


Case Report

External oblique intercostal (EOI) block for enhanced recovery after liver surgery: a case series

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Summary

We report our clinical experience with the external oblique intercostal block in three consecutive adult patients who underwent liver surgery for resection of metastases. Enhanced recovery guidelines for liver surgery recommend intrathecal opioids and peripheral regional anaesthetic techniques in the context of multimodal analgesia to achieve adequate postoperative analgesia and early functional recovery. However, both laparoscopic and open approaches to liver surgery involve incisions in the upper abdomen, an anatomical area not well covered by previously described peripheral regional anaesthetic techniques. The external oblique intercostal block is a novel motor- and opioid-sparing technique which blocks both the anterior and lateral cutaneous branches of the thoracoabdominal nerves which innervate the upper abdominal quadrant. In all cases in this series, we performed the blocks in a short period of time and without complications. All patients remained pain- and opioid-free in the postoperative period and achieved enhanced recovery outcomes early. We found the external oblique intercostal block to be a simple, convenient, effective and opioid-sparing regional anaesthetic technique for postoperative analgesia after liver surgery. By minimising opioid use and by obviating the need for central neuraxial anaesthesia techniques in the postoperative period, this block could be incorporated into enhanced recovery protocols for hepatobiliary surgery.

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Introduction

Enhanced Recovery after Surgery (ERAS) has become the new standard of perioperative care, with ERAS guidelines recommending locoregional techniques as part of multimodal analgesic strategies for optimal pain control to facilitate early postoperative mobilisation and functional recovery [1]. The recent introduction of fascial plane blocks (FPBs) has led to a decline in the use of the thoracic epidural, especially for minimally invasive approaches to surgery. These blocks arguably better serve the purposes of ERAS: they are safe, easy to learn, less time-consuming, are not complicated by hemodynamic instability, urinary retention or motor weakness, and can be easily adapted to multimodal analgesia protocols [2].

The ideal regional anaesthetic technique for upper abdominal surgery should block both the anterior and lateral cutaneous branches of the intercostal nerves from T6 to T10. Whilst various FPBs have been described for truncal analgesia, until recently, there has been a paucity of evidence regarding their effectiveness to provide analgesia for supra-umbilical and subcostal

incisions. The external oblique intercostal (EOI) block is a recently described FPB which has been shown to cover the anterior and lateral upper abdominal wall [3]. It provides analgesia for the upper abdomen without the systemic effects of sympathetic blockade, and without affecting motor and bladder functions. Therefore, this block could be incorporated in multimodal analgesia protocols for enhanced recovery after upper abdominal surgery.

We report our clinical experience with this novel block in three adult patients who underwent liver surgery for resection of metastases. All patients received this block in the context of multimodal analgesia for enhanced recovery after surgery.

Report

Following written informed consent, the block was performed in three patients who underwent hepatic surgery for resection of colorectal cancer liver metastases (Table 1). A laparoscopic approach was used in two patients (75-year-old woman with a body mass index [BMI] of 25 kg.m⁻², and a 70-year-old, man with a BMI of 23 kg.m⁻²), whilst one patient (67-year-old man with a BMI of 22 kg.m⁻²) had an open right hepatectomy. These patients followed our ERAS pathway for liver surgery. We did not use an epidural due to concerns regarding postoperative coagulation abnormalities. We opted for a single shot spinal with 3 ml plain ropivacaine 0.2% and morphine (200 µg) before induction of general anaesthesia in all patients. In the two patients who had laparoscopic surgery, we performed a right-sided single shot EOI block after the surgery concluded and before emergence from general anaesthesia, to prevent postoperative pain in the postanesthesia care unit (PACU). We assumed that by the time the patients were awake and transferred to PACU the block would have taken effect. In the patient who underwent open right hepatectomy, we placed a right-sided EOI catheter in the recovery area; this patient complained of moderate pain (numerical pain rating scale, NPRS 5/10) upon waking. Instead of administering opioids for rescue analgesia, we decided to perform the block and site a catheter to prolong the analgesia into the postoperative period.

All patients were positioned supine, and an aseptic technique was used. A linear high-frequency probe (12 MHz, Vscan Air™, GE Healthcare, Europe) was placed in the sagittal plane between anterior axillary line and midclavicular line at the level of the sixth rib, allowing identification of the sixth rib, the intercostal and the external oblique muscles (Fig. 1a and b). A 50 mm needle (Stimuplex® Ultra 360®, B.Braun, Melsungen, Germany) was advanced in plane from cephalic to caudal direction to place the tip in the musculofascial plane between the superficial external oblique muscle and the deep intercostal muscle. After negative aspiration, a total volume of 20 ml (ropivacaine 0.375% with 75 µg clonidine) was injected in 5 ml increments while observing with the ultrasound for adequate fluid spread between the fascia of external oblique above and the rib or fascia of the intercostal muscle below. For the catheter technique, we used a perineural catheter kit (Contiplex®S NRFit®Set, B.Braun, Melsungen, Germany)(Fig. 1c).

The two patients who had laparoscopic liver surgery were prescribed postoperative analgesia with regular low-dose paracetamol (1 g every 12 h) and rescue analgesia with tramadol 100 mg. None of them required any postoperative opioids either in PACU or in the ward. Both patients had an uncomplicated recovery and were transferred to a regular surgical ward after discharge from PACU. They were mobilised the same day and they were discharged from the hospital after 3 days following an uneventful recovery.

In the patient with the EOI catheter, satisfactory analgesia achieved within 15 min following the block (NPRS dropped from 5/10 to 0/10). The postoperative analgesia plan included a bolus technique with catheter top-ups every 12 h. We used 20 ml ropivacaine 0.375% and 75 µg clonidine during each top up. On discharge from PACU, the patient was transferred to the high-dependency unit for close monitoring for the first 24 h. The following day, the patient was transferred to the ward and was

Table 1 Summary of patient demographics, block characteristics and dynamics and analgesia outcomes. Sensory block was assessed by loss of sensation to cold using an alcohol-soaked gauze.

Patient number	Age	Sex	Comorbidities	Operation	Block technique	Dermatomal sensory coverage 30 min after block
1	75	F	Hypothyroidism Dyslipidaemia	Laparoscopic right hepatic metastasectomy	Single shot	T4–T10
2	70	M	Dyslipidaemia	Laparoscopic right hepatic metastasectomy	Single shot	T6–T11
3	67	M	Hypertension	Open right hepatectomy	Catheter	T5–T11

M, Male; F, Female; T, Thoracic.

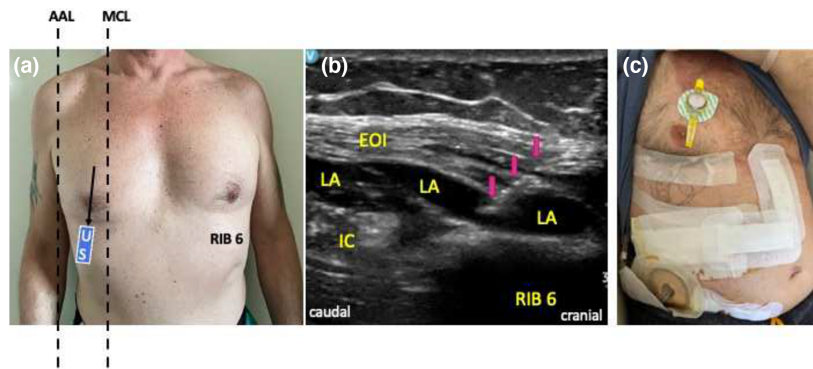


Figure 1 (a) Surface anatomy of the block. AAL, Anterior Axillary Line; MCL, Midclavicular Line; RIB 6, sixth rib; US box indicates ultrasound probe placement at the level of the sixth rib between AAL and MCL; Black arrow indicates needle insertion orientation (in-plane from cranial to caudal). (b) Sonoanatomy of the block. EO, External Oblique muscle; IC, Intercostal muscle; LA, Local Anaesthetic; Pink arrows indicate needle position. (c) EOI catheter in-situ for postoperative pain management in a patient who underwent open right hepatectomy. Permissions were obtained for the use of all images in this figure.

able to mobilise, initially with help and then independently from the second postoperative day. This patient was prescribed paracetamol 500 mg as rescue only, to avoid any drug-related hepatotoxicity; however, no paracetamol or any other analgesics were required in the postoperative period until hospital discharge, and the pain was managed exclusively with the EOI catheter. The catheter was removed on the fourth postoperative day.

None of the patients experienced block-related adverse reactions, such as hemodynamic instability, motor block, insertion site bleeding or infection, and local anaesthetic toxicity. All patients achieved ERAS outcomes early and reported they were satisfied with pain management.

Discussion

The EOI block is a novel FPB with a clear end point of injection at the tissue plane between the external oblique and the intercostal muscles at the level of the sixth intercostal space between the midclavicular and the anterior axillary lines. The site of injection is superficial with easily identifiable sonographic landmarks, and it can be performed with the patient in the supine position, making application easier even in obese patients [4]. The needle insertion site is more distant from the site of surgery than the previously described techniques. Therefore, it does not interfere with the operative field and is amendable to catheter insertion. We used this block in laparoscopic and open liver surgery for upper abdominal wall analgesia, which is difficult to achieve with previously described FPBs.

The upper abdominal wall is innervated by the thoracoabdominal nerves T6 to T10 and therefore blockade of these nerves is required for somatic analgesia. The potential mechanism of this technique has been proposed by Elsharkawy et al., who showed staining of both the anterior and lateral cutaneous branches of T7 to T10 with only one injection required in fresh frozen cadavers [3]. The same group also showed consistent dermatomal blockade of the same nerves at both the midline and the anterior axillary line in a series of 22 patients who underwent various upper abdominal procedures [3]. We reproduced a similar dermatomal sensory coverage, with evidence of blockade of both anterior and lateral branches of upper thoracoabdominal nerves.

The EOI block possesses the enhanced recovery qualities missed by previously described FPBs used for upper abdominal analgesia. Thoracic paravertebral blocks (PVB) are associated with epidural spread of local anaesthetic and pneumothorax. Furthermore, their role in abdominal surgery is not very well investigated [5]. Compared to the PVB, the erector spinae plane block (ESPB) appears to be safer; however, the spread of injectate and the resultant sensorial block appears to be variable and not predictable [6, 7]. Like the PVB, the ESPB cannot be done with the patient in the supine position, and both blocks may be difficult to perform in obese patients. The subcostal transversus abdominis plane (TAP) block and the rectus sheath block spare the lateral cutaneous branches and hence their clinical utility is limited to midline incisions only; in addition, their proximity to the surgical field makes their application inconvenient for subcostal type incisions [8]. On the other hand, the EOI block appears to

be simple, safe, effective, less time-consuming, convenient, superficial and easy to do even in obese patients; it has emerged as a strong candidate in the never-ending quest for the ideal FPB to facilitate the goals of enhanced recovery.

Enhanced recovery guidelines for liver surgery endorse not only minimally invasive surgical approaches but also less invasive regional anaesthetic techniques in the context of multimodal analgesia to facilitate early mobilisation and oral intake [9]. The plethora of peripheral regional anaesthetic techniques to choose from allows for the implementation of a personalised approach to postoperative pain management [10]. The EOI block appears to be the ideal block for upper abdominal procedures and can be easily incorporated into ERAS protocols for hepatobiliary surgery.

This case series provides further support for the hypothesis that the EOI block is suitable for upper abdominal analgesia. These findings may be somewhat limited by the small number and the heterogeneity of patients. Future studies, either randomised controlled trials or large cohort studies, are therefore recommended. Future studies could investigate the opioid-sparing capacity of this block when it is implemented in the context of ERAS for a variety of upper abdominal procedures, such as bariatrics, upper gastrointestinal, hepatobiliary and pancreatic surgery.

Overall, this case series strengthens the limited evidence available regarding the practical implications of the EOI block; it has also contributed towards enhancing our understanding of the role of this novel block in enhanced recovery analgesia after liver surgery. Its simplicity, safety profile, sensorial blockade distribution and analgesic efficacy make the EOI block an ideal regional anaesthetic technique to facilitate the goals of enhanced recovery and provide opioid-sparing analgesia for upper abdominal surgery.

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