The efficacy of ultrasound-guided oblique subcostal transversus abdominis plane block in patients undergoing open cholecystectomy

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Keywords: oblique subcostal TAP block, open cholecystectomy, anterior abdominal wall, thoracolumbar intercostal nerves, intraoperative analgesia

Abstract

Background: Ultrasound-guided oblique subcostal transversus abdominis plane (TAP) blockade has been described recently as providing a wider analgesic blockade than the posterior approach, with the possibility of being suitable for surgery both superior and inferior to the umbilicus. The objective of this study was to report the authors' experience of intraoperative oblique subcostal TAP blockade during open cholecystectomy.

Case report: This is a case series of 10 patients who had bilateral oblique subcostal TAP blockade for elective laparoscopic cholecystectomy which was subsequently converted to open cholecystectomy. Intraoperative haemodynamic parameters (pulse rate, systolic and diastolic blood pressure and mean arterial blood pressure) were recorded every five minutes. A rescue bolus of intravenous fentanyl (0.5 µg/kg) was given when any of the above-mentioned parameters were raised more than 15% from the baseline. The postoperative visual analogue score (VAS) was recorded in the recovery room. Intraoperative administration of rescue fentanyl bolus was minimal with a mean postoperative VAS of 2.1 ± 1.60. No complications were noted related to TAP blockade.

Conclusion: Ultrasound-guided oblique subcostal TAP blockade can be effective as intraoperative analgesia in abdominal surgery. Randomised controlled studies comparing TAP blockade with other modes of analgesia are needed to determine its efficacy for abdominal surgery.

Ⓟ **Peer reviewed. (Submitted: 2011-05-17, Accepted: 2011-07-20)** **South Afr J Anaesth Analg 2011;17(4):308-310**

Introduction

The ultrasound-guided transversus abdominis plane (TAP) blockade is a relatively new regional anaesthetic technique that provides adequate postoperative analgesia for abdominal surgery. This technique involves injection of local anaesthetic through the lumbar triangle of Petit into the plane between the transversus abdominis and the internal oblique muscles to block the thoracolumbar intercostal nerves.[1] Over the last few years, TAP blockade has been shown to improve patient comfort and decrease systemic opioid requirements postoperatively.[2-6]

TAP blockade has been rapidly evolving and this had led to the recently described oblique subcostal approach. Preliminary data have shown that this approach provides wider sensory blockade and is suitable for surgery both superior and inferior to the umbilicus. Despite the encouraging initial results, there have yet to be studies demonstrating the efficacy of oblique subcostal TAP block when used as a means of intraoperative analgesia. Studies comparing TAP block with standard systemic opioids or intraoperative epidural anaesthesia are also lacking.[7] To date, there is only one study evaluating the efficacy of classical TAP block compared with conventional general anaesthesia for laparoscopic cholecystectomy.[8]

This is a case series of 10 patients who were given ultrasound-guided oblique subcostal TAP blockade for laparoscopic cholecystectomy. All were subsequently converted to open technique as a result of technical difficulty and anatomical variations.

Case report

The work discussed in this report was conducted at the Sarawak General Hospital, Malaysia, after permission was granted by the hospital ethics committee. Written informed consent was obtained from all the participants and the technique of regional anaesthesia was explained. As there was a possibility of the laparoscopic surgery being converted to open surgery, patients were reassured that, despite TAP block, other standard measures, i.e. systemic opioids, which provide adequate pain relief would

be administered if haemodynamic changes suggested increasing pain intraoperatively. All the participants were subjected to standard general anaesthesia involving induction of anaesthesia with fentanyl 2 µg/kg, propofol 2 mg/kg and vecuronium 0.1 mg/kg, followed by tracheal intubation and maintenance of anaesthesia with MAC 1.0 to 1.2 sevoflurane in air/oxygen [fractional inspired oxygen (FiO_2) 30%]. Pressure-controlled mechanical ventilation was used to maintain end-tidal carbon dioxide between 35 and 40 mmHg.

Subsequently, oblique subcostal TAP blocks were performed under guidance of a GE LOGIQ e® portable ultrasound machine and a linear 5-13 MHz ultrasound transducer. The puncture area and the ultrasound probe were prepared in an aseptic manner. The rectus abdominis and underlying transversus abdominis muscles were identified near the costal margin and xyphoid process. An in-plane image was obtained and a 22 G Stimuplex® D Plus 120 mm needle (B Braun Melsungen AG, Germany) was inserted through the rectus muscle 2 to 3 cm medial to the probe. Once the tip of the needle was visualised to be in the plane between the rectus muscle and transversus abdominis muscle, and after negative pressure aspiration, 20 ml ropivacaine 3.75 mg/ml was administered incrementally in the TAP (hydrodissection) by the needle passing along the oblique subcostal line, extending inferolaterally from the xyphoid toward the anterior part of the iliac crest. The contralateral block was performed in a similar manner. The total ropivacaine dosage used was 150 mg (or the maximum subtoxic dose, 3 mg/kg) diluted to 40 ml with 0.9% saline.

Skin incision was made 15 minutes after oblique subcostal TAP block was performed. The four ports for laparoscopic cholecystectomy were inserted and the subsequent surgical procedure was performed according to departmental protocols. Haemodynamics prior to induction of anaesthesia were taken as the baseline. The pulse rate and noninvasive systolic, diastolic and mean arterial pressures were recorded every five minutes. Rescue intravenous fentanyl 0.5 µg/kg was administered when any of the above parameters increased by 15% relative to the baseline measurement. Similar repeated doses were given whenever haemodynamics remained 15% above baseline. Intraoperatively, the 10 cases were subsequently converted to open cholecystectomies, with an approximately 8 cm right subcostal incision made in all of them. The total number of fentanyl boluses and total dosage of fentanyl were taken as measurements of primary outcome.

Patients were observed in the recovery room for two hours and postoperative pain severity, sedation and nausea score were recorded as measurements of secondary outcome. Pain severity was measured using a visual analogue scale (VAS; 0 = no pain, 10 = worst imaginable pain). Sedation score was measured using a categorical scoring system (0 = awake and alert, 1 = quietly awake, 2 = asleep but easily roused, 3 = deep sleep). Nausea was likewise measured using a categorical system (0 = none, 1 = mild, 2 = moderate, 3 = severe). The patient demographics and the characteristics of intra- and postoperative anaesthetic management are summarised in Table I.

Discussion

Ultrasound-guided regional anaesthesia is evolving rapidly, leading to the development of a variety of approaches for TAP block: from the classical posterior approach to subcostal, and most recently, oblique subcostal approaches. As reported recently, oblique subcostal TAP block appears to provide a wider area of anaesthesia than the other approaches (thoracolumbar nerve T6-L1).[7] The efficacy of TAP blockade in providing postoperative analgesia in various abdominal surgeries is very encouraging.[2-6] However, studies evaluating the efficacy of TAP blockade intraoperatively are lacking. This case series of 10 patients

Table I: Patient demographics and characteristics of perioperative pain and anaesthesia

	Age (years)	Gender	[a]ASA score	Weight (kg)	Height (cm)	Body mass index	Duration of surgery (min)	Time of conversion to open from starting (min)	Number of fentanyl boluses	Total dosage of fentanyl (µg)	Postoperative [b]VAS (0-10)	Postoperative sedation score (0-3)	Postoperative nausea score (0-3)
1	72	[c]F	2	52	155	21.64	98	55	0	0	1	0	0
2	67	F	1	62	154	26.14	164	50	0	0	3	0	0
3	43	F	1	51	152	22.07	105	20	1	25	1	0	0
4	57	[d]M	1	75	172	25.35	140	30	0	0	2	0	0
5	31	F	1	52	150	23.11	243	200	0	0	4	1	0
6	45	F	2	65	154	27.41	193	35	1	40	4	1	0
7	45	F	1	85	149	38.29	180	45	0	0	4	0	0
8	47	M	1	63	164	23.42	150	25	0	0	0	0	0
9	46	F	1	60	158	24.03	160	30	0	0	2	0	0
10	39	F	1	57	152	24.67	130	25	0	0	0	0	0

a = American Society of Anesthesiologists, b = visual analogue score for pain, c = female, d = male

receiving bilateral ultrasound-guided oblique subcostal TAP blockade in open cholecystectomy is the first to report the efficacy of oblique subcostal TAP blockade in an open surgery intraoperatively.

With improved understanding of the technique of oblique subcostal TAP block[7] and the mechanism of spread of the local anaesthetic drug in the TAP,[9,10] more efficacious regional anaesthesia can be provided. As TAP blockade has not been tested for intraoperative use, a more minimally invasive surgical procedure, e.g. laparoscopic cholecystectomy, was initially chosen to study. However, all 10 of these cases were excluded from that study as the surgical procedure was converted from laparoscopic to open cholecystectomy. Upon conversion of the surgical procedure, our investigators continued to record all the parameters, and followed the study protocol until the end of surgery. Systemic long-acting opioids (e.g. morphine) were not immediately administered upon conversion to open surgery. We found that haemodynamic parameters were stable even after conversion to open surgery and the requirement for intravenous fentanyl bolus as rescue analgesia was minimal. Postoperatively in the recovery room, the patients only complained of mild upper abdominal pain with a VAS of 4 and below (mean 2.10 ± 1.60). This finding is consistent with the study by El-Dawlatly et al., in which TAP block significantly reduced the intraoperative sufentanil usage in patients with laparoscopic cholecystectomy.[8]

This study demonstrated that TAP block improves patient comfort and reduces concomitant opioid usage, which results in reduced side-effects of opioids and avoidance of potential damage to spinal cord structures secondary to neuraxial blockade. However, a major disadvantage of TAP block is the inability to block visceral pain, which can be substantial, both intra- and postoperatively.[11] The rescue fentanyl boluses which were given to some of the patients intraoperatively were to provide analgesia for visceral pain.

We noticed that the patients with higher pain scores were those who had undergone longer surgery (i.e. more than two hours), where the effect of local anaesthetic in the TAP may have diminished as a result of normal redistribution and metabolism. None of the patients suffered from any side-effects of systemic opioids, as usage of opioids was minimal with the use of oblique subcostal TAP block. No complication related to oblique subcostal TAP blockade was reported.

Conclusion

The results from this prospective, uncontrolled case series are encouraging. However, more extensive studies on the intraoperative efficacy of TAP blockade are needed to justify its application. The better sensory coverage of oblique subcostal TAP blockade raises the possibility of using TAP block with only short-acting systemic opioids as intraoperative analgesia for abdominal surgery. As the current trend of anaesthesia practice is moving towards safer ultrasound-guided regional anaesthesia and away from the unwanted effects of systemic opioids and the potentially devastating effect of neuraxial blockade, intraoperative oblique subcostal TAP blockade is a promising alternative in the daily practice of anaesthesia.

Acknowledgements

The authors would like to thank Dr Evelyn Tai Li Min for her help in editing the manuscript.

Declarations

The authors declared no financial or personal conflict of interest which may have inappropriately influenced them in writing this paper.

This work received no external funding.

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