CASE REPORT

Oblique sub-costal transversus abdominis plane (TAP) catheters: an alternative to epidural analgesia after upper abdominal surgery

G. Niraj,¹ A. Kelkar¹ and A. J. Fox²

¹ Specialist Registrar in Anaesthesia, ² Consultant in Anaesthesia and Intensive Care Medicine, Department of Anaesthesia and Critical Care Medicine, University Hospitals of Leicester NHS Trust, Leicester General Hospital, Leicester, UK

Summary

The authors present three cases where catheters placed in the oblique sub-costal transversus abdominis plane provided prolonged analgesia after upper abdominal surgery. Patient 1 was admitted with severe sepsis following major hepatobiliary surgery. Bilateral catheters facilitated weaning from mechanical ventilation and provided adequate analgesia for 4 days. Patient 2 underwent emergency laparotomy for intestinal obstruction having refused consent for epidural analgesia. The transversus abdominis plane catheters provided a significant opioid sparing effect. A unilateral catheter offered rescue analgesia in patient 3 when the epidural catheter was displaced. We put forward a case for oblique sub-costal transversus abdominis plane catheters as an alternative to epidural analgesia after upper abdominal surgery.

Correspondence to: Dr Niraj Gopinath
E-mail: nirajgopinath@yahoo.co.uk
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Transversus abdominis plane (TAP) block is a promising new regional anaesthetic technique. The indications for use of TAP block as part of a balanced anaesthetic technique are increasing [1–7]. However, the use of TAP catheters in the peri-operative care of the patient has not been described before. We present three patients in whom oblique sub-costal TAP catheters were used to provide significant analgesia after major upper abdominal surgery.

Case 1

A 77-year-old male weighing 110 kg was readmitted to the Intensive Care Unit (ICU) with signs of severe intra-abdominal sepsis 2 weeks following a Whipple’s procedure. His past medical history included hypertension and a right radical nephrectomy for renal cell carcinoma. A CT scan of his abdomen revealed an intraperitoneal collection. Therefore, he underwent an emergency laparotomy at which a completion pancreatectomy and washout of the peritoneal cavity was performed. He received a 10-unit transfusion of packed red blood cells intra-operatively. The patient was ventilated using invasive positive pressure ventilation postoperatively and initially required a high dose noradrenaline infusion (2 mg.h⁻¹) to maintain an adequate arterial blood pressure. On day two after his emergency surgery he had made sufficient clinical improvement to consider weaning him from artificial ventilation. However, there was a 51-cm rooftop incision across the upper abdomen and three peritoneal drains were in situ. As the patient had expressed a wish prior to surgery not to have an epidural sited, bilateral oblique sub-costal TAP catheters were inserted, local anaesthetic solution was administered and the morphine infusion was switched off. The patient was extubated 52 h after surgery. Visual analogue scores (VAS) at rest and on coughing were measured at 6 hourly intervals after extubation for 48 h. The average VAS at rest was 0/10 and on coughing was 2/10. The patient received 20 ml of 0.5% bupivacaine every 12 h. Regular paracetamol was administered but he did not require any opioids throughout the duration of his ICU stay. The TAP catheters were used for 4 days to provide analgesia and enabled the patient to undergo effective chest
physiotherapy. The patient subsequently made an unremarkable recovery and was discharged from ICU on day seven.

**Case 2**

An 83-year-old female weighing 80 kg, admitted with acute intestinal obstruction, was scheduled for an emergency laparotomy. Past medical history included total abdominal hysterectomy and lumbar laminectomy. The patient refused an epidural prior to surgery in view of her previous back surgery and ongoing lumbar back pain but she consented to bilateral oblique sub-costal TAP catheter insertion. At laparotomy, she underwent adhesiolysis and the surgical incision extended from just below the xiphisternum to 3 cm above the symphysis pubis. At the end of surgery, bilateral TAP catheters were inserted and 20 ml of 0.375% of bupivacaine injected into each TA plane. Following emergence from anaesthesia, the patient was given patient controlled analgesia (PCA) with morphine and transferred to the high dependency unit (HDU). She was prescribed regular paracetamol. VAS pain scores at rest and on coughing were recorded every 6 h. The TAP catheters were topped up at 12-h intervals for a total duration of 72 h using 20 ml of 0.375% of bupivacaine on each side. On day two after surgery, the patient complained of pain on the right side of her upper abdomen (VAS 8/10 on coughing), which did not resolve with a 5-ml bolus of 0.25% bupivacaine. The catheter on the right side was removed and a new TAP catheter was inserted after injecting 10 ml of 0.25% bupivacaine. The patient experienced immediate pain relief (VAS on coughing 1/10). The TAP catheters were used for 72 h. The patient used 8 mg of morphine on day 1 and a total of 30 mg during the subsequent 48 h. The skin was prepared with 2% chlorhexidine solution and a high frequency (5–10 MH) ultrasound probe (SonoSite Micromax; SonoSite, Inc. Bothwell, WA, USA) was placed obliquely on the upper abdominal wall along the sub-costal margin near the midline. The rectus abdominis muscle was identified. The ultrasound probe was gradually moved laterally along the sub-costal margin and the transversus abdominis muscle was identified lying posterior to the rectus muscle (Fig. 1). After identification of the neuro-fascial transversus abdominis plane between the rectus abdominis and the transversus abdominis muscle, the skin and subcutaneous tissue beneath the probe were anesthetised using 1% lidocaine. A 16-gauge epidural (Tuohy) needle was then introduced anteriorly in the plane of the ultrasound beam and directed towards the transversus abdominis plane. On entering the neuro-fascial plane and following negative aspiration, 20 ml 0.375% bupivacaine was injected. The injectate could be

**Case 3**

A 61-year-old male weighing 70 kg was admitted to the HDU following excision of the biliary tree and hepato-duodenojejunostomy. Past medical history included myocardial infarction, stable angina and hypertension. There was a rooftop incision on the right side and an abdominal drain just above the right iliac fossa. Analgesia was maintained with an epidural infusion, regular paracetamol and tramadol as required. The patient required noradrenaline infusion to support his arterial blood pressure and maintain an adequate urine output. On day two following surgery, the epidural catheter became displaced and the patient developed severe pain. Visual analogue score at rest was 3/10 and on coughing was 9/10. After discussing the options with the patient, a right sided oblique sub-costal TAP catheter was inserted and 25 ml of 0.5% bupivacaine was administered. He experienced immediate pain relief with the VAS at rest becoming 0/10 and 1/10 on coughing. The arterial blood pressure was now satisfactory and the noradrenaline infusion was discontinued. The TAP catheter was topped up with local anaesthetic boluses every 12 h and the patient remained comfortable apart from persisting mild discomfort at the peritoneal drain site (T12 dermatome). A morphine PCA and regular paracetamol were commenced and a total of 39 mg morphine was used during the subsequent 48 h.

**Technique**

The skin was prepared with 2% chlorhexidine solution and a high frequency (5–10 MHz) ultrasound probe (SonoSite Micromax; SonoSite, Inc. Bothwell, WA, USA) was placed obliquely on the upper abdominal wall along the sub-costal margin near the midline. The rectus abdominis muscle was identified. The ultrasound probe was gradually moved laterally along the sub-costal margin and the transversus abdominis muscle was identified lying posterior to the rectus muscle (Fig. 1). After identification of the neuro-fascial transversus abdominis plane between the rectus abdominis and the transversus abdominis muscle, the skin and subcutaneous tissue beneath the probe were anesthetised using 1% lidocaine. A 16-gauge epidural (Tuohy) needle was then introduced anteriorly in the plane of the ultrasound beam and directed towards the transversus abdominis plane. On entering the neuro-fascial plane and following negative aspiration, 20 ml 0.375% bupivacaine was injected. The injectate could be
observed spreading in the transversus abdominis plane as a dark oval shape. An epidural catheter was then threaded into the TA plane. Gentle pressure was required to coax 6–7 cm of the catheter into TA plane. Correct catheter placement in the TA plane was confirmed by injecting 5 ml normal saline with a small air bubble in the syringe. The sudden appearance of the hyperechoic air bubble in the fluid distended (hypoechoic) TA plane confirmed correct positioning of the catheter. The catheter was cut at the 20-cm mark and attached to a filter which was taped to the chest wall in the midline.

**Discussion**

Good postoperative pain control is an important part of adequate postoperative care [8]. However, 30–80% of postoperative patients complain of moderate to severe post-surgical pain [9]. Epidural analgesia remains the gold standard after major surgery involving abdominal wall incision. When an epidural fails or is contraindicated, analgesia involves large doses of opioids which have side effects that may be poorly tolerated. The desire to find an alternative means of providing effective postoperative analgesia has led to the development of the TAP block. This is a new regional anaesthetic technique that allows sensory blockade of the anterolateral abdominal wall via local anaesthetic deposition superficial to the transversus abdominis muscle. It was first described by McDonnell et al. as a landmark technique to provide analgesia for lower abdominal surgery [10]. Hebbard et al. [6] subsequently described an ultrasound guided technique for the TAP block which they named the posterior TAP block. Hebbard [7] has also described the ultrasound guided oblique sub-costal TAP block for providing analgesia after upper abdominal surgery.

Clinical trials of the single shot posterior TAP block have shown a significant reduction in morphine consumption during the first 24–36 h after surgery [1–4]. Single shot TAP blocks have also been used to provide analgesia in patients admitted to the ICU and as rescue analgesia for ineffective epidural analgesia [5]. To date, there have been no clinical trials of oblique sub-costal TAP blocks.

The authors now describe three cases where oblique sub-costal TAP catheters combined with morphine PCA provided effective analgesia for a large surgical abdominal incision. The conventional alternative option was morphine PCA but sub-costal TAP catheters provided effective analgesia for 72 h after surgery. TAP block analgesia covered over 80% of the patient’s large surgical wound with the patient feeling discomfort at the lower end of the incision.

In the third case, the patient had an epidural infusion that provided excellent analgesia for the first 24 h after surgery. The sympathetic block caused by the epidural resulted in hypotension resistant to fluid loading and the patient required a noradrenaline infusion to maintain renal perfusion. Displacement of the epidural catheter resulted in the onset of severe pain following which insertion of a TAP catheter provided effective analgesia for over 48 h without accompanying hypotension.

Historically, there have been two options for patients undergoing major abdominal surgery: epidural infusion and PCA with opioids, most commonly morphine. Although PCA with morphine can provide effective analgesia at rest (static analgesia), it fails to provide adequate analgesia on movement (dynamic analgesia) [11]. Large doses of opioids can cause both distressing side effects (nausea, vomiting, constipation, sedation) and serious complications (respiratory depression). When effective, epidural local anaesthesia provides excellent static and dynamic analgesia. However, when a previously working epidural analgesia fails, patients experience severe pain which can be difficult to control. Epidural failure may result from missed segments, dislodgement of the catheter, catheter kinking, etc. Epidural analgesia is also associated with a myriad of well known complications and there exists a subgroup of patients for whom epidural insertion is contraindicated.

Oblique sub-costal TAP catheters are relatively easy to insert under ultrasound guidance and TAP blocks have an excellent safety profile to date. The oblique sub-costal TAP blocks can provide effective analgesia for surgical incisions extending from the T6 to T10 dermatomes. There is occasional sparing of the T12 dermatome and definite sparing of the L1 dermatome. Pain arising from surgical incisions or drains placed in these dermatomes (T12–L1) can be quite difficult to control with the oblique sub-costal TAP block alone. The authors believe that oblique sub-costal TAP catheters combined with
PCA morphine could be a viable alternative option to epidural analgesia in patients undergoing upper abdominal surgery. However the authors also realise that randomised controlled studies comparing TAP catheters with epidural analgesia are necessary for this technique to gain widespread acceptance.

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References


