

Effectiveness of ultrasound guided erector spinae block for post-operative analgesia following laparoscopic cholecystectomy in a tertiary level hospital

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ABSTRACT

Introduction: A minimally invasive method for the treatment of gallstone disease is laparoscopic cholecystectomy (LC). Various strategies and methods are used to alleviate post-operative pain, and some patients still experience moderate to severe pain. Erector spinae plane block (ESPB) has been demonstrated to have beneficial post-operative analgesic effects when used as a part of multimodal analgesia.

Objective: To evaluate the post-operative analgesic effect of ultrasound guided bilateral erector spinae plane block in adult patients undergoing laparoscopic cholecystectomy.

Methodology: A prospective observational comparative study was carried out in 102 patients at Kathmandu Medical College from June 2023 to December 2023 after ethical clearance. Patients were randomized to receive either bilateral ESPB at T7 level or port site infiltration with 40 ml of 0.25% bupivacaine. Primary outcome measures were total opioid consumption and mean Visual Analogue Scale (VAS) in the first 24 hours post-operatively. The results were analyzed using the Statistical Package for the Social Sciences (SPSS) software. Continuous and categorical data were analyzed using appropriate statistical analysis. A p-value < 0.05 was considered statistically significant.

Results: Bilateral ESPB significantly reduced post-operative pain score compared to port site infiltration. We observed statistically significant differences in VAS between two groups at 6, 12 and 24 hours' time frame. The mean 24 hours opioid consumption in ESPB was 33.33±31.091 mg and in port site infiltration group was 112.75±42.241; p=0.000001.

Conclusion: Ultrasound guided bilateral ESPB provides effective post-operative analgesia and reduced opioid consumption after laparoscopic cholecystectomy compared to port-site infiltration.

Keywords: Laparoscopic cholecystectomy; post-operative analgesia; ultrasound guided erector spinae plane block.

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INTRODUCTION

Laparoscopic cholecystectomy (LC) is a commonly performed minimally invasive surgical procedure frequently resulting in moderate to severe post-operative pain with two components, somatic and visceral. Trocar entry incisions lead to somatic pain, while peritoneal distension with diaphragm irritation causes visceral pain.^{1,2}

Various multimodal analgesic approaches have been used in perioperative period following laparoscopic

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cholecystectomy.^{3,4} Ultrasound-Guided Erector Spinae Plane block, was first described by Forero et al.⁵ It is rapidly gaining popularity among anaesthesiologists and applied in various surgeries as a part of multimodal analgesic regimens.⁶

The ESPB is performed by depositing the local anaesthetic (LA) in the fascial plane, deep to the erector spinae muscle at the tip of the transverse process of the vertebra. It targets the ventral rami, dorsal rami and rami communicantes of the spinal nerves and thus results in the blockade of both somatic and visceral pain.^{7,8} ESPB block provides analgesic effect on somatic and visceral pain by blocking the dorsal and ventral rami of the spinal nerves, depending on the level of injection site.⁹ Bilateral ESP block has reported to be as effective as thoracic epidural analgesia as the local anaesthetic widely spreads cranially and caudally.¹⁰

METHODOLOGY

This study was a hospital-based prospective, observational comparative study, done at department of anaesthesia and critical care, Kathmandu Medical College Public Limited. Data collection was done from June 2023 to December 2023 after ethical clearance from institutional review committee (Ref. 09062023/05). The sample size was calculated assuming an effect size of 0.5 between the groups, alpha error 0.05 and power of 80%. The calculated sample size was 102 using G power software version 3.1.9.4.

After informed written consent, 102 adult patients scheduled for elective laparoscopic cholecystectomy under general anaesthesia were enrolled in this study.

Patients belonging to American Society of Anaesthesiologists physical status I and II of either sex, aged 18-60 were included in this study.

Patient with coagulation disorder, history of allergy to local anaesthetics, psychiatric illness, substance abuse and opioid dependent and morbid obesity (body mass index ≥ 35 kg.m²) were excluded from this study.

Detailed pre-anaesthetic evaluation was done a day prior to surgery. Pre-operatively all patients were instructed regarding the visual analogue scale (VAS) in which 0 means no pain and 10 indicates severe pain. Patient were kept nil per oral for 8 hours prior surgery. All patient received tablet Ranitidine 150 mg as oral premedication. On the day of surgery, in operation theatre intravenous access was obtained with 18G cannula. All patients received general anesthesia

with ASA standard monitoring. Anesthesia was induced by Fentanyl 2mcg/kg, propofol 2mg/kg and endotracheal tube was facilitated with vecuronium 0.1mg/kg intravenously. Anesthesia was maintained with total 1liter of gas in equal oxygen and air ratio, isoflurane (1-1.5%), intermittent dose of vecuronium with controlled ventilation. ET_{CO}₂ was maintained between 30-35mmHg. Intra-abdominal pressure was maintained at 10-12 mmHg to minimize hemodynamic and respiratory complications. All the patients received paracetamol 1 gm intravenous infusion intraoperatively at the beginning of surgery. At the end of surgery before extubation, patient received either ultrasound guided bilateral erector spinae plane block using high frequency linear ultrasound probe or port-site local anaesthetic infiltration.

Patients were assigned into two groups to receive ultrasound guided, bilateral erector spinae plane block or port site infiltration using sequentially numbered opaque envelopes.

Port-site infiltration was done with 40ml of 0.25% isobaric bupivacaine in which 30 ml instilled in the gall bladder fossa, surrounding structure and the rest 10 ml was injected at the laparoscopic port sites while ultrasound guided bilateral ESPB was given at lateral position with 40 ml of 0.25% isobaric bupivacaine with 21 gauge of sonoplex needle, at the level of T7 transverse processes using intra-plane technique in cranio-caudal direction.

When patient's spontaneous respiratory effort appeared, muscle relaxation was reversed with neostigmine 0.05mg/kg and glycopyrolate 0.01mg/kg. Following adequate and complete recovery patient was transferred to the post-operative unit and after that transferred to ward. Intravenous Injection paracetamol 1 gm 8 hourly with injection ketorolac 30 mg 8 hourly were given as post-operative standard analgesic in both groups. Then the pain was assessed at 1hr, 3 hr, 6 hr, 12 hr and 24 hr duration via VAS score. At any point of time, VAS score is more or equal to 4, injection tramadol 50mg was given as rescue analgesia. Total tramadol consumption over 24 hr was recorded.

The data were entered in Microsoft Excel Sheet and analysed using SPSS Statistics for Windows, version x.23 (SPSS Inc., Chicago, Ill., USA). Descriptive results were presented in frequencies, percentage, mean and standard deviation (SD). Differences between the groups were analyzed by student's t-test for normal distribution data and for non-parametric data, Chi-square test was used. The p-value <0.05 was statistically significant.

RESULTS

A total of 102 patients who fulfilled the inclusion criteria were enrolled for this study where Erector spinae plane block group (n=51) and port site infiltration group (n=51). There were 17 (33.3%) male and 34 (66.7%) female in erector spinae plane block group whereas 15 (29.4%) male and 36 (70.6%) female in port site infiltration group. On analyzing the demographic data, we found no statistically significant differences in age, sex, ASA classification, weight and duration of surgery among the groups. (Table 1) None of the patients in either group had post-operative pain requiring rescue analgesia at one hour and three hours due to analgesic effect of intra-operative opioids. The ESPB and port site infiltration were equivalent in decreasing post-operative pain in the first three hours. The mean VAS score were found to be reduced in patients who had received bilateral erector spinae plane block at 6, 12 and 24 hours post-operatively as compared to the port site infiltration group. These differences in mean VAS scores were found to be statistically significant (Table 2). The mean tramadol consumption was 33.33 ± 31.091 mg in erector spinae plane block and 112.75 ± 42.241 mg in port site infiltration. The overall 24 hours tramadol consumptions was significantly higher ($p=0.001$) in patient with port

site infiltration group (Table 3). There were no other procedures related complication including infiltration site bleeding, local anaesthesia systemic toxicity, pneumothorax and injury to visceral organ.

DISCUSSION

Adequate post-operative pain management after surgery allows reduction in the post-operative stress response, permits rapid mobilization, better patient satisfaction and allows early hospital discharge.⁴ Post-operative pain after laparoscopic cholecystectomy has two components. Somatic pain arises from abdominal wall trauma due to the ports and the visceral pain arising from the gall bladder resection, stretching of peritoneum due to pneumoperitoneum. Erector spinae plane block plays a great role for post-operative analgesia.^{11,12} Traditional methods of treating post-operative pain treatment after laparoscopic cholecystectomy are administration of opioids, local anaesthesia infiltration, anti-inflammatory drugs and thoracic epidural analgesia. Administration of opioids causes respiratory depression, sedation, nausea and vomiting, constipation and delayed hospital discharge, fear of addiction and dependence largely results in under treatment of pain.^{4,13}

Table 1: Comparison of demographic variables between the groups

Variables	ESP block	Port site infiltration	p-value
Age (years)	45.29±15.448	45.35±14.470	0.607
Sex	Male	17 (33.3%)	0.831
	Female	34 (66.7%)	
ASA	1	25 (49%)	0.691
	2	26 (51%)	
Weight (kg)	64.10±11.432	63.88±9.688	0.205
Duration of Surgery (min)	52.65±14.878	55.82±17.693	0.391

Table 2: Comparison of mean VAS score between the groups

Time interval	ESP block	Port site infiltration	p-value
1 hr	3.63±1.800	4.25±1.611	0.066
3 hr	3.08±1.383	4.71±7.471	0.129
6 hr	2.45±0.986	3.98±1.086	0.001*
12 hr	2.43±.728	3.35±.976	0.003*
24 hr	1.69±.990	2.63±.894	0.002*

p-value significant at <0.05 *= independent t test

Table 3: Comparison of analgesic consumption between the groups

Total opioids consumption (mg)	ESP block	Port site infiltration	p-value
Tramadol	33.33±31.091	112.75±42.241	0.001

p-value significant at <0.05 *= independent t test

Recent literature revealed that multimodal analgesia technique has been used to improve the analgesic effect.³ Ultrasound guided erector spinae plane block is one of the effective components of multimodal analgesia and has become popular for post-operative pain management. Erector spinae plane block was first described by Forero et. al by depositing local anaesthesia in the fascial plane, deeper than the erector spinae muscle at the tip of the transverse process of the vertebra.⁷

In our study 34 (66.7%) in erector spinae plane block and 36 (70.6%) port site infiltration were female. The higher in female population signifies, gall stone diseases are more common in them which were similar to study shown by Kharbuja et al.¹⁵

Our study revealed that there was significant decrease in VAS pain score in the erector spinae plane group during the first 24 hours which was similar to the findings as concluded by Ibrahim M et. al.¹⁶

In our study, the total opioid requirement during first 24 hours was significantly less in erector spinae plane group than port site infiltration group. (33.33 ± 31.091 mg vs 112.75 ± 42.241 mg; $p=0.000001$) which was similar to study done by Ibrahim M et. al and Sahu et al.^{12,16}

Various randomized clinical trials had shown the clinical efficacy of erector spinae plane block in adults undergoing laparoscopic cholecystectomy surgery. Most of them showed the effectiveness of ESP block by reduction of post-operative rescue analgesia, lowering

the pain scores and reduction in opioid consumption. Similarly, following erector spinae plane block there was significant reduction in post-operative tramadol consumption, lowering pain scores and sparing opioid induced side effects as demonstrated by our present study with no local anaesthetic systemic toxicity was noted. This might be due to the use of real time ultrasound and low volume of local anaesthetics used.

CONCLUSION

This study concluded that ultrasound guided bilateral ESPB provides better post-operative analgesia with low pain score and reduces post-operative opioid requirement compared to port-site infiltration. It is a safe and effective component of multimodal analgesia for the post-operative pain management in patient undergoing laparoscopic cholecystectomy.

Erector spinae plane block improved the quality of recovery and post-operative analgesia in patients undergoing laparoscopic cholecystectomy. We therefore recommend that ESPB be included in the multimodal post-operative analgesia protocol.

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