercostal nerve block with local wound infiltration, showed lower VAS score at rest in intercostal group that was similar with our study(25).

This study demonstrate that ICB decreases pain intensity for first 6h and analgesic consumption for up to 24h during postoperative period which was in line with previous study that have examined the analgesic effects of conventional ICB in patient undergoing open cholecystectomy, percutaneous nepherolithotomy ,breast surgery and Nuss procedure(21, 39, 40).

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 hour, 95% CI: [14.59- 21.40] versus ICB group, median time: 6 hour 95% CI: [3.7 - 8.2] (p=0.005). Similarly study done by Goda et al with mean time to first analgesic request after paravertebral block for upper abdominal surgery was 18.83±4.75 hour(32) . This finding was also supported by other studies(35, 41) .

However a study conducted in Ethiopia with time to first analgesic request 120 minutes, this could be due to different in technique of paravertebral block, study design and hospital pain management protocol(34). Multiple-injection TPVB resulted in pain reduction after cholecystectomy via subcostal incision that could attribute to blockade of somatic and sympathetic pain fibers originating from T5-L1.

In our study, the median time to first analgesic request after ICB for cholecystectomy was 6 hour 95% CI: [3.7 - 8.2] (p=0.005) in contrary to Angral R.et al the time to first analgesic request is (9.45±4.44hr) this might be due to concentration difference and surgical procedure in which laparoscopic surgery were used whereas open cholecystectomy were used in present study. Similarly study by P.hugh et al time to first analgesic request was 225 minutes. This difference in duration may be explained by difference in technique of intercostal block in which single interspace intercostal block were used whereas multiple injection intercostal was used in present study(26).

Moreover, this study revealed that the total amount of analgesic consumption over the postoperative 24 hours was lower with the median tramadol 0(50) mg and 0(75) mg diclofenac in the TPVB group and median tramadol 50(50) mg and diclofenac 75(75) mg in ICB group which 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 present study(34).

Lekhak *et al.* (42)demonstrated that ICB is generally safe and simple to perform and may represent an advantage over the use of TPVBs, which are inserted much more medially than the intercostal blocks used, and may result in subarachnoid injection. Although the value of a single ICB has been questioned, the study conducted by Perttunen *et al. (43)* found that analgesia after a single ICB with bupivacaine could last up to 20 h, but required intravenous morphine as a supplement.

As regard to postoperative nausea and vomiting the present study conclude that TPVB and ICB decrease PONV. In agreement with study by Ruqaya M. Elsayed et al (32)that concluded paravertebral decreases postoperative nausea and vomiting.

Limitation

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 anesthetist and surgeon. Lack of standard pain management protocol in the study hospital was especially during postoperative period was among limitation we encountered during data collection. In addition, one of the potential study design drawbacks is the shorter duration of postoperative follow up.

Strength

We have tried to make comparable study groups in terms of socio demographic distribution, perioperative factors that affect study outcome and the same surgical procedure so that the difference observed may be due to exposure factors.

Conclusion

We conclude that thoracic paravertebral block and intercostal block are effective analgesic technique for open cholecystectomy surgery with both techniques, reduced postoperative pain, total analgesic dose requirements. Thoracic paravertebral block were effective analgesic on coughing and longer postoperative analgesia than intercostal block. We therefore conclude that two technique are a valuable alternative to each other for open cholecystectomy.

Recommendation

- We recommend the use of TPVB and ICB with experienced hand at the end of surgery for patient undergoing open cholecystectomy under general anesthesia for postoperative pain management as part of multimodal analgesia.
- Anesthetist:

  We also recommend anesthetist to integrate TPVB and ICB as protocol for postoperative pain management in open cholecystectomy.

- Researcher:

  Further study with adequate sample size, randomized control trial with adequate follow up period and postoperative complication study.

Reference

1. Ersuno T1 . Gallstone disease in a teaching hospital, Addis Ababa: a 5-year review. Ethiop Med J. 2006 44(1):49-59.

2. Khan MN, Ashraf MN, Khan HD. Spinal Anesthesia versus General Anesthesia for Open Cholecystectomy: Comparison of Postoperative Course. Ann Pak Inst Med Sci 2013;9(2):95-8.

3. Winfried Meissner FC, Dominique Fletcher, Frank Huygen,, Bart Morlion EN, Antonio Montes Pérez & Joseph, Pergolizzi. Improving the management of post-operative acute pain: priorities for change Current Medical Research and Opinion, 2015;31(11):2131-43.

4. Aliya Ahmed NL, and Robyna Khan. Post-operative analgesia for major abdominal surgery and its effectiveness in a tertiary care hospital. J Anaesthesiol Clin Pharmacol. 2013 Oct-Dec;29(4):472-7.

5. Seyed Jalal Hashemi SMH, Seyed Taghi Hashemi. Paravertebral block using bupivacaine with/without fentanyl on postoperative pain after laparoscopic cholecystectomy: A double-blind, randomized, control trial Adv Biomed Res 2014;3:187.

6. Linda Le-Wendling JD, Ihnatsenka AHaB. Analgesia for the Trunk: A Comparison of Epidural, Thoracic Paravertebral and Transversus Abdominis Plane Blocks.open science; 2014

7. Kehlet H RG, Callesen T. Postoperative opioid analgesia: time for a reconsideration? . J Clin Anesth. 1996;8:441-5.

8. Anil Agarwal, Ravinder K. Batra, Anjolie Chhabra, Rajeshwari Subramaniam, Misra1 MC. The evaluation of efficacy and safety of paravertebral block for perioperative analgesia in patients undergoing laparoscopic cholecystectomy. Saudi Journal of Anaesthesia. 2012;Vol. 6,(Issue 4,).

9. Hadzic. A. Regional Anesthesia and Acute Pain Management New York: The McGraw-Hili Companies; 2007.

10. B. Pourseidi AK-M. Effect of intercostals neural blockade with Marcaine (bupivacaine) on postoperative pain after laparoscopic cholecystectomy. Surg Endosc (2007;21:1557-9.

11. Raymond Sinatra M, PhD. Causes and Consequences of Inadequate Management of Acute Pain. Pain Medicine 2010;11:1859–71.

12. Ahmed Eldaba ML. Different local anesthetic technique for postoperative analgesia in open cholecystectomy .Ain-Shams Journal of Anesthesiology 2015; 08:252-8.

13. Gautam DPKDDAPDS. Evaluation of Continuous Thoracic Paravertebral Block for Post-Operative Pain Relief in Patients Undergoing Open Cholecystectomy. Indian journal of applied research. July 2016 Volume : 6 (Issue : 7).

14. Veerabhadram Garimella M, MRCS1 Christina Cellini, MD1. Postoperative Pain Control. Clin Colon Rectal Surg 2013;26:191-6.

15. Nathalie Dieudonne M, Alexandra Gomola, MD, Philippe Bonnichon, MD, and, Yves M. Ozier M. Prevention of Postoperative Pain After Thyroid Surgery: A Double-Blind Randomized Study of Bilateral Superficial Cervical Plexus Blocks.Anesth Analg. 2001;92:1538 -42.

16. Hans J. Gerbershagen MD, Ph.D., Sanjay Aduckathil, M.D, Albert J. M. van Wijck, M.D., Ph.D. Linda M. Peelen PD, § Cor J. Kalkman, M.D., Ph.D. Winfried Meissner, M.D., Ph.D. Pain Intensity on the First Day after Surgery. Inc Lippincott Williams & Wilkins Anesthesiology. 2013;118(4): 934-44.

17. Nalini Vadivelu MSM, MDb; and Deepak Narayan, MDc. Recent Advances in Postoperative Pain Management .Yale journal of biology and medicine (2010); 83:pp.11-25.

18. Michael Sommer M, Janneke M. de Rijke, PhD, Maarten van Kleef, MD, PhD, Alfons G. H. Kessels M, MSc,w Madelon L. Peters, PhD,z Jose´ W. Geurts, MSc, Jacob Patijn M, Hans-Fritz Gramke, MD, and Marco A. E. Marcus, MD, PhD. Predictors of Acute Postoperative Pain After Elective Surgery .Clin J Pain February 2010; Volume 26(Number 2).

19. Prashant Kumar Singh PS, and Mangala Lahakar. Prevalence of acute post-operative pain in patients in adult age-group undergoing inpatient abdominal surgery and correlation of intensity of pain and satisfaction with analgesic management: A cross-sectional single institutebased study .Indian J Anaesth 2016 Oct;60(10):737-43.

20. Serbülent Gökhan Beyaz HÖ, 1 Tolga Ergönenç,1 and Ali Fuat Erdem1. The thoracic paravertebral block performed for open cholecystectomy operation in order to anesthesia:Two cases.

21. Vizcarra-Roma´n MA B-AJ, Cruz-Jarquı´n A, et al. . Effectiveness of intercostal nerve block with ropivacaine in analgesia of patients undergoing emergency open cholecystectomy under general anesthesia. Rev Gastroenterol Mex. 2012;77:9-14.

22. Maidatsi P1 GN, Zaralidou A, Ourailoglou V, Giala M. Intercostal nerve blockade with a mixture of bupivacaine and phenol enhance the efficacy of intravenous patient-controlled analgesia in the control of post-cholecystectomy pain. Eur J Anaesthesiol. 1998 Sep;15(5):529-34.

23. Ross WB1 TJ, Leong YP, Wyman A, Smithers BM. Intercostal blockade and pulmonary function after cholecystectomy. Surgery. 1989 Feb;105((2 Pt 1)):166-9.

24. Blake DW1 DG, Novella J. Interpleural administration of bupivacaine after cholecystectomy: a comparison with intercostal nerve block. Anaesth Intensive Care. 1989 Aug;; 17((3)):269-74.

25. Muhammad ilyas miwsf, babar hussain khan, waseem ismat. Intercostal nerve blockade versus local anaesthetic wound infiltration for postcholecystectomy analgesia 2012;6.

26. Rajesh Angral DSL, Dr Satyedev Gupta. Post-operative analgesic technique in laparoscopic cholecystectomy: Comparison of local instillation with bupivacaine vs intravenous butorphanol vs intercostal nerve block with bupivacaine .Indian Journal of Anaesthesia. 2012;3:8-15.

27. Bigler D1 DW, Hansen R, Rosenberg J, Kehlet H. Effects of thoracic paravertebral block with bupivacaine versus combined thoracic epidural blockwith bupivacaine and morphine on pain and pulmonary function after cholecystectomy.. Acta Anaesthesiol Scand 1989 Oct;33(7):561-4.

28. Anil Angarwal,Ravinder kumar ,and Krithika kirshnan. Paravertebral Block. J Anaesthesiol Clin Pharmacol. 2011 Jan-Mar;27(1):5-11.

29. G.Kamhawy et al. Comparison of TAP versus TPVB for postoperative analgesia after open cholecystectomy. Egyptian journal of anesthesia. 2017;33 323-9.

30. Mihaela Visoiu M, Antonio Cassara, MD, and Charles Inshik Yang, MD. Bilateral Paravertebral Blockade (T7-10) Versus Incisional Local Anesthetic Administration for Pediatric Laparoscopic Cholecystectomy: A Prospective, Randomized Clinical Study .Anesth Analg. 2015;120:1106-13.

31. Naja ZM1 E-RM, Ziade F, Al-Tannir M, Itani T. Preoperative vs. postoperative bilateral paravertebral blocks for laparoscopic cholecystectomy: a prospective randomized clinical trial. Pain Pract. 2011 Nov-Dec;11(6):509-15.

32. Ruqaya M. Elsayed Taeke. Comparative study between ultrasound guided tap block and paravertebral block in upper abdominal surgeries. Randomized controlled trial. Egyptian Journal of Anaesthesia 2017;33:83-9.

33. Awwad ZM AB. Pain relief using continuous bupivacaine infusion in the paravertebral space after loin incision. Saudi Med J. 2004;25:1369- 73.

34. Fentie et al. Efficacy of single-injection unilateral thoracic paravertebral block for post open cholecystectomy pain relief: a prospective randomized study at Gondar University Hospital. Local and Regional Anesthesia 2017;10 67-74.

35. Akcaboy Eyaz, Gogus N. Comparison of paravertebral block versus fast-track general anesthesia via laryngeal mask airway in outpatient inguinal herniorrhaphy. J Anesth. 2010;24:687-93.

36. McCaffery, M., Beebe, A., et al. (1989). Pain: Clinical manual for nursing practice, Mosby St. Louis, MO.

37. Mausa L. AE. Different local anesthetic technique for postoperative analgesia in open cholecystectomy. Ain-Shams Journal of Anesthesiology 2015;08:252-8.

38. Hazem El Sayed Moawada, Diaa-Eldin Taha. Paravertebral block against intercostal nerve block for postoperative pain relief in open renal surgery: a randomized controlled trial . Ain-Shams Journal of Anesthesiology. 2015;08:413-9.

39. Lukosiene L MA, Trepenaitis D, et al. Single shot intercostal block for pain management in pediatric patients undergoing the Nuss procedure: a double-blind, randomized, controlled study. J Pediatr Surg. 2014;49:1753-7.

40. Lukosiene L RD, Macas A, et al. Postoperative pain management in pediatric patients undergoing minimally invasive repair of pectus excavatum: the role of intercostal block. J Pediatr Surg. 2013;48:2425-30.

41. Hadzic A KB, Loreio D, et al. Paravertebral Blocks Provide Superior Same-Day Recovery over General Anesthesia for Patients Undergoing Inguinal Hernia Repair. Anesth Analg. 2006;102:1076-81.

42. Lekhak B Bec, Conacher ID, Nouraei SM. Total spinal anaesthesia in association with insertion of a paravertebral catheter. Br J Anaesth. 2001;86:280 -2.

43. Perttunen K Noe, Heinonen J, Hirvisaloel, Saloja, Kalso E. Extradural, paravertebral and intercostal nerve blocks for postthoracotomy pain. . Br J Anaesth 1995;75:541 -7.

Annex one: Information sheet to get permission for the research

Introduction

This information sheet is prepared to explain the research project that you are asked to join by a group research investigators.

The research team includes MSc students, two senior advisor from AAU and four data collector from menelik II and Empress Zewditu Memorial Hospital.

Name of Principal investigator: - Bedru jemal

Advisor's name: - Ms.:- misrak W/yohanes

Ms.:- Siyret Tesfaye

Name of sponsor: - AAU

Name of organization: - AAU, Health science college, anesthesia department

This information sheet is prepared by the above-mentioned investigator.

Risk

There is no any risk or harm that you will face by participating in this research. Any personal information recorded will not be copied and transferred to other bodies. No need of writing participants' name but by a code. Every piece of information will be kept confidentially.

Benefits

There is no incentive or payment to be gained by taking part in this project. The information collected from this research project will be kept confidential and only accessed by the researcher and research assistant only. This research project will be reviewed and approved by ethical committee of the department. If you want to know more information, you can contact the committee through the address below.

Tel: - +251924415702

E-mail-bedruanst@gmail.com

Annex two: Consent form

Dear participant:

This is a research designed to compare effectiveness of thoracic paravertebral block and intercostal nerve block with bupivacaine in patients undergoing open cholecystectomy under general anesthesia as part of postoperative analgesia .As a chance you were included in the study. So, we kindly request your involvement in the study and honest response to achieve the objective of the study. Your response completely confidential and you have full right either to refuse a single question or leave the study. However, your honest response to those question will help us to asses and understand the effect. So, we are requesting you to give honest response and keep participation.

Would you willing to participate in the study please? YES/NO

Thanks for taking part in the study!!!!

For further question ask investigator

Tel: - +251924415702
E-mail-bedruanst@gmail.com

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Annex three: patient data

Section I: Socio Demographic Data (chart review)

Card number:		**Bed no:**	**Code**
S.no	**Question**	**Response**	
101	Age		
103	ASA (I/II)	A. ASA I B. ASA II	
104	Sex (M/F)	A. Male B. Female	
105	weight		
106	height		
107	BMI	18.5–24.9 25–29.9 30–34.9 >35	

Section II: Data during preoperative period

Ser. number	Question	Response		
201	Base line Heart rate	____bpm		
202	Base line Blood pressure(MAP)	____/____(____)mmhg		
203	Base line RR & spo2	_____bpm &_____%		
204	Diagnosis	Acute Cholecystitis Chronic Cholecystitis Cholilithiasis		
205	Intraoperative diagnosis	_____		

		–		
206	Does the patient have concomitant gallbladder cancer?	1. YES 2. NO		
207	Does the patient have concurrent common bile duct stone	1. YES 2. NO		
209	Is the patient Pregnant?	1. YES 2.NO		
210	Does the patient has bleeding disorder or coagulations profile revealed abnormal?	1. YES 2. NO		
211	Does the patient is anxious during preoperative period	1. YES 2. NO		
212	Does the patient take anxiolytic agent?	1. YES 2.NO		If no skip to No 214
213	Does the patient has history of previous surgery?	1. YES 2. NO		
214	Does the patient is in pain during preoperative period	1. YES 2. NO		If no skip to NO 216
215	If yes for the above question, how was the severity of pain?	1. Sever 2. Moderate 3. Mild		
216	Does the patient have any co-existing disease?	1.YES 2.NO If ,yes specify		If no skip to No 217

Section III: Question related to anesthetic and surgical interventions

S.no	Question	Response	Code	
301	Does the patient receive analgesia during induction?	1. Yes 2. No		If no skip to No 303
302	If YES specify type ,time and dose	_____(____mg) _____(____mg		
303	Does the patient receive any anti emetic agent before induction?	Yes 2. NO		If no skip to No 305
304	If yes specify type and dose	----------(----mg)		
305	Does Ketamine used as Induction agent?	1. YES 2. NO		
306	Type of skin incision	subcostal incision Midline incision		
307	hemodynamic parameter during intraoperative period			
	Before induction	BP PR SaO2		
	After induction of anesthesia	BP PR SaO2		
	At the end of surgery	BP PR SaO2		
308	Does the patient took intraoperative analgesic	Fentanyl Morphine Pethidine Tramadol Diclofenac		If no skip to No 310
	If the patient took one of the above. When?	After induction during intraoperative period At the end of surgery before transferred to recovery room		
309	If the patient took one of the above	_____,_____,_____mg		

	time and dose of the drug given			
310	Does the patient take anti emetic during intraoperative period?	1. YES 2. NO		If no skip to No 312
311	If yes specify type, time and dose of the drug given	----------,-------,--------mg		
312	Does the patient extubated in the OR?	YES NO		If no skip to No 315
313	If yes is a patient responsive	YES NO		
314	Experience of the surgeon	1. R3 2. R4 3. Senior		
315	Experience of anesthetist	1.Msc Y2 2. MSc Y1		
315	Estimated intraoperative blood loss			
316	Duration of surgery			
317	Duration of anesthesia			
318	Intraoperative fluid balance			
318	Type of post op pain management groups	TPVB INB Conventional general anesthesia		
319	Time from TPVB or INB to admission to recovery	……minutes		

Section IV: Hemodynamic parameters in post-operative period Immediately at Arrival of Recovery Room, 6th hr, 12th hr, 18th hr and 24thhr.

S.no	V/S		**Immediately At Arrival of Recovery Room (at 0 hour)**	**6th hr. post op**	**12th hr. post op**	**18th hr. post op**	**24th hour post op**
401	Time (local)						
403	BP(mmHg) **SBP/DBP(MAP)**						
404	PR (bpm)						
405	Respiratory rate						
406	SPO2 (%)						
407	NRS	Static					
		Dynamic					
408	Analgesia given Type and mg						
409	Other medication given in mg						

Complications during the post-operative period

s.no	Type of complication	Score /response	Remark
501	Hypotension	Yes No	
502	Nausea	None Mild Moderate Severe	A nausea score of >0 at any time post-op
503	Vomiting	Yes No	
504	Desaturation	1.>90% 2. <90%	
505	Others (specify)		

601. Duration in minutes till Initial analgesic requirement after the patient arrived in the recovery

A. Arrived at _____pm/am {time per 24hr/date/month/ETH .year}
B. Analgesic required time _____PM/AM {time per24hr/date/month/Eth. year}
C. Duration till first analgesic request _____

602. Total and type of analgesic consumption within 24 hours after the patient arrived in recovery/ward

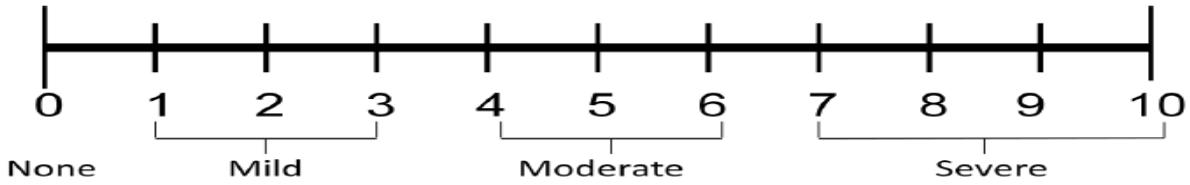
A. tramadol ----------mg
B. diclofenac ----------mg
C. morphine ----------mg
D. pethidine ……mg

603. is patient re-operated within 24 hours? A. YES B. NO

Appendix four: The numeric Rating scale (NRS)

English version

The numeric Rating scale (NRS)



The scale will be taken 5 times within the first24 hours. Patients will be asked to rate their pain will be assessed and recorded at 0 min (immediately on acceptance of patient at recovery room) and 0-6, 6-12, 12-18, 18-24 hours post-operatively.

The patient will be asked one of the following questions:

A. What number on a 0 to 10 scale would you give your pain right now?
B. When the explanation suggested above is not sufficient for the patient, further explanation or conceptualization of the scale will be done:

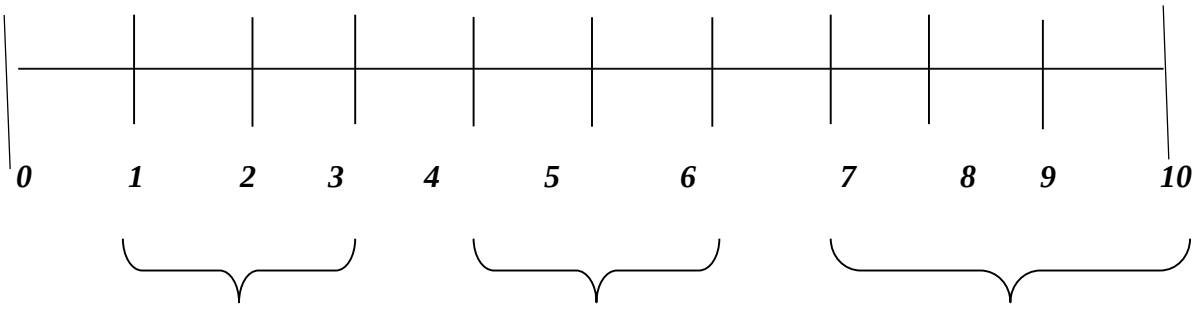
0 = No Pain

1-3 = Mild Pain (nagging, annoying, interfering little with ADLs)

4–6 = Moderate Pain (interferes significantly with ADLs)

7-10 Severe Pain (disabling; unable to perform ADLs)

The numeric Rating scale (NRS)



የለም መካከለኛ ከፍተኛ በጣም ከፍተኛ

መለኪያዉ በ 24 ሰአት ዉስጥ 5 ጊዜ የ ሚለካ ሲሆን ታካሚዎች የሚሰማቸዉ የህመም መጠን በየ 6 ሰአት ልዩነት እንዲያሳዩን እንጠይቃለን

ታካሚዎች የሚከተሉትን ጥያቄዎች ይጠየቃሉ፤-

ሀ . አሁን ከተገለጹት ቁጥሮች ማለትም (0-10) ባሉት ዉስጥ የእርስዎ የህመም መጠን ስንት ላይ ነው

ለ. ከላይ የተገለጸዉ በቂ ካልሆነ ተጨማሪ ማብራሪያ ይሰጡታል ፡

0 ህመም የለም

1-3 መካከለኛ ህመም (መነጫነጭ፣መርበሽ፣ወ.ዘ.ተ)

4-6 ከፍተኛ ህመም (ከ ህመሙ በተያያዘ ስራን በ አግባቡ አለመስራት)

7-10 በጣም ከፍተኛ ህመም (እለታዊ ትግባራትን ማከናወን አለመቻል)

Annex five: Data accuracy check sheet

S.No.	Tools	Yes	No
1	Are the Inclusion criteria /exclusion criteria done appropriately		
1	Are all questions on Sociodemographic data filed appropriately?		
2	Are all questions on preoperative period data filled appropriately?		
3	Are all questions on intraoperative period data filled appropriately?		
4	Are all questions on postoperative period data filled appropriately?		
	Did the postoperative analgesic drugs filled with appropriate type of drug, time and dose		
5	Did the SOP followed strictly		

Annex six: Standard operating procedure

Those patients who fulfill the standard of practice should be recruited to the study.

Step 1: open cholecystectomy under general anesthesia.

Cholecystectomy under general anesthesia without ketamine, analgesia without strong opioid, and maintenance with VAA and muscle relaxant.

Step 2

Patients' peripheral oxygen saturation, heart rate, blood pressure, electrical activity of the heart will be measured every 10 minutes using non-invasive techniques of pulse oximetry, non-invasive blood pressure cuff, & ECG respectively.

Step 3

Following closure of the skin using antiseptic solution skin will be prepared in the respective areas for either TPVB block or INB will be performed as follows.

Landmark to perform TPVB block

Spinal processes are the main landmarks for the thoracic paravertebral block. Processes are outlined from C7 (the most prominent vertebrate) to T7 (tip of scapulae). The tips of the spinous processes should be marked on the skin. Then a parasagittal line can be measured and drawn 2.5 cm lateral to the midline.

Technique – TPVB block

After cleaning the skin with an antiseptic solution in lateral position, the fingers of the palpating hand should straddle the paramedian line and fix the skin to avoid medial-lateral skin movement. The 22G needle is attached to a syringe containing local anesthetic is advanced perpendicularly to the skin at the level of the T7-T9 spinous process. After the transverse process is contacted, the needle is walk off superiorly or inferiorly .The ultimate goal is to insert the needle to a depth of 1 cm past the transverse process. 15ml of local anesthetic (0.25% bupivacaine) is injected to surgical side. To avoid intravascular injection aspiration of the syringe for blood will be performed every 5ml injection of the local anesthetic

Landmark to perform INB block

Landmarks for intercostal space are identified first by determining the midline and the spinous processes (skin marks). The 7th rib (lowest rib covered by the angle of the scapula) estimate T7 ,Once identified by palpation, the inferior border of the corresponding ribs can be marked on the skin Intercostal space is then determined by palpation at each level to be blocked, and the insertion point for needle is marked 6–8 cm lateral to the midline.

Technique – INB blocks

After cleaning the skin with an antiseptic solution while the patient is lateral position, the fingers of the palpating hand should straddle the insertion site at the inferior border of the rib and fix the skin to avoid unwanted skin movement. 22-gauge needle is attached to a syringe containing local anesthetic is advanced at an angle of approximately 20° cephalad to the skin Contact with the rib should be made while maintaining the same angle of insertion, the needle is walked off the inferior border of the rib as the skin is allowed to return to its initial position. Then the needle is advanced 3 mm below the inferior margin of the rib, with the goal of placing the tip in the space containing the neurovascular bundle, upon insertion of intercostal space 3ml of 0.25% bupivacaine is injected per intercostal space from T7-11 and total of 15ml 0.25% bupivacaine. To avoid intravascular injection aspiration of the syringe for blood will be performed.

Step 4

Post-operative

Post-operatively in recovery room, sensory block is assessed using pinprick technique after that, pain severity will be assessed using the NRS. During follow-up visits in the recovery room, patients' blood pressure, heart rates, and pain score values will be recorded. Patients' blood pressure, pulse rate, respiratory rate, & saturation will be recorded every time the NPS is assessed.

Appendix seven: American Society of Anesthesiologists (ASA) physical status classification of patients.

Class	Definition
1	Normal healthy patient
2	Patient with mild systemic disease (no functional limitations)
3	Patient with severe systemic disease (some functional limitations)
4	Patient with severe systemic disease that is a constant threat to life (functionality incapacitated)
5	Moribund patient who is not expected to survive without the operation
6	Brain-dead patient whose organs are being removed for donor purposes
E	If the procedure is an emergency, the physical status is followed by "E" (for example, "2E")

Adopted from Morgan and Mikhail 5th edition

Annex eight: Classification of Obesity based on BMI.

BMI(kg/m2)	Description
<18.5	Underweight
18.5–24.9	Normal
25–29.9	Overweight
30–34.9	Obesity (class I)
35–39.9	Obesity (class II)
≥40	Morbid obesity (class III)
≥50	Super obesity
≥60	Super -super obesity

Adopted from Paul G. Barash clinical anesthesia 7th edition.

Annex nine: declaration

I, the undersigned, declare that this thesis is my original work in partial fulfillment of the requirements for the Master of Science degree in Anaesthesia. I understand that plagiarism will not be tolerated and all directly quoted material has been appropriately referenced

Name: _____

Signature: _____

Submission to MSc Tutor, Dept. of Anesthesia, Addis Ababa University.

Date of Submission: _____

This thesis work has been submitted for examination with my/our approval as Advisors and Tutors on the Master of Science degree in Anaesthesia

Name Signature

1. _____ _____

2. _____ _____

3._____ _____