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Original Research Article

A Comparative Randomized Study of USG Guided Erector Spinae Block Vs Oblique Subcostal Transabdominal Plane Block for Post-Operative Analgesia in Patient Undergoing Laparoscopic Cholecystectomy

Aradhana Devi[1], Prajna Nanda[2], Olvyna Dsouza[3], Sudeep Mohapatra[4]

[1,2]Assistant Professor, Dept. of Anaesthesiology, IMS & SUM-2 Medical College and Hospital, BBSR
[3]Professor, Dept. of Anaesthesiology, MGM Medical College and Hospital, Navi Mumbai
[4]Professor, Dept. of Anaesthesiology, IMS & SUM-2 Medical College and Hospital, BBSR

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Corresponding author: Dr. Aradhana Devi
Conflict of interest: Nil

Abstract

Background: Oblique subcostal transverses abdominis plane block has been used for postoperative analgesia in patients undergoing Laparoscopic Cholecystectomy, but found not so effective. Our aim was to compare the efficacy of Erector spinae plane block with Oblique subcostal transverses abdominis plane block for postoperative analgesia.

Materials and methods: This was a undertaken prospective randomized controlled study was done taking 60 adult patients admitted for laparoscopic cholecystectomy under anaesthesia who were arbitrarily split into 2 groups of 30 each. 30 patients were administered ultrasound guided erector spinae block and 30 were administered ultrasound guided OSTAP block. Intra-operative vitals and intra-operative analgesic requirement, post-operative NRS pain score was monitored.

Results: It was noted that the analgesic requirement was comparatively less in ESP block (group1) than OSTAP block (group2) intraoperatively and postoperatively. The postoperative NRS scores at rest and on coughing were notably lower in the group 1 when compared to the group 2. Duration for 1st rescue analgesia was increased in ESP block (group 1) which was remarkably significant. Rescue analgesia requirement was more in OSTAP block (group 2) in contrast to ESP block (group1).

Conclusion: This study concludes that the total analgesic requirement in first 24 hours was comparatively lesser in ESP block group compared to OSTAP block group in patient undergoing LC. Also, time for first rescue analgesia was prolonged in ESP block group.

Keywords: Laparoscopic Cholecystectomy, Erector Spinae Plane Block, Oblique, Subcostal Transverses Abdominis Plane Block, Post-Operative NRS, Pain Score.

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Introduction

Open Cholecystectomy was the gold standard for treatment of cholecystitis with cholelithiasis. But this procedure has been almost replaced by a minimally invasive surgery called the Laparoscopic Cholecystectomy (LC). [1] Being an invasive surgery, LC has varying degrees of pain post-operatively. To overcome this pain number of analgesics, infiltration of local anaesthetic to the incision sites and opioids were used which had some side effects. [2] Then came many regional blocks which provided good analgesia with lesser side effects and the requirement of the standard analgesics decreased. Sub-costal transverses abdominis block was compared with conventional port site infiltration and OSTAP block was found to be better. [3] Ultrasound guided transverses abdominis plane block improves the precision of local anaesthetic for TAP block [4]. A variant of TAP block called OSTAP which is given in an Oblique Sub costal type where the local anaesthetic was introduced in between the rectus sheath and the transverses abdominis. This block when given bilaterally before surgery effectively controls post-operative pain in upper abdominal surgeries but visceral pain was not blocked [5]. ESP (Erector Spinae Plane) block for use in thoracic neuropathic pain, but the somatic and visceral analgesia was similar to thoracic epidural analgesia when given bilaterally [6]. ESP block at T4-5 levels gives adequate analgesia for breast surgeries and for upper abdominal surgeries the local anaesthetic is injected at the transverse process of T8-T9 vertebra deep to

erector spinae fascia under USG guidance. Since the extent of erector spinae muscle is from the nuchal line to the sacrum this block provides analgesia over a larger area. OSTAP block can be used for somatic and parietal pain relief for almost whole abdomen, but is ineffective in blocking visceral nerves. ESP block blocks the dorsal rami ventral rami and rami communicantis of spinal nerves [6]. In some studies they have estimated the efficacy of OSTAP block and ESP block in controlling post-operative pain after laparoscopic cholecystectomy. This study compares the postoperative analgesic efficacy of ESP and OSTAP Block in the patients of laparoscopic cholecystectomies at our hospital.

Methods

This prospective and randomized study was undertaken after assent from the Institute Ethical Committee in MGM Hospital Navi Mumbai. 60 adult patients ranging in age between 20-60 yrs of both gender with ASA I/II admitted for laparoscopic cholecystectomy under anaesthesia were arbitrarily split into 2groups of 30 each where 30 were administered ultrasound guided erector spinae block and 30 were administered ultrasound guided OSTAP block.

Inclusive Criteria being Patients of either sex Aged 20-60yrs ASA grade I/II posted for elective Laparoscopic cholecystectomy.

Exclusive Criteria being Patient refusal, Inability to give informed consent, Patient diagnosed with any cardiac conditions, severe hepatic and renal disease, with psychiatric disorders, any contraindications to erector spinae block or OSTAP block such as Bleeding disorders, local site infection, any drug history of allergy or hypersensitivity.

All patients were kept nil by mouth (NBM) as per protocol. After patient was shifted to the operation theatre, heart rate, blood pressure (non-invasive), pulse oximetry (spo2) and echocardiogram was monitored. Preoperative data were documented. Intravenous cannula was secured in a peripheral vein. IV Glycopyrrolate 0.004 mg/kg and IV Midazolam 0.05mg/kg was given as premedication. All patients were induced with iv Propofol 2-3mg/kg and iv Fentanyl 2mcg/kg. Endotracheal intubation was done after giving iv Vecuronium 0.1mg/kg. General anaesthesia maintained with isoflurane 1-2% in 5L of 40% oxygen and 60% nitrous oxide mixture.

All blocks were carried out after induction of general anaesthesia after taking aseptic precautions before the start of laparoscopic cholecystectomy. Blocks were achieved with help of ultrasound using a 38mm L6–12 linear probe with a frequency of (6-15MHz).0.25% bupivacaine was injected, 20ml each on both sides. Intraoperative HR, MAP, SPO2 was noted. 0.5mcg/kg of fentanyl was administered for any 20% rise in HR and MAP. After completion of surgery, extubation was done after reversal and shifted to post anaesthesia care unit.

Procedure ESP Block: Bilateral Erector spinae plane block was accomplished with USG guidance following intubation. Patient was put on lateral decubitus position. Landmark 3cm lateral to T9 spinous process was marked and high-frequency linear transducer was put longitudinally. The erector spinae muscles were localised above the transverse process of T9. Under aseptic precautions a 23G-gauge 100mm long Quincke Babcock needle was introduced in an in-plane cranial-to-caudal manner. The needle tip was entered and was put deep to the erector spinae muscle. Here 2-3 ml of isotonic saline was injected and the spread of fluid lifting the erector spine muscle confirms the ESP plane. Then 20ml bupivacaine 0.25% was infused on both side.

Procedure: OSTAP Block

All the patients were put in supine position. High frequency linear transducer was placed immediately below the costal margin obliquely using an in-plane approach. The block was performed following intubation. Under all aseptic measures the transducer was placed 2cm below xiphoid process and moved along the subcostal edge to identify the rectus abdominis and the transverse abdominis muscle. 23G needle is introduced 2-3cm lateral to the transducer and 1-2ml solution was injected between rectus abdominis muscle and transverse abdominis muscle and dissection of the plane will be seen. After confirming the plane, the rest of the anaesthetic agent was injected. 20ml of 0.25% Bupivacaine was injected on each side. Intra-operative MAP, HR was monitored every 10 mins and intra-operative analgesic requirement was noted. For any rise in >20% of HR and MAP 0.5mcg/kg of Inj. Fentanyl was administered. In the recovery room, NRS pain score was recorded at 30th min then at 1,2,3,6,9,12,15,18,21 and 24 hours post operatively and scores kept for statistical evaluation. When NRS score became >4, iv Paracetamol 1gm was given as rescue analgesia. Vitals monitored post operatively. Any adverse effect was noted. The NRS Pain scale is one of the most commonly used pain scales. It consist of a eleven point numerical scale. It is labeled from zero to ten on a horizontal line to rate pain by patients. For no pain, NRS score=0. For worst pain, NRS score=10.

Statistical Analysis: For statistical analysis, Statistical Package for the Social Sciences (SPSS) version 21was used. Data were analysed as mean ± standard deviation. Independent t-test was used for univariate analysis comparing quantitative data. Mann–Whitney U test was applied for non-normally distributed data used. Qualitative data were compared using Chi square test. Fisher's exact test was applied for categorical variables. Normality

distribution of variables was tested using Shapiro–Wilk test. P value < 0.05 was taken as statistically remarkable.

Results

Sixty nine cases enrolled for LC were assessed for eligibility in this trial. One case for coagulation abnormality, three cases for block site infection, two cases for chronic renal failure, and three cases for BMI>30kg/m2 were not included in the trial. 60 cases were found eligible for randomization. All 60 cases completed the trial.

The difference between the demographic parameters amongst patients of the two groups were almost similar and found to be statistically insignificant (p value >0.05). (Table 1)

Table 1: Distribution of Variables in among both groups

Variable	Group 1(n-30)	Group 2(n-30)	P-value
Age in years (Mean±SD)	52.18±10.46	51.49±11.25	0.262
Female	16	17	0.157
Male	14	13	
ASAI	21	20	0.730
ASAII	9	10	
Surgical time (Mins) (Mean±SD)	45.32±8.84	47.46±7.95	
BMI (kg/m2) (Mean±SD)	24.14±3.15	23.18±3.52	

Figure 1 shows comparison of intraoperative fentanyl requirement between the two groups. Though fentanyl requirement in ESP block (group 1) was less than OSTAP block (group2) in intraoperative period, it was comparable (p>0.05).

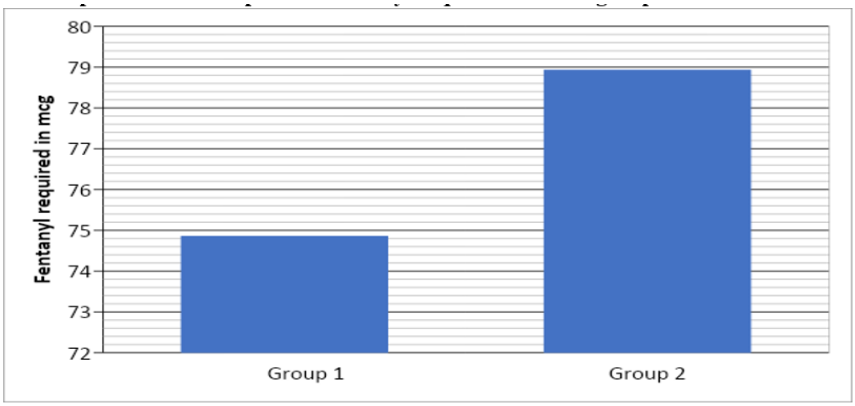

Figure 1: Comparison of intraoperative fentanyl required between groups

Total paracetamol required in postoperative 24hrs was 1.7±0.45 gm in ESP (group 1) and 2.62±0.32 gm in OSTAP (group 2) and the difference was remarkable. (p<0.05)

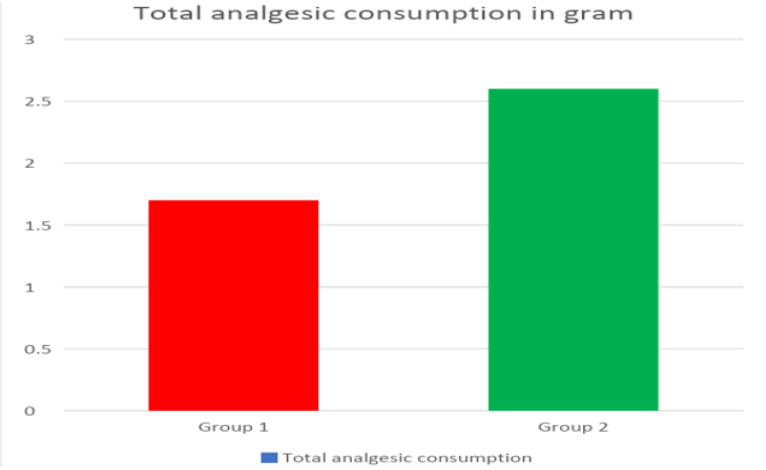

Figure 2: Total analgesic consumption in 24hrs

Time for first analgesic demand was 373.83±35.67 min in ESP block (group1) and 248.21±32.94 min in OSTAP (group2), the difference being significant. (p<0.05)

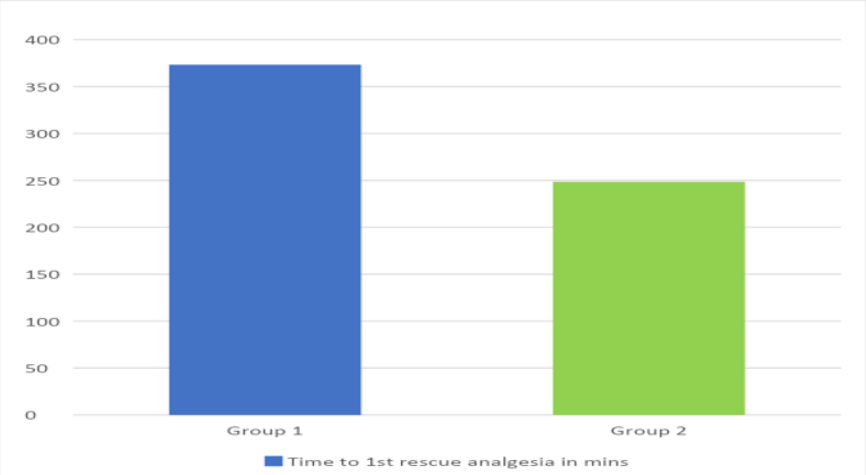

Figure 3: Time for first analgesic demand

Table 2: Numeric Rating Scale scores at rest

Group 1 Group2 Time interval (n-30) (n-30) P- value (Mean±SD) (Mean±SD)			
30th min	1.14±1.26	1.4±1.96	0.182
1sthr	1.65±1.08	1.55±1.4	0.165
2ndhr	1.88±1.14	1.89±1.17	0.152
3rdhr	1.45±1.19	1.88±1.76	0.175
6thhr	1.88±1.15	2.52±1.92	<0.001
8thhr	1.34±1.47	2.75±1.99	<0.001
12thhr	2.61±1.17	2.8±1.89	0.162
15thhr	2.74±0.68	2.78±1.93	0.173
18thhr	2.56±1.35	2.45±1.18	0.441
21sthr	2.29±0.55	2.14±0.79	0.335
24thhr	3.22±0.41	3.35±0.53	0.021

Table 2 shows NRS at rest among two groups. Up to 3hrs NRS score at rest in ESP block (group1) was comparable to OSTAP block (group2) which was comparable. After 3hrs NRS score in group 2 started to increase in comparison to group 1(P<0.05).

Table 3: Numeric Rating Scale scores during coughing/movement

Group 1 Group2 Time interval (n-30) (n-30) P- value (Mean±SD) (Mean±SD)			
30th min	1.24±2.24	1.26±2.29	0.217
1st hr	1.75±2.52	1.78±2.36	0.179
2nd hr	1.96±2.14	2.81±2.13	0.115
3rd hr	1.84±2.17	2.85±2.25	<0.001
6th hr	2.35±1.19	2.87±1.21	<0.001
8th hr	2.74±1.46	2.89±1.39	<0.001
12th hr	2.94±1.75	3.21±1.63	0.172
15th hr	2.98±1.57	3.23±1.53	0.115
18th hr	2.99±1.77	3.11±1.72	0.271
21st hr	3.21±1.55	3.14±1.43	0.198
24th hr	3.54±1.92	3.46±1.92	0.952

Table 3 shows numeric rating scale (NRS) on coughing/ movement in all the two groups. Upto 2hr NRS score on coughing/ movement in ESP (group 1) was comparable to OSTAP block (group 2) (p>0.05) But after 2 hrs NRS score in OSTAP (group 2) is significantly higher to compared to ESP (group 1) (P<0.05).

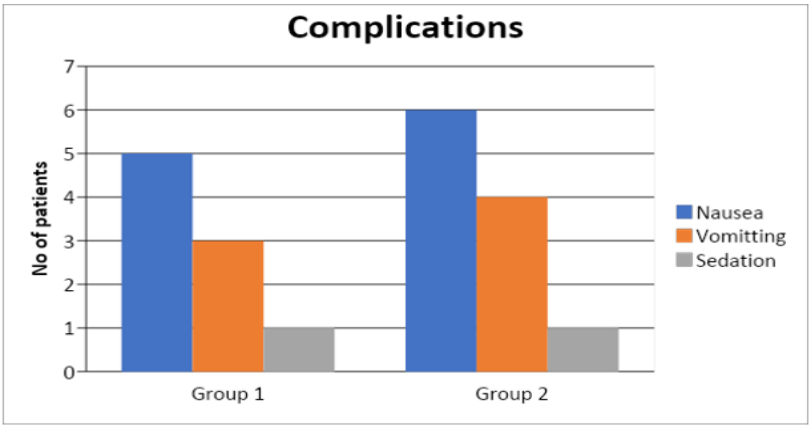

Figure 4: Complications

Figure 4 shows different complications (nausea, vomiting, and sedation) between the two groups ESP block (group 1) and OSTAP block (group 2). Incidence of complications were comparable among both the groups.

Discussion

Open cholecystectomy has been mostly replaced by laparoscopic cholecystectomy since the early 1990s. [1] This being a surgical invasive technique is accompanied with moderate to severe postoperative pain. The Laparoscopic Cholecystectomy pain has various parts; one being somatic pain at the trocar insertion site, surgical manipulation giving rise to visceral pain, pneumoperitoneum and referred pain to the tip of the right shoulder. [7]

Many analgesics, anti-inflammatory drugs, local anaesthetic infiltration and opioids were used for pain relief. [2] Regional blocks provided good analgesia. Transversus abdominis plane (TAP) block was better than local anaesthetic infiltration [3] and the precision improved when it was done under ultrasound guidance [4].Thoracic epidural analgesia, thoracic paravertebral block and quadrates lumborum block are the various techniques which has been used successfully. Nonetheless, these procedures are time consuming and difficult leading to undesirable effects [13]. Thoracic epidural analgesia had prolonged hospitalization than conventional analgesic methods. [8] Similarly, complications like pneumothorax is most commonly associated with ultrasound guided thoracic paravertebral block. [9] ESP block done under USG guidance is comparatively performed easily and quickly, producing equal benefits and associated with less risk. [10]

As the erector spinae muscle originates from nuchal line upto the sacrum, it provides analgesia over a larger area by blocking the ventral, dorsal and rami communicates of spinal nerves [6]. Erector Spinae block blocks the rami communicantes which transmits fibres of the sympathetic ganglia. Some studies have shown efficacy of ESP block for pain management after Laparoscopic Cholecystectomy. [11] OSTAP Block affects the somatic and parietal components of postoperative pain after LC, the lack of a visceral component causes inadequate analgesia in some patients. Injection in the subcostal area; LA is injected between the posterior rectus sheath (PRS) and Transverse abdominis muscle. This block when given bilaterally prior to surgery, controlled postoperative somatic pain in upper abdominal surgeries but visceral pain is not blocked. [5,12]

This research was designed to compare the effectiveness of postoperative analgesia by ultrasound guided ESP block vs OSTAP block in patients undergoing laparoscopic cholecystectomy. Sixty nine patients incorporated in this study were posted for Laparoscopic Cholecystectomy. One patient having deranged coagulation profile, three with block site skin infection, two suffering from chronic renal failure and three had BMI>30kg/m2 were excluded from the study. Therefore, in this research 60 cases were included. Inj. Bupivacaine 0.25% was injected in between the rectus sheath and the transverses abdominis muscle. The age distribution in ESP block (Group 1) was 52.18±10.46 and 51.49±11.25 in OSTAP (Group 2). The P value was 0.262 ($p>0.05$). There were 16 females 14 males in ESP (Group1) and 17 females 13 males in OSTAP block (Group 2) making the P value 0.157 ($p>0.05$).

In ESP block (group 1), 21 patients were in ASA I status and 9 in ASA II status. In OSTAP (group2), 20 patients were in ASA I and 10 patients were in ASA II status, so the p value was 0.730 (P value > 0.05). The mean BMI of ESP block (group1) was 24.14±3.15kg/m2 and OSTAP block (Group2) was 24.18±3.12 kg/m2 the p value being 0.162 which was statistically insignificant ($p>0.05$). There was no significant statistical difference between the two groups regarding age, sex, ASA status, BMI, block performance time and duration of patients. It was noted that the analgesic requirement was comparatively less in ESP block (group1) than

OSTAP block (group 2) intraoperatively and postoperatively. The intraoperative fentanyl requirement and postoperative Paracetamol requirement was much lower in the ESP group. The postoperative NRS scores at rest and on coughing were notably lower in the group 1 when compared to the group 2.

Duration for 1st rescue analgesia was increased in ESP block (group1) which was remarkably significant. Rescue analgesia requirement was more in OSTAP block (group 2) in contrast to ESP block (group1). During the intraoperative period, the heart rate and MAP was slightly less in ESP block (group 1), with no statistically significant difference between the ESP block (group 1) and OSTAP block (group 2) ($p>0.05$).

Although fentanyl required intra operatively was higher in the OSTAP block Group 2 (78.94±20.52mcg) in comparison to ESP Group 1 (74.86±18.44mcg) and p value being 0.218 which was statistically in significant. PONV and sedation was comparable. 373.83±28.94 mins in Group 1 and 280.51±45.66mins in Group 2 was the mean time taken for the first rescue analgesia, which was clinically significant (p value<0.05)

The NRS score when patient is at Rest in ESP block (group1) and OSTAP block (group2) was comparable upto 3hours. After 3 hours NRS score in Group2 started to increase in comparison to Group 1(p value<0.05). NRS score on coughing or movement was lower in Group 1 than in Group 2 upto 2 hours which was not statistically significant, but after 2hours the NRS score started rising till 8th hour in Group 2 versus Group1 (p value < 0.05).

The total paracetamol consumption in the first 24hrs postoperatively was noted to be 1.7±0.45gms in ESP block (group 1) and 2.62±0.32gms in OSTAP block (group 2), statistically significant (p value<0.05) Tulgar et al. [14] Described various groups of analgesia protocols in three patients who had undergone ERCP followed by LC. They conducted ESP block under ultrasound guidance by injecting 10 ml of 0.5% bupivacaine, 5 ml of 2% Lidocaine and 5 ml of isotonic saline at the T8 level after anaesthesia induction.

Their report was that in an ambulatory surgical setting, the patients had NRS scores less than 3/10. In another study, Tulgar et al. [15] evaluated the effect of ESP block under ultrasound guidance on the pain scale postoperatively and requirement of analgesics after LC in a randomized controlled trial. In that study, due to failure of block, they escalated the bupivacaine concentration to 0.375%. Aksu et. al [16] Described three pediatric patients who were given ESP block along with paracetamol (15 mg/kg) IV for analgesia after LC. These ESP blocks were performed at the level of T7 with 0.5 ml/.kg of 0.25% bupivacaine (maximum dose: 20 ml per each side) and it was seen that none of the patients required rescue analgesia in the first 48 hours postoperatively. Aksu C et al [16] came to the conclusion that ESP block given bilaterally was a more potent analgesia in pediatric LC. It was seen that the total analgesic consumption (Paracetamol in gms) in 1st 24hrs was notably lower in ESP block (group1) than OSTAP block (group 2) Altiparmac et al [17] in their study opined that USG guided ESP block decreased the intraoperative fentanyl requirement, pain scores, and postoperative opioid requirements more successfully than OSTAP block in patients undergoing LC surgery. The time to first requirement of additional analgesia was significantly more in the ESP group. At Rest, numeric rating scale (NRS) scores were comparable in both groups upto 3hrs but in the subsequent hours the NRS score in the OSTAP group started increasing. On coughing or movement, the NRS score was comparable upto 2 hrs but after that NRS score in the OSTAP group was raised.

Conclusion

The study concludes that the total analgesic requirement in first 24 hours was comparatively lesser in ESP block group compared to OSTAP block group done under USG guidance in patient undergoing LC. Also, time for first rescue analgesia was prolonged in ESP block group. Intraoperative requirement of fentanyl was also reduced in ESP block group than in OSTAP block group.

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