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Eman Sayed Ibrahim

Department of Anaesthesia and ICU, Liver Institute, Menoufia University -Shebeen Elkom (Egypt)., emansayed825@gmail.com

Zeinab Fathy Elsayed Abdelaty

Department of Anaesthesia and ICU, Liver Institute, Menoufia University -Shebeen Elkom (Egypt).

Mamdouh Elsayed Lotfy

Department of Anaesthesia and ICU, Faculty of medicine Menoufia University -Shebeen Elkom (Egypt)

Hanaa Saeed Abdelhafez

Department of Anaesthesia and ICU, Liver Institute, Menoufia University -Shebeen Elkom (Egypt)

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Wesam Eldin Abdelrahman Sultan

Department of Anaesthesia and ICU, Faculty of medicine Menoufia University -Shebeen Elkom (Egypt)

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ORIGINAL STUDY

Ultrasound Guided Quadratus Lumborum Block in Cirrhotic Patients Undergoing Major Abdominal Surgery (Randomized Control Trial)

Eman Sayed Ibrahim ^{a,*}, Zeinab F. Elsayed Abdelaty ^a, Mamdouh E. Lotfy ^b, Hanaa S. Abdelhafez ^a, Wesam E.A. Sultan ^b

^a Department of Anaesthesia and ICU, Liver Institute, Menoufia University, Shebeen Elkom, Egypt

^b Department of Anaesthesia and ICU, Faculty of Medicine Menoufia University, Shebeen Elkom, Egypt

Abstract

Objectives: To assess the effect of ultrasound-guided bilateral continuous anterior QLB on alleviating pain and fentanyl consumption in cirrhotic patients who undergoing major abdominal surgery.

Methods: 60 cirrhotic patients undergoing major abdominal surgery were involved in this double-blinded randomized control study. In group B bilateral anterior QLB with (0.4 ml/kg) bupivacaine 0.25% in each space between QL and psoas major muscle then continuous infusion of bupivacaine 0.25% at dose 10 ml/h. In group S bilateral anterior QLB with equal volume of 0.9 saline in the same plane. Hemodynamics, intra and postoperative analgesic consumption, VAS score, incidence of nausea and vomiting, respiratory complications were recorded.

Results: The mean fentanyl consumption intra and 12 h postoperative in group B and group C were (337.93 ± 135.39 and 312 ± 170.36 VS. 518.33 ± 121.40 and 582.00 ± 141.16 µg P < 0.001) respectively. The VAS scores was statistically significant lower in group B than group C P value < 0.001. There was no statistically significant different in the incidence of side effects and ICU stay percentage of patients who developed NAV in group B was 30% compared with 63.33% in group C P value = 0.02.

Conclusion: The QL block provides better pain management as regarded by VAS score with less opioid consumption in cirrhotic patients undergoing major abdominal surgery. In addition, there are no differences between studied groups as regard postoperative complications.

Keywords: Bilateral, Cirrhotic patient, Pain scores, Quadratus lumborum (QL) block, Ultrasound

1. Introduction

In cirrhotic patients the risk of encephalopathy, portal hypertension, bleeding was associated with many analgesic agents, such as paracetamol and non-steroidal anti-inflammatory drugs (NSAIDs), with drug-induced liver injury [1]. So in such patients' usage of multimodal analgesia with combinations of analgesics acting via different mechanisms was very helpful [2]. In Quadratus lumborum block (QLB), ultrasound guidance is effective to determine the accurate anatomical site of local anesthetics. There are three approaches to

QLB, anterior (QLB3), lateral (QLB1) and posterior (QLB2), with different mechanism of action for each of them. The key to the analgesic effects of the QLB lies in the thoracolumbar fascia (TLF) which is a complex, connective tissue tubular structure formed by binding aponeuroses and fascia layers, which, enveloping the back muscles potentially ensuring the spread of anesthetics in the craniocaudal direction [3]. Studies have shown that usage of abdominal trunk blocks were provide, better postoperative pain control with less systemic analgesia, shorten the duration of ICU stay with better GIT and early urinary catheter removal. QLB has a great potential

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* Corresponding author at: National Liver Institute, Menoufia University, Shebeen Elkom, Egypt
E-mail address: emansayed825@gmail.com (E.S. Ibrahim).

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in this area of enhanced recovery after surgery by enhancements of early oral intake and early mobilization which easily achieved with good pain control [4–6].

In our institute the main polices is to provide our special kind of patients with all novel anesthetic techniques with high safety, better monitoring and better outcomes so we designed this study with our primary outcome was to assess the effect of ultrasound-guided bilateral continuous anterior QLB on alleviating pain and fentanyl consumption in cirrhotic patients who undergoing major abdominal surgery. The Secondary outcomes were evaluate the effect of anterior QLB on intraoperative and post-operative hemodynamic, VAS score and post-operative complications like nausea and vomiting and chest complications.

2. Methods

These prospective, randomized, double-blind study performed in the anesthesia and ICU department in National Liver Institute NLI Menoufia University after approval of Institutional Review Board of NLI, Menoufia University, Egypt, and Cochrane South Africa clinical trial (www.pactr.org) the number of registry is PACTR202204772010591. 60 cirrhotic patients undergoing major abdominal surgery (Whipple, liver resection, HJ&JJ) were registered in this study. Inclusion criteria were adult patients with hepatitis C (Child A &early B) planned for major abdominal surgery, American Society of Anesthesiologists (ASAII–III) and aged between 20 and 70 years. Exclusion criteria were previous history of preoperative opioid use, body mass index >35, allergy to local anesthetics, patients with coagulopathy, the presence of any systemic infection and diabetes mellitus or uncontrolled systemic hypertension. All patients signed the written informed consent.

Intra venous midazolam: 0.03 mg/kg was administered to the patients transferred to the operating theater before the induction of general anesthesia. Ultrasound-guided anterior QL block at the level of second lumbar vertebra (L2) transverse process using a low frequency convex probe (SonoSite X-Porte transducer, 2–5 MHz) which was placed at this level near posterior axillary line. A18G trocar needle was applied (TOHY epidural Kit, B. Braun Medical Inc.) to puncture using in-plane insertion method from the dorsal to ventral direction. After confirming the site by hydro dissection, insertion of epidural catheter about 3 cm at the space done, then

patients randomly allocated to group B ($n = 30$) and group S ($n = 30$).

In group B: bilateral anterior QLB with (0.4 ml/kg) bupivacaine 0.25% in each space between QL and psoas major muscle then continuous infusion of bupivacaine 0.25% at dose 10 ml/h [7].

In group S: bilateral anterior QLB with equal volume of 0.9 saline in the same plane.

General anesthesia was induced with an intravenous dose of propofol (1.5–2 mg/kg), fentanyl 2 μ g/kg and rocuronium (0.9 mg/kg), after 3–5 min pre-oxygenation using O₂/Air mixture (FiO₂ = 0.8) followed by tracheal intubation. In all patients, ventilator settings using pressure regulating volume-target mode, with a TV of 6–8 ml/kg of ideal body weight with the optimum PEEP for each patient. Using a semi closed system (Datex Ohmeda GE, USA) aiming to keep end tidal CO₂ between 35 and 45 mmHg and SaO₂>95%. An intermittent bolus of rocuronium (0.15 mg/kg) was administered to provide balanced general anesthesia. Anesthesia was maintained with Sevoflurane in O₂/Air mixture keeping BIS between 40 and 60. Invasive blood pressure of right radial artery. Both groups received intravenous analgesia like fentanyl or other opioids needs indicated by hemodynamics and BIS records. Patients were transferred to the recovery room after being extubated, then to the ICU. The data collected include demographic data included age (years), sex, and BMI (kg/m²). Medical comorbidity, Systemic hemodynamic were heart rate (beat/min), mean arterial blood pressure (mmHg) base line T₀ then every 1 h (T₁-T₅), and cardiometry derived variables of cardiac output (CO) (l/min) were recorded. Intraoperative data included total intraoperative fentanyl consumption, blood product transfusion requirements, and time of surgery. When patients transferred to ICU injection of 0.3 ml/kg of 0.25% bupivacaine given in both catheters and every 8 h in the B group and equal volume of 0.9 normal saline in the S group. Intravenous fentanyl was administered after surgery once the patient was fully awake through a PCA fentanyl pump (Fresenius -Le Grand Chemin – F38590 BREZINS, Germany) programmed for a demand-only mode with no basal rate. 1 g paracetamol was ordered to be given at eight-hour intervals. Evaluations of the patients will be made by another investigator who did not know which group the patients in, follow up of postoperative hemodynamics and VAS hourly in ICU(T₁-T₁₂) in the 1st 12 h, and close monitoring for postoperative complications like

nausea and vomiting, respiratory complications and postoperative development of lower limb weakness. Total amount of fentanyl consumption intraoperative and postoperative in 2 groups was recorded. Time of urinary catheter removal and duration of ICU stay were registered.

2.1. Sample size calculation

Sample size was calculated according to the type of study design and the objectives of the study. This study was designed to be a randomized controlled double-blinded prospective clinical trial. The main objective of this research is to evaluate the effect of quadratus lumborum block on intra operative analgesic consumption.

The input items to sample size equation are as follows: null hypothesis (there is no difference between the two studied groups in response to the used maneuver, variability (the variance of the outcome that is estimated by the standard deviation/standard error), type I error (5%), the smallest effect (the minimal difference between cases and controls) (0.05), The proportion between groups of the study is 1:1, (p) the level of confidence (almost 95%), For 0.05 significance level, $Z_{\alpha} = 1.96$, margin of error 11.88%, undefined population number, and the proposed power of the study (80%), for 80% power, $Z_{\beta} = 0.84$, and the formula used was:

$$n = \left(\frac{r+1}{r} \right) \frac{(\bar{p})(1-\bar{p})(Z_{\beta} + Z_{\alpha/2})^2}{(p_1 - p_2)^2}$$

Estimated number of sample size needed is 60 participants. Attrition rate assumed 0% = 0 participants. Total number of Participants = 60. Group 1/ Group 2 = 1:1. 30 participants per group 2 [8,9].

2.2. Statistical analysis

SPSS version15 (SPSS Inc., Chicago, IL, USA) was used to perform all the statistical analyses. Descriptive analysis for quantitative data includes mean and Standard deviation for normally distributed variables. For qualitative categorical variables, frequency and percentage were applied. Test of normality using Shapiro test. Independent sample t-test was performed to assess the difference among groups. A chi-squared test was performed to estimate the change in categorical variables. The statistical analysis was based on a two-tailed test using a level of significance for analysis at $p \leq 0.05$. All suitable graphs were done using R Software.

3. Results

Total 64 patients were included in this study, 2 patients were lost during follow up intraoperative for massive bleeding, air embolism, and 2 patients were lost during follow up in ICU for hemodynamic instability and pulmonary embolism (Fig. 1). Finally 60 patients were involved in this study. General characteristics values were compared between 2 groups as mean (SD) with no statistically significant difference between 2 groups, P value > 0.05 , Table 1. Data presented as mean (SD), Heart rate (HR) (beat/min) Systolic and diastolic blood pressure (SBP, DBP) (mmHg). Regarding the successive hours 2nd, 3rd 4th and 5th hour, there was statistically significant difference between 2 groups being less in group B, with P value < 0.05 , as shown in Tables 2 and 3. Blood loss and operation time were compared between 2 groups, data presented as Mean (SD), with no statistically significant difference between 2 groups, P value = 0.258. The mean fentanyl consumption intra and 12 h postoperative in group B and group C were $(337.93 \pm 135.39$ and 312 ± 170.36 VS. 518.33 ± 121.40 and 582.00 ± 141.16 μg $P < 0.001$) respectively as shown in Fig. 2. VAS score was

Table 1. General characteristics.

Variables	Group B (n = 30)	Group S (n = 30)	P
Sex			
Female	7 (23.33)	13 (43.33)	0.17
Male	23 (76.67)	17 (56.67)	
Weight			
Mean (SD)	73.87 (8.57)	75.83 (9.54)	0.40
Length			
Mean (SD)	167.93 (5.46)	167.20 (5.12)	0.59
BMI			
Mean (SD)	25.27 (2.66)	24.95 (2.44)	0.63
Age			
Mean (SD)	53.63 (9.40)	49.67 (11.43)	0.15
HTN			
Yes	3 (10.00)	2 (6.67%)	>0.99
DM			
Yes	9 (30.00)	7 (23.33%)	0.77
IHD			
Yes	1 (3.33%)	2 (6.67%)	>0.99
Type of operation			
HJ & JJ	10 (33.33%)	6 (20.00%)	
Hepatic resection	12 (40.00%)	13 (43.33%)	0.47
Whipple	8 (26.67%)	11 (36.67%)	
Blood loss (ml)			
Mean (SD)	506.90 (183.58)	460.00 (124.15)	0.26
Operation time			
Mean (SD)	5.56 (0.89)	5.55 (0.91)	0.95

Data presented as mean (SD), and percent.

BMI, body mass index; DM, diabetes mellitus; HJ, hepaticojujnostomy; HTN, Hypertension; IHD, ischemic heart disease; JJ, jujnostomy, P value < 0.05 being statistically significant difference between 2 groups.

Table 2. Comparison of intraoperative SBP, DBP, and HR.

Variables	Group B (n = 30)	Group S (n = 30)	P
HR			
T0			
Mean (SD)	80.87 (10.30)	79.97 (7.20)	0.70
T1			
Mean (SD)	78.13 (12.45)	82.50 (8.13)	0.11
T2			
Mean (SD)	70.00 (11.39)	80.83 (7.24)	<0.001*
T3			
Mean (SD)	74.30 (15.21)	82.52 (8.45)	0.01*
T4			
Mean (SD)	76.50 (13.80)	82.93 (8.16)	0.03*
T5			
Mean (SD)	76.75 (12.33)	86.43 (8.51)	0.001*
SBP (mmHg) T0			
Mean (SD)	124.33 (18.13)	125.23 (7.26)	0.80
T1			
Mean (SD)	120.33 (20.42)	123.33 (5.47)	0.44
T2			
Mean (SD)	103.67 (13.26)	122.00 (8.47)	<0.001*
T3			
Mean (SD)	103.00 (16.85)	120.00 (11.34)	<0.001*
T4			
Mean (SD)	106.67 (16.05)	121.55 (12.89)	<0.001*
T5			
Mean (SD)	102.14 (12.28)	117.50 (13.78)	<0.001*
DBP (mm Hg)			
T0			
Mean (SD)	79.73 (11.18)	79.23 (9.03)	0.85
T1			
Mean (SD)	74.30 (14.03)	78.50 (7.14)	0.15
T2			
Mean (SD)	63.47 (11.54)	78.53 (8.10)	<0.001*
T3			
Mean (SD)	62.83 (11.94)	77.76 (8.90)	<0.001*
T4			
Mean (SD)	68.73 (11.28)	77.66 (9.87)	0.002*
T5			
Mean (SD)	63.86 (9.12)	77.93 (9.79)	<0.001*

Data presented as mean (SD). Heart rate (HR) (beat/min) Systolic and diastolic blood pressure (SBP, DBP) (mm Hg), *P* value < 0.05 being statistically significant difference between 2 groups.

assessed postoperative and recorded after ½ hour, 6 h and 12 h, mean (SD) show statistically significant difference between 2 groups, the score was decreased in group B than in group S, *P* value < 0.001, as shown in Figs. 3 and 4. Patients who developed chest complications (postoperative lung collapse and chest infection) was 11 (36.67%) in group B and 14 (46.67%) in group S, there was no statistically significant difference between 2 groups, *P* = 0.60, time for urinary catheter removal; was no statistically significant different between 2 groups, *P* = 0.07. Regarding postoperative nausea and vomiting (N&V): there was statistically significant reduction in the percent of patient developed N&V in group B than group S (30% compared with

63.33%, *P* value = 0.02). ICU stay was compared between 2 groups showing no statistically significant difference, *P* value = 0.58 as presented in Table 4. According to our policy in this category of patients, all patients in our study started ambulation at postoperative day one morning. Regarding postoperative lower limb weakness, there was no patient complaining from it. Total bupivacaine used in group B, bolus dose; mean was 1.8 ± 0.13 mg/kg, minimum dose was 1.6 mg/kg and maximum dose was 2.2 mg/kg. For infusion dose; mean was 0.7 ± 0.06 mg/kg/h, minimum dose was 0.5 mg/kg/h and maximum dose was 0.7 mg/kg/h.

4. Discussion

Pain control regimens should tailored to every case according to medical, psychological, and physical condition; age; level of fear or anxiety; surgical procedure; personal preference; and response to agents given. The optimal strategy for perioperative pain control consists of multimodal therapy to minimize the need for opioids [10].

We aimed in this study to assess the effect of ultrasound-guided bilateral continuous anterior QLB on alleviating pain and fentanyl consumption in cirrhotic patients who undergoing major abdominal surgery. The main outcome is the QL block provides better pain management with less opioid consumption, this coincides with results shown by Qiang Zhu et al. [11], who found that, anterior continuous QLB was effective in reducing pain score in a study made on 63 patient undergoing open liver resection, also in a study made by Mengya Pang et al. [12], using trans muscular (TMQLB) QLB in laparoscopic resection in 80 patients, they found that TMQLB significantly reduce total opioid use. The key to the analgesic effect for the QLB lies in the thoracolumbar fascia (TLF) which potentially guarantee the spread of anesthetics in the craniocaudal direction [3].

Gabr S.M. Thabet et al. [13], compare between the effects of Quadratus Lumborum block and Transversus Abdominis plane block for postoperative pain after caesarean delivery and conclude that: Ultrasound-guided Quadratus lum-borum block effectively control the postoperative pain and minimize opioids used than, Transversus abdominis plane block in caesarean section Qinxue Peng et al. [14], study the effect of adding adjuvant (magnesium sulfate) to ropivacaine in ultrasound-guided Quadratus Lumborum block on postoperative analgesia and conclude that this addition increases the duration of analgesia, reduces analgesic requirements, and better patient satisfaction. Lin et al. [15],

Table 3. Postoperative hemodynamics in 1st 12 h.

Variables	Group B (n = 30)	Group S (n = 30)	P
HR			
T1			
Mean (SD)	78.00 (12.87)	82.07 (10.53)	0.186
T2			
Mean (SD)	79.70 (10.55)	84.53 (10.96)	0.087
T3			
Mean (SD)	80.67 (11.76)	83.80 (10.76)	0.286
T4			
Mean (SD)	78.27 (11.80)	83.07 (10.78)	0.105
T5			
Mean (SD)	77.97 (10.88)	84.87 (10.81)	0.017*
T6			
Mean (SD)	80.13 (11.32)	81.80 (8.78)	0.527
T7			
Mean (SD)	79.77 (11.98)	81.90 (9.73)	0.452
T8			
Mean (SD)	77.93 (10.23)	82.76 (10.54)	0.080
T9			
Mean (SD)	78.20 (9.16)	79.57 (16.11)	0.688
T10			
Mean (SD)	80.80 (12.61)	85.60 (19.52)	0.263
T11			
Mean (SD)	78.23 (11.20)	83.07 (11.36)	0.102
T12			
Mean (SD)	79.90 (9.23)	81.23 (9.39)	0.581
SBP (mmHg)			
T1			
Mean (SD)	118.00 (14.00)	124.00 (6.75)	0.040*
T2			
Mean (SD)	118.33 (12.34)	123.33 (8.02)	0.069
T3			
Mean (SD)	116.33 (13.26)	123.17 (6.50)	0.015*
T4			
Mean (SD)	117.00 (10.88)	120.83 (9.48)	0.151
T5			
Mean (SD)	116.07 (10.87)	121.33 (9.00)	0.048*
T6			
Mean (SD)	115.67 (11.04)	121.67 (5.92)	0.012*
T7			
Mean (SD)	117.00 (12.91)	122.00 (8.05)	0.078
T8			
Mean (SD)	118.67 (11.67)	118.33 (10.20)	0.907
T9			
Mean (SD)	119.23 (7.16)	118.30 (7.41)	0.622
T10			
Mean (SD)	118.67 (11.37)	118.00 (9.25)	0.804
T11			
Mean (SD)	115.00 (9.38)	119.67 (8.09)	0.044*
T12			
Mean (SD)	113.60 (7.96)	116.33 (8.50)	0.204
DBP (mmHg)			
T1			
Mean (SD)	72.60 (9.43)	78.53 (6.16)	0.006*
T2			
Mean (SD)	71.90 (6.53)	76.53 (6.55)	0.008*
T3			
Mean (SD)	75.60 (8.55)	78.17 (5.94)	0.183
T4			
Mean (SD)	75.10 (9.48)	78.50 (7.19)	0.123
T5			

(continued on next page)

Table 3. (continued)

Variables	Group B (n = 30)	Group S (n = 30)	P
Mean (SD)	75.79 (7.24)	79.03 (5.64)	0.061
T6			
Mean (SD)	75.70 (11.07)	76.47 (6.93)	0.749
T7			
Mean (SD)	74.73 (9.61)	75.43 (14.79)	0.829
T8			
Mean (SD)	78.57 (8.97)	77.30 (7.84)	0.563
T9			
Mean (SD)	82.10 (6.28)	83.41 (8.02)	0.488
T10			
Mean (SD)	75.07 (9.28)	74.97 (7.29)	0.963
T11			
Mean (SD)	73.60 (9.20)	78.77 (7.00)	0.018*
T12			
Mean (SD)	72.50 (14.26)	77.57 (6.76)	0.086

N = number of patients, T1-12 = postoperative hours from 1 to 12, HR = heart rate, SBP = systolic blood pressure, DBP = diastolic blood pressure, * indicate significant difference $P < 0.05$.

evaluated the ultrasound-guided posterior Quadratus Lumborum block for acute postoperative analgesia in adult patients and conclude that QLB2 provide effective analgesia for patients under general anesthesia. Anders Krohg et al. [16], found that QL block with ropivacaine decreases the ketobemidone postoperatively and better analgesia after cesarean delivery. Korgün Ökmen et al. [17], they think that posterior QLB is an effective analgesia technique after laparoscopic cholecystectomy operation.

In contrast to our finding Sophia Margareta Brixel et al. [18], who found that posterior QLB does not affect morphine consumption or pain score when used in total hip replacement.

In this study, we found that patients who underwent continuous bilateral anterior QLB had some reduce in the heart rate and blood pressure intraoperative (beginning from the 2nd hour after induction and during the successive hours and in some times in postoperative period. The thoracolumbar fascia has high density of sympathetic nerve fibers and abundant mechanical stimulation receptors this may explain our findings regarding hemodynamics difference in anterior QLB group.

In contrast to our study a study made by Shyam Prasad Mantha et al. [19], who using TMQLB on 60 patients undergoing nephrectomy, revealed no significant difference in hemodynamic this may be explained by using lower dose and concentration from the local anesthetics. Also our results not coincides with the study made by Qiang Zhu et al. [11], which made on 63 patients undergoing liver resection using anterior QLB and show no statistically

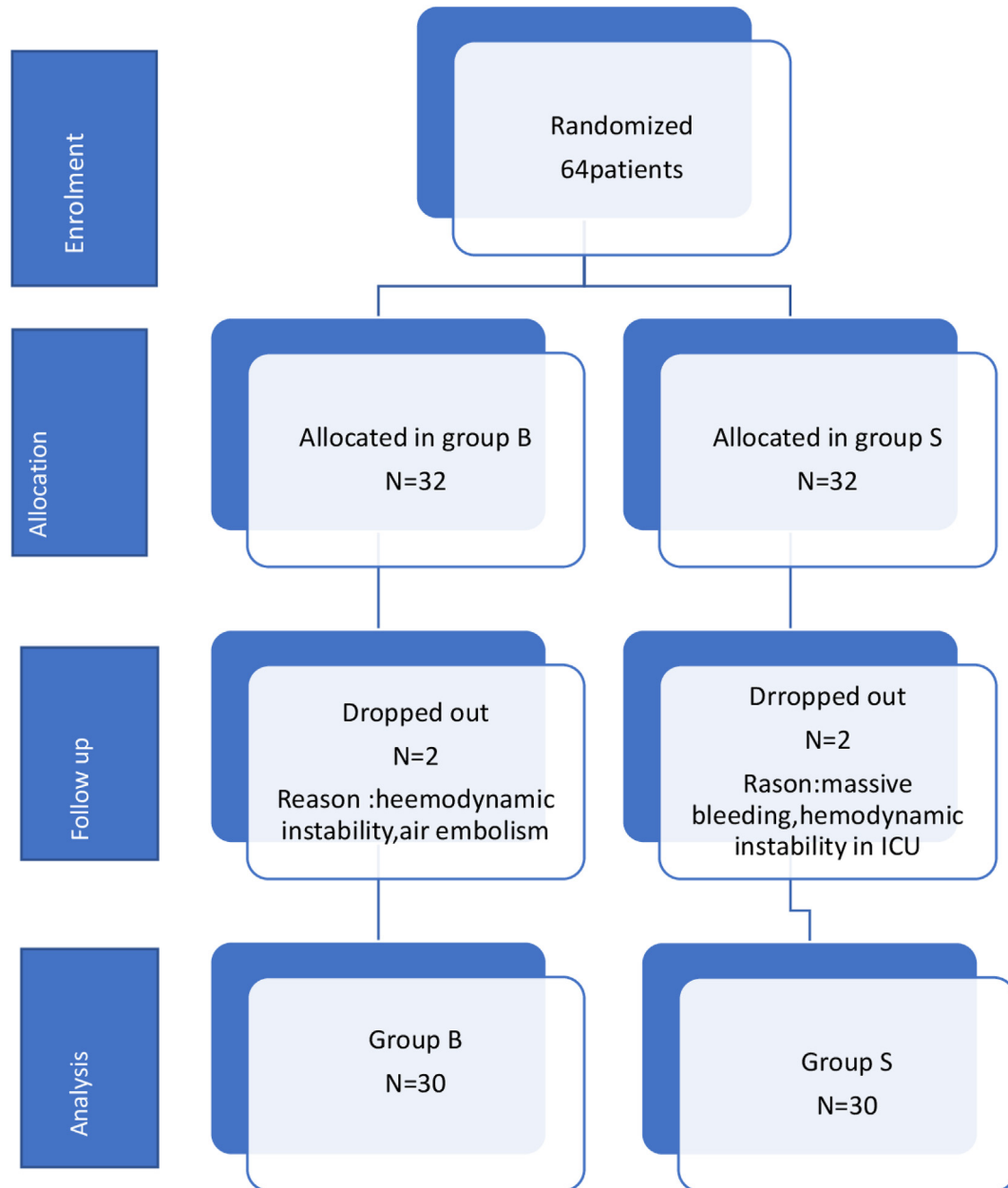


Fig. 1. CONSRT (Consolidated Standards of Reporting Trials) flow chart, showing patients allocation at different stages of the study, group B (QLB with bupivacaine injection), group S (QLB with saline injection).

significant difference in postoperative hemodynamics between CQLB group and PCA group.

In our study VAS score was assessed postoperative (after ½, 6 and 12 h) and the mean was statistically decreased in the intervention group (group B) than in the control group (group S) P value < 0.001, this finding is similar to the study made by Qiang Zhu et al. [11].

Postoperative complications such as nausea and vomiting considered being one of most complications that decrease patient satisfaction, in our study we found that anterior CQLB group has less

incidence of post operative N&V compared to PCA group, this was against finding made by Qiang Zhu et al. [11].

In this study we found that there was no significant difference between 2 groups regarding chest complications, these coincide with Qiang Zhu et al., in a study made on open liver resection.

No patient was reported in our study to develop muscle weakness in lower limb as a complication from anterior QLB, this also reported by Qiang Zhu et al. [11], and Shyam Prasad Mantha et al., who reported that one patient developed muscle weakness in lower

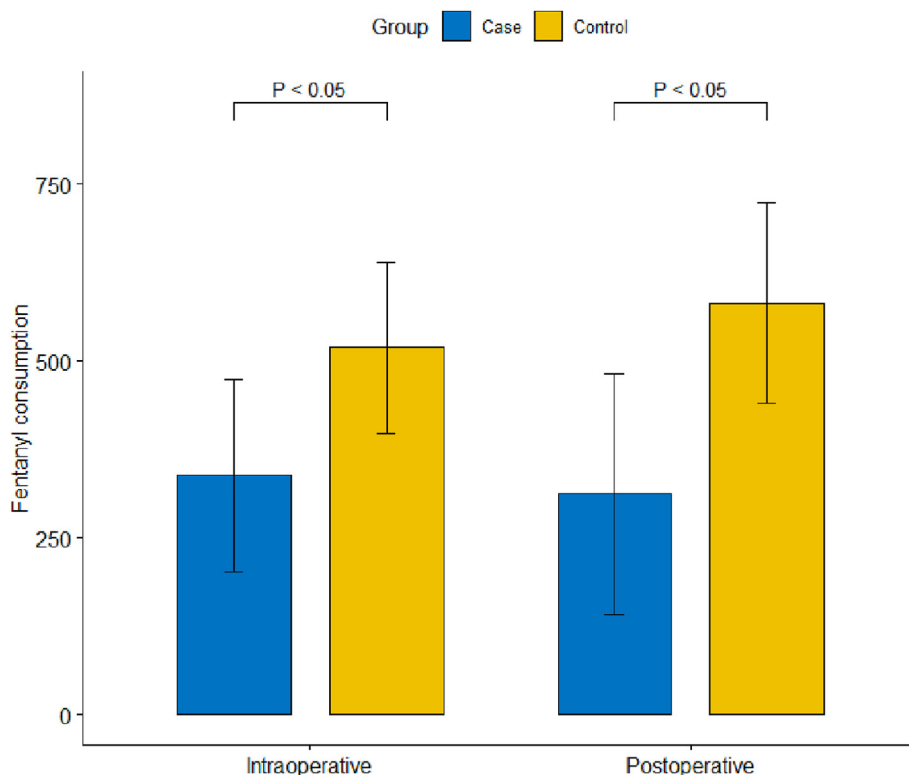


Fig. 2. Show fentanyl consumption intraoperative and post-operative. Blue column indicate group B (case), Yellow column indicate group S (control).

limb and explained by the authors as a result of 20 ml local anesthetic as a bolus injection using trans muscular QLB with 0.125% bupivacaine in patients undergoing nephrectomy [19]. Luning Chen et al. [20],

report that patients developed muscle weakness in lower limb in his study comparing trans-muscular versus lateral QLB nephrolithotomy. **In conclusion:** our study demonstrated that the QL block provides

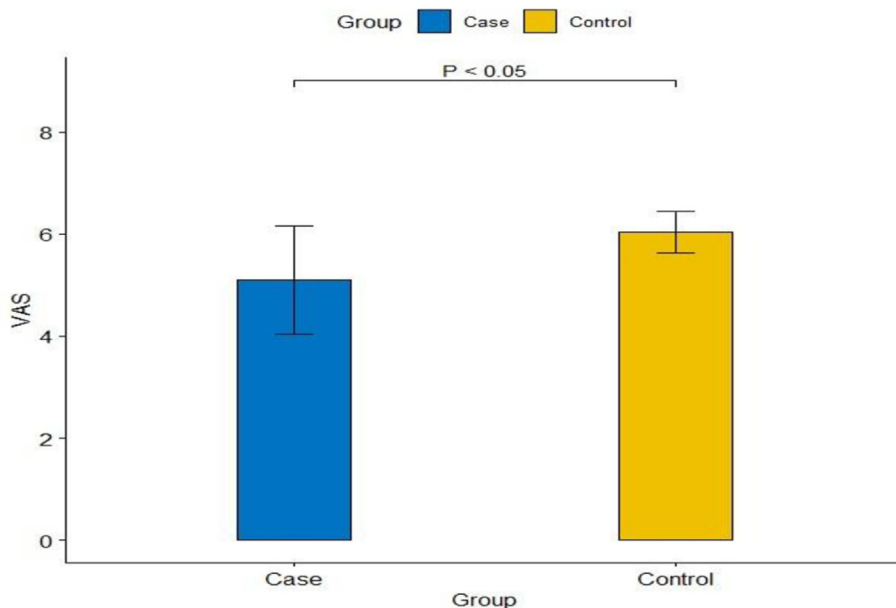


Fig. 3. Showing visual analogue score (VAS) at 1/2 h after ICU admission, blue column indicate group B (case), Yellow column indicate group S (control).

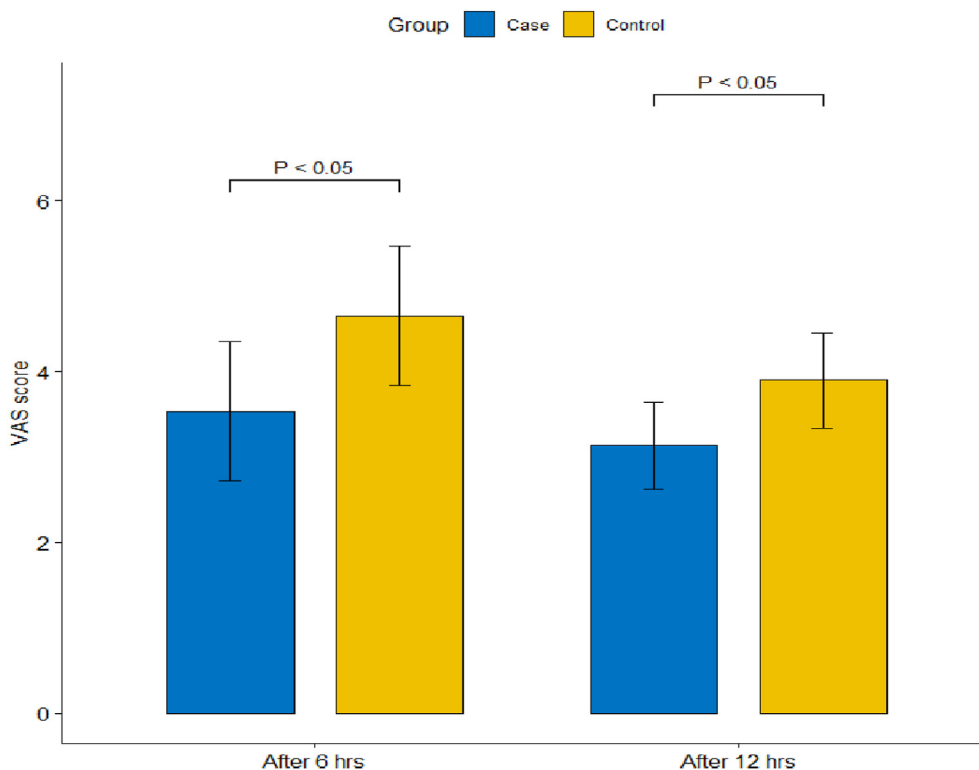


Fig. 4. Showing visual analogue score (VAS) at 6 h and 12 h after ICU admission. Blue column indicate group B (case), Yellow column indicate group S (control).

Table 4. Postoperative complications.

Dependent: Group	Group B (n = 30)	Group S (n = 30)	P
Respiratory complications			
Yes	11 (36.67%)	14 (46.67%)	0.60
Urinary catheter removal			
POD1	22 (73.33%)	18 (60.00%)	
POD2	1 (3.33%)	7 (23.33%)	0.07
POD3	7 (23.33%)	5 (16.67%)	
N & V			
Yes	9 (30.00)	19 (63.33)	0.02*
ICU stay (days)			
Mean (SD)	2.57 (0.86)	2.47 (0.51)	0.58

N&V (nausea and vomiting) is shown as count (percent), analyzed by Chi-squared test. ICU stay is shown as mean (SD), analyzed by independent sample *t*-test *P* value < 0.05 indicate statistically significant difference between 2 group.

better pain management with less opioid consumption in cirrhotic patients undergoing major abdominal surgery. The limitation in our study is the use of adjuvant to the local anesthetics used in the block and that will do in further study.

Conflicts of interest

There are no conflicts of interest.

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