

## Case Series

# Enhanced Recovery with Erector Spinae Plane Block in Hepatobiliary Surgeries: A Case Series.

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## Abstract

**Introduction :** The erector spinae plane (ESP) block is a novel technique for post-operative pain management in abdominal surgery. Peri-operative analgesia provision is an essential component of ERAS (Enhancing Recovery after Surgery) pathways, which aim to improve recovery, reduce opioid consumption, and facilitate early mobilization. This case series demonstrates the utility of the ESP block in improving pain control and enhancing recovery in hepatobiliary surgeries, specifically in reducing post-operative pain, opioid consumption, and promoting early functional recovery.

**Case Reports :** This case series reports on various hepatobiliary surgeries, including radical cholecystectomy, pancreatic pseudocyst drainage, Common Bile Duct (CBD) exploration, excision of hydatid cyst of the liver, and exploratory laparotomy for ruptured liver abscess. Pre-emptive ESP blocks were administered at lower thoracic levels using ultrasound guidance. Intra-operative nociceptive monitoring was done using the CONOX® monitor, and post-operative NRS scores were recorded at various time points for 24 hours.

**Discussion :** Significant reduction in post-operative pain scores, decreased opioid requirements both intra-operatively and post-operatively, early ambulation, and shorter hospital stays were observed in all five cases. This demonstrates the potential benefits of the ESP block in improving post-operative pain management and enhancing recovery in patients undergoing abdominal surgery, specifically in the context of hepatobiliary procedures.

**Conclusion :** The ESP block is a valuable adjunct in post-operative pain management for abdominal surgeries, offering effective analgesia, reducing opioid consumption, and facilitating early recovery.

**Keywords:** Early Ambulation, Nociception, Pain, Postoperative, Analgesia, Nerve Block

## INTRODUCTION

Analgesia for hepatobiliary surgeries can be provided by both parenteral means and Regional Anaesthesia/Analgesia techniques. Enhanced Recovery After Surgery (ERAS) pathways in hepatobiliary surgeries aim to improve patient outcomes and decrease opioid prescribing in post-surgical patients.<sup>1</sup> ERAS represents multimodal strategies that include patient education, optimal analgesic relief, stress reduction with regional anaesthesia, focused nursing and early mobilisation to augment the rapid return of functional recovery.<sup>2</sup> Thoracic epidural analgesia, nerve blocks such as paravertebral block, transversus abdominis plane block (TAP), or quadratus lumborum block (QLB) have been used for the provision of analgesia in hepatobiliary surgeries.<sup>3</sup>

The Erector Spinae Plane (ESP) Block was first used successfully by Forero et al. in patients with thoracic neuropathic pain.<sup>4</sup> Since then, the ESP block has been used for provision of

analgesia in a multitude of surgeries, including cervical surgeries, mastectomies, thoracic and cardiovascular surgeries, open abdominal surgeries, caesarean sections, laparoscopic abdominal surgeries and spinal surgeries.<sup>5</sup>

In the ESP block, the target is the dorsal and ventral rami of the spinal nerves that lie in close proximity to the transverse process of vertebrae, which is easily identifiable and relatively distant from major vascular structures and the pleura. The ESP block is particularly advantageous for providing extensive analgesia with a single puncture, making it a versatile technique that can be performed in a variety of patient positions such as sitting, lateral decubitus, or prone. This makes it possible to administer the block away from the surgical site, which is beneficial in certain surgeries like hepatobiliary procedures.<sup>6</sup> In this case series, the application of ESP block in five different patients undergoing hepatobiliary surgeries is discussed, demonstrating its potential in enhancing recovery and reducing opioid consumption.

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## METHODOLOGY

Patients of either gender with ASA (American Society of Anaesthesiologists) Physical Status I or II, and posted for various hepatobiliary surgeries were included. The patients were informed during preoperative assessment (in the language they understood) regarding the procedure that would be done in the operative room, and written informed consent was obtained. The ESP block is a well-established standard technique of pain relief. The cases were done at different times and thus Institutional Ethics Clearance was not obtained. All study subjects were familiarized with usage of Numerical Rating Scale (NRS), identifying 0 (zero) as no pain and 10 (ten) as worst imaginable pain.

The patients were fasted as per ASA guidelines and given T. Alprazolam 0.25mg orally at night and on the morning of the surgery. Upon arrival in the operation theatre, all Standard ASA Monitors were attached. An Intravenous Cannula was secured and a standard induction regimen with Inj. Fentanyl (2µg/kg), Inj. Propofol (1.5-2.5mg/kg titrated to the loss of verbal response) and Inj. Vecuronium (0.1mg/kg) was followed. After securing the airway, the patients were turned to a lateral position for block administration.

The block was performed under all aseptic precautions. After cleaning and draping, a covered, sterile Ultrasound Probe was used to identify the Transverse Process of the vertebra (vertebral level decided depending on the surgical site) in the sagittal plane. A 100mm, 21-gauge echogenic cannula needle was directed towards the lateral margin of the transverse process using real time in-plane visualisation in Cephalad-Caudal direction (**Figure 1**). 20 mL of 0.25% bupivacaine (maximum 2 mg/kg) was used for each block administration site (for bilateral blocks the total volume was 40mL of 0.25% bupivacaine). Inj. Dexmedetomidine 1µg/kg was used as an adjuvant. The superior and inferior spread of the solution was visualised under ultrasound guidance. The study subjects were then immediately made supine and the surgery commenced post the block administration.

**Figure 1.** Ultrasound Anatomy of the Erector Spinae Plane.



Intra-operatively, CONOX® (Fresenius Kabi) monitoring (**Figure 2**) was used to guide additional fentanyl bolus requirements. A bolus of 0.5 µg/kg Fentanyl was administered when the qNOX (nociception) index rose >60. Intra-operative qNOX index was kept at a value of ≤ 60.

Post Operative Pain was assessed using Numerical Rating Scale (NRS) on arrival at PACU,<sup>7</sup> at 30 mins, 2, 4, 6, 9, 12 and 24 hours postoperatively. Inj. Diclofenac 75 mg IV was administered if the NRS was >3/10.

**Figure 2.** Conox Monitor With The Qnox Nociception Index.



**CASE REPORTS**

**Case 1**

A 65-year-old, 50 kg female with a history of gallstone disease was diagnosed with gallbladder carcinoma and posted for a radical cholecystectomy with lymphadenectomy via laparotomy. Her co-morbidities included type 2 diabetes mellitus (well controlled with Tab Metformin 500 mg BD) and COPD (Chronic Obstructive Pulmonary Disease). After induction of general anaesthesia, bilateral ESP block was performed at T7 level using 20 ml of 0.25% bupivacaine and 25 µg dexmedetomidine on each side. The patient was made supine and handed over to surgeons; the surgery proceeded uneventfully. Intra-operative nociception monitoring was done, and qNOX index was maintained at a value of ≤ 60 (**Table 1**). The patient was extubated and shifted to the post-operative area. NRS scores were consistently less than 3 till 24 hours post-operatively, except at 9 hours when the NRS was 5/10 (**Table 2**). Total amount of rescue analgesic required was 75 mg Diclofenac (**Table 3**); opioids were not required. The patient was subsequently discharged on post-operative day 3.

**Case 2**

A 50-year-old, 60 kg male with a history of chronic pancreatitis presented with a large symptomatic pancreatic pseudocyst requiring drainage. His medical history included hypertension well-controlled with Inj Telmisartan 40 mg HS. Ultrasound-guided percutaneous drainage of the pancreatic pseudocyst was planned. After induction of general anaesthesia, left-sided ESP block was administered guidance at T9 level using 20 ml of 0.25% bupivacaine and 60 µg of dexmedetomidine. The drainage procedure was uneventful, and the patient remained pain-free throughout the procedure (**Table 1**). NRS scores recorded for the first 24 hours (Table 2) post-procedure were consistently less than 3/10, indicating effective analgesia. No rescue analgesics or opioids were required. The patient was discharged on post-operative day 2.

**Table 1.** Intra-operative nociception monitoring with CONOX® monitor.

Case No	q-NOX value at various time-points intra-operatively								
	After Induction	Block Administration	Skin incision	30 mins	60 mins	90 mins	120 mins	150 mins	180 mins
1	54	42	57	54	43	36	33	37	
2	52	47	46	32	39	45			
3	59	35	44	46	57	77	43	46	57
4	48	44	45	56	55	52			
5	50	42	38	35	37	45			

qNOX – Nociception index. It is a dimensionless number ranging from 0-99. A qNOX value of 61-99 suggests that the patient is likely to respond to noxious stimuli

**Case 3**

A 40-year-old, 60 kg female with a history of recurrent abdominal pain and jaundice was diagnosed with a choledochal cyst. She was posted for common bile duct (CBD) exploration with choledochal cyst excision and hepaticojejunostomy. Her medical

history included Type 2 Diabetes Mellitus well controlled with Tab Glimepiride (2 mg) + Metformin (500 mg) BD. Her baseline investigations revealed a derangement of liver enzymes, with an INR (International Normalised Ratio) value of 1.5. After administration of general anaesthesia, a bilateral ESP block was performed at T8 level using 20 ml of 0.25% bupivacaine and 30 µg of dexmedetomidine on each side. Subsequently, the patient was made supine and handed over to the surgeons. Intra-operative hemodynamics were stable, with one top-up of fentanyl 30 µg administered 90 minutes into the surgery (qNOX value >60) (Table 1). The patient was extubated and shifted to the post-operative area. The rescue analgesic Inj. Diclofenac 75 mg IV was required 12 hours post-operatively (NRS 4/10). Except for this instance, NRS scores were less than 3/10 for 24 hours post-operatively (Table 2). No opioids were required post-operatively. This patient had an early return of bowel function and was discharged on post-operative day 3.

**Table 2.** NRS scores post-operatively (Scores out of 10).

SURGERY	NRS-0 mins	NRS-30 mins	NRS-1 hour	NRS-2 hours	NRS-4 hours	NRS-6 hours	NRS-9 hours	NRS-12 hours	NRS-24 hours
Radical Cholecystectomy	2	1	0	2	3	3	5	0	1
Pancreatic Pseudocyst drainage	1	2	1	0	0	0	1	0	2
CBD Exploration	3	2	0	0	2	2	3	4	2
Excision of Hydatid Cyst	2	1	0	2	2	2	3	4	1
Exploratory laparotomy	2	3	2	1	1	0	2	3	2

NRS – Numerical Rating Scale

#### Case 4

A 53-year-old, 70 kg male patient diagnosed with large hydatid cyst of the liver (10 x 7 cm) was scheduled for a laparoscopic cystectomy. His medical history included Hypertension which was well controlled with Tab Telmisartan 40 mg BD. After induction of General Anaesthesia, the ESP block was administered at the T7 level bilaterally using 20 mL of 0.25 % bupivacaine and 35 µg of dexmedetomidine on each side. No intra-operative opioid boluses were required, as guided by the qNOX nociceptive index (Table 1). After surgery, the patient was extubated and shifted to the post-operative area. NRS scores were monitored for 24 hours post-operatively (Table 2) and Inj. Diclofenac 75 mg IV was required 12 hours post-operatively with NRS of 4/10 (Table 3). The patient was allowed to ambulate on post-operative day 2 and was discharged on post-operative day 3.

**Table 3.** Total amount of analgesic requirement.

Case No	ANALGESIC REQUIREMENT	
	Intra-Operative	Post-Operative
1	NIL	Inj Diclofenac 75 mg IV at 9 hours post-operatively (NRS 5/10)
2	NIL	NIL
3	30 µg IV Fentanyl 90 minutes into surgery (q-NOX 77)	Inj Diclofenac 75 mg IV at 12 hours post-operatively (NRS 4/10)
4	NIL	Inj Diclofenac 75 mg IV at 12 hours post-operatively (NRS 4/10)
5	NIL	NIL

#### Case 5

A 14-year-old, 45 kg female patient presenting with complaints of severe abdominal pain for 1 day was diagnosed with a ruptured amoebic liver abscess. She underwent exploratory laparotomy for abscess drainage, peritoneal lavage and drain placement. She had no known medical co-morbidities. After induction of general anaesthesia, a bilateral ESP block was administered at T8 level using 15 mL of 0.25 % Bupivacaine and 20 µg dexmedetomidine on each side. The intra-operative course was uneventful. Additional intra-operative analgesics were not required (as guided by the qNOX index ≤ 60) (Table 1). Following reversal of neuromuscular blockade and extubation, the patient was shifted to the post-operative area. NRS scores were less than 3/10 for 24 hours post-operatively (Table 2) and the patient was discharged on post-operative day 3.

## DISCUSSION

This case series emphasizes the potential benefits of the erector spinae plane (ESP) block in improving post-operative pain management and enhancing recovery in patients undergoing hepato-biliary surgeries. By blocking the transmission of pain signals from the spinal nerves to the central nervous system, the ESP block can reduce the need for systemic opioids, which are associated with many deleterious side-effects such as respiratory depression, nausea, constipation, and opioid-induced hyperalgesia.<sup>8</sup>

We employed nociceptive monitoring to guide intra-operative analgesic requirements. This allowed us to distinguish pain-related haemodynamic changes from those caused by other factors, such as blood loss or inadequate anaesthesia depth. The qNOX index corresponded to the probability of the patient under general anaesthesia responding to a noxious stimulus, and is a dimensionless number ranging from 0-99.<sup>9</sup> A qNOX value of 61-99 suggested that the patient was likely to respond to noxious stimuli and hence additional fentanyl boluses were administered at this time. In our case series, out of the 5 patients, only 1 patient (Case 3) required an additional intra-operative opioid bolus as guided by the qNOX index.

Regional Anaesthesia is a critical component in a multimodal pain-management strategy, and involves the use of epidural analgesia, nerve blocks and fascial plane blocks. A meta-analysis by Pepper et al. demonstrated that regional anaesthesia significantly improves acute postoperative pain and reduces opioid consumption. The authors also highlighted that regional anaesthesia not only decreases the incidence of prolonged opioid use, but also decreases the development of chronic postsurgical pain at 3 and 6 months after non-cardiac surgery.<sup>10</sup>

The peri-operative use of thoracic epidural analgesics has been shown to substantially decrease pain, reduce opioid consumption and increase patient satisfaction. However, the placement of a thoracic epidural comes with some limitations, including the requirement for patients to remain hospitalized while the epidural is in place, as well as concerns regarding the use of anticoagulants and antiplatelet drugs.<sup>11</sup> Additionally, epidural catheter insertion is contraindicated in patients with coagulopathy, a condition often seen in liver disease. In a study by Ayub et al., the authors opted for the ESP block in two patients undergoing hepatobiliary surgeries, both of whom were thrombocytopenic and therefore unsuitable for epidural anaesthesia. The ESP block provided effective pain relief post-operatively.<sup>12</sup> Notably, the Erector Spinae Plane is devoid of major vascular structures compared to epidural or paravertebral blocks, and the continuous real-time ultrasound guidance ensures a high level of precision, further reducing the risk of inadvertent vascular puncture.<sup>12</sup>

In addition, pharmacological sympathectomy leads to

vasodilation and hypotension, requiring large volumes of intravenous fluid resuscitation and vasopressor support in HPB surgeries,<sup>13</sup> where massive blood loss and fluid shifts can be anticipated. As a result, fascial plane blocks, such as the ESP block, may present a more viable option for providing peri-operative analgesia in these settings.

In the cases of radical cholecystectomy, pancreatic pseudocyst drainage, CBD exploration for choledochal cyst, excision of hydatid cyst of liver and exploratory laparotomy, the ESP block resulted in significant reductions in post-operative pain scores and opioid requirements. This facilitated early ambulation, accelerated bowel recovery, and reduced hospital stays, ultimately enhancing the overall patient experience and contributing to cost reduction in healthcare. These outcomes support the principles of Enhanced Recovery After Surgery (ERAS). A retrospective analysis done by Greenbaum et al. further confirmed that the ESP block is a feasible method for providing analgesia in Hepato-biliary surgeries, improving key ERAS endpoints by reducing hemodynamic fluctuations, fluid over-resuscitation, and opioid administration.<sup>14</sup>

## CONCLUSION

The ESP block is a valuable addition to the armamentarium of post-operative pain management strategies for hepato-biliary surgeries, offering effective analgesia, reducing opioid consumption, and facilitating early recovery. Larger randomized controlled trials are needed to corroborate these findings and to optimize the technique's parameters, including the role of adjuvants, the optimal dosage of local anaesthetics, and long-term outcomes such as effects on tumour recurrence.

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