CASE REPORT

Postoperative analgesia with transversus abdominis plane catheter infusions of levobupivacaine after major gynecological and obstetrical surgery. A case series

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Abstract
Transversus abdominis plane block has become an important method of postoperative pain management for patients undergoing abdominal surgery but the modest duration is a major limitation. We report the successful use of a novel TAP catheter technique for continuous infusion of levobupivacaine in six gynecologic and obstetric patients.

Bilateral TAP catheters were inserted at the end of surgery by ultrasound imaging using a Contiplex\textsuperscript{®} C needle (B. Braun, Melsungen, Germany) in the Triangle of Petit or in a posterosubcostal level based on the location of the surgical incision. Following negative aspiration, 0.25% levobupivacaine 5 mL was injected. After withdrawing the needle, while holding the over-the-needle catheter in place, bilateral continuous infusion of 0.125% levobupivacaine at 2 mL/h from elastomeric pumps (INFusor SV2, Baxter, France) was started and continued for up to 50 h. Before removal of the catheter, a bolus of 10 mL levobupivacaine 0.25% was administered.

Successful analgesia was achieved in all six cases utilizing continuous infusion of levobupivacaine, minimizing the volume required. TAP infusions produce significant opioid sparing and better patient mobility. This technique may be a reliable alternative to neuraxial analgesia in major gynecological and obstetrical surgery.

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Analgesia postoperatoria con infusiones de levobupivacaina mediante catéter en el plano transverso del abdomen tras cirugía mayor ginecológica y obstétrica. Serie de casos

Resumen El bloqueo del plano transverso del abdomen (PTA) se ha convertido en un importante método para tratar el dolor posoperatorio en pacientes que se someten a una cirugía abdominal, pero su modesta duración es una limitación importante. Presentamos una puesta en práctica con éxito de la novedosa técnica de catéter PTA para infusión continua de levobupivacaina en 6 pacientes ginecológicas y obstétricas.

Los catéteres bilaterales PTA se insertaron al final de la intervención por medio de ecografía con una aguja Contiplex® C (B. Braun, Melsungen, Alemania) en el triángulo de Petit o en la región subcostal posterior, basándose en el punto de la incisión quirúrgica. Después de la aspiración negativa se inyectaron 5 ml de levobupivacaina al 0,25%. Una vez retirada la aguja, mientras se mantenía el catéter sobre la aguja en su lugar, se inició la infusión continua de 2 ml/h de levobupivacaina al 0,125% mediante bombas elastoméricas (INFusor SV2, Baxter, Francia), que se prolongó durante 50 h. Antes de la retirada del catéter, se suministró un bolus de 10 ml de levobupivacaina al 0,25%.

La analgesia fue exitosa en los 6 casos en los que se usó la infusión continua de levobupivacaina, con una reducción del volumen preciso. Las infusiones PTA suponen un ahorro significativo de opioides y ofrecen una mejor movilidad del paciente. Esta técnica puede ser una alternativa viable a la analgesia neuroaxial en intervenciones mayores ginecológicas y obstétricas.

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Introduction

Transversus abdominis plane (TAP) block has become an important method of postoperative pain management for patients undergoing abdominal surgery. Nevertheless, a limitation of the block is the modest duration, which was originally reported to persist in reducing opioid requirements for at least 24 h. A small number of reports have described the use of continuous local anesthetic infusion via catheters placed bilaterally in the TAP to address this problem, but safety (intravascular concentrations of local anesthetic exceed the threshold of toxicity) and technical constraints (difficult catheter placement and early dislodgement) may restrict the clinical application of this approach.

This case series of six gynecologic and obstetric surgery patients documents the successful use of a novel TAP catheter technique for continuous infusion of levobupivacaine.

Case series

Institutional review board approval was obtained before implementing this method. Written informed consent was obtained from all patients, who acknowledged the description of their case in this report.

Technique

A similar technique was used for each patient, with bilateral TAP catheters inserted at the end of surgery. The specific approach for the TAP block was based on the location of the surgical incision. When the incision was predominantly sub-umbilical, a posterior TAP block in the Triangle of Petit was performed, with the needle insertion point midway between the costal margin and the iliac crest on the anterior axillary line. For surgical incisions that were supra-umbilical or full abdominal length, a posterolateral approach was performed. A high frequency (5–10 MHz) ultrasound probe (SonoSite Micromax; SonoSite, Inc., Bothell, WA, USA) was placed obliquely on the upper abdominal wall along the sub-costal margin to identify the rectus abdominis muscle. The probe was gradually moved laterally along the sub-costal margin until the transversus abdominis muscle was identified lying posterior to the mid-axillary line. After visualization of the neuro-fascial TAP, a Contiplex® C needle (B. Braun, Melsungen, Germany) was introduced in-plane and directed toward the transversus abdominis muscle, using hydrolocation with 0.9% normal saline to confirm needle tip location in the fascial plane. Following negative aspiration, 0.25% levobupivacaine 5 mL was injected and the needle withdrawn, while holding the over-the-needle catheter in place. Correct catheter placement in the TAP was confirmed by injecting a small air bubble from the syringe. The sudden appearance of the hyperechoic bubble in the fluid distended (hypoechoic) plane confirmed correct positioning of the catheter. Bilateral continuous infusion of 0.125% levobupivacaine at 2 mL/h from small elastomeric pumps (INFusor SV2, Baxter, France) was started and continued for up to 50 h. Before removal of the catheter, a bolus of 10 mL levobupivacaine 0.25% was administered.

Peripheral venous blood samples were taken from “patient 5” at 10 min and 4, 8, 24, 30, 48 and 60 h after
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starting the technique, to determine plasma concentrations of levobupivacaine.

Postoperatively, all patients also received acetaminophen 1g intravenously (IV) every 6h, and in the absence of a contraindication to an anti-inflammatory drug, dexketoprofen trometamol 50 mg IV at the conclusion of surgery and every 8h for 72h. Tramadol 50 mg IV was given as a rescue analgesic at a minimum interval of 6h. Patient satisfaction with postsurgical analgesia, pain scores every 4h, total analgesic consumption and possible complications related to the analgesic regimen were recorded until the TAP catheters removed.

The six cases are summarized in Table 1. TAP blocks and catheters were successfully inserted in all cases. There were no block failures, technical complications or clinical signs of systemic levobupivacaine toxicity. All patients experienced mild pain (less than two on a 0–10 visual analog scale) during the duration of the infusion, often without the need for supplementary opioid analgesics, and reported high satisfaction with their postoperative analgesia.

Discussion

TAP block has become an important tool after abdominal wall surgery. The somatic sensory afferent block improves postoperative analgesia, reduces opioids use and appears to have a good safety profile. However, its modest duration is a significant limitation.2 This problem can be overcome by continuous infusion or intermittent bolus catheter-based techniques.3–10 A bolus injection, followed by a large-volume infusion bilaterally, has the potential to result in significant intravascular concentrations of local anesthetic, which may exceed the threshold of toxicity.5 Despite marked individual variability, this mandates careful risk benefit assessment of continuous TAP blocks, especially in susceptible patients, such as those with renal or hepatic dysfunction, or the geriatric and pregnant population. Breast milk transfer of local anesthetic must also be remembered. On the other hand, technical and operational constraints appear to limit the adoption of catheter methods in the clinical practice. All studies and case reports to date have used epidural catheters inserted into the TAP through a Tuohy needle.

The technique used in this case series has two novel features. Firstly, it involved placement of Contiplex6 C catheters, a novel system in which the catheter-over-the-needle design helps to simply and effectively overcome some challenges of insertion. Secondly, the technique may decreased systemic exposure to local anesthetic by minimizing the volume required for an effective block, as shown by the pharmacokinetic profile of “patient 5”. Total and unbound plasma levobupivacaine concentrations during TAP catheter infusions from 10 min to 60 h are shown in Fig. 1. The total plasma concentration increased rapidly after the initial bolus of the TAP block. There was a second phase increase in total plasma levobupivacaine concentration at the 50 h time point, after administration of a second bolus of levobupivacaine before removal of the catheter. This was not accompanied by an increase in the unbound levobupivacaine concentration due to local anesthetic binding to elevated levels of binding proteins such as alpha-1-acid glycoprotein, as a result of the postoperative inflammatory response. The peak total plasma levobupivacaine concentration of 258 ng/mL was reached after 60 h, whereas the peak concentration of unbound levobupivacaine of 12 ng/mL occurred much earlier at the 10 min time, significantly below of toxicity threshold (2 μg/mL).

In a field block, the anatomical spread dictates the volume required to cover the appropriate segmental abdominal wall nerves.11 The volume used in this series was much lower than previously described. One possible explanation is that insertion of the catheter in an optimal position and the volume accumulation during the infusion compensated for a low initial volume. Higher volumes of local anesthetic have traditionally been used to ensure block across multiple dermatomes, but it is possible that this approach is only necessary for a single-shot block. Previous catheter studies have
### Table 1: Patient demographics and analgesia.

<table>
<thead>
<tr>
<th></th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
<th>Case 5</th>
<th>Case 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>58</td>
<td>45</td>
<td>53</td>
<td>36</td>
<td>30</td>
<td>39</td>
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<tr>
<td>Weight (Kg)</td>
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<td>70</td>
<td>159</td>
<td>165</td>
<td>67</td>
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<tr>
<td>Height (cm)</td>
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<td>155</td>
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<td>None</td>
<td>G1P0</td>
<td>G2P1</td>
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<tr>
<td>Medical/obstetrical</td>
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<td>Portal hypertension</td>
<td>Hysterectomy,</td>
<td>Hysterectomy,</td>
<td>CS</td>
<td>CS</td>
</tr>
<tr>
<td>Surgery</td>
<td>Portal</td>
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<td>salpingo-oophorectomy,</td>
<td>salpingo-oophorectomy,</td>
<td>CS</td>
<td>CS</td>
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<tr>
<td></td>
<td>Omentectomy</td>
<td>Hysterectomy</td>
<td>lymphadenectomy</td>
<td>Ovarian carcinoma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indication of surgery</td>
<td>Ovarian carcinoma</td>
<td>Endometrial</td>
<td>Breech presentation</td>
<td>Cerebral aneurysm</td>
<td>Requested rather than vaginal delivery</td>
<td></td>
</tr>
<tr>
<td>Indication for TAP catheters</td>
<td>Minor coagulopathy</td>
<td>carcinoma</td>
<td>refusal of epidural analgesia</td>
<td>Anxiety NSAIDs allergy</td>
<td>NSAIDs allergy</td>
<td></td>
</tr>
<tr>
<td>Opioids request</td>
<td>Nil</td>
<td>Nil</td>
<td>Tramadol 50 mg</td>
<td>Nil</td>
<td>Nil</td>
<td>Tramadol 100 mg</td>
</tr>
<tr>
<td>Somatic Pain Score</td>
<td>0 (0)</td>
<td>0.5 (0.5)</td>
<td>r 1 (0.7)</td>
<td>r 0 (0)</td>
<td>r 0.6 (0.8)</td>
<td>r 2.3 (2.1)</td>
</tr>
<tr>
<td></td>
<td>0 (0)</td>
<td>0.8 (0.7)</td>
<td>m 1.3 (1)</td>
<td>m 0 (0)</td>
<td>m 1.1 (1)</td>
<td>m 2.4 (2.2)</td>
</tr>
<tr>
<td>Visceral Pain Score</td>
<td>0 (0)</td>
<td>1 (1.4)</td>
<td>r 1.1 (0.9)</td>
<td>r 1 (1.8)</td>
<td>r 0 (0)</td>
<td>r 2.3 (2.1)</td>
</tr>
<tr>
<td></td>
<td>0 (0)</td>
<td>1.9 (1.5)</td>
<td>m 1.2 (1)</td>
<td>m 1 (1.8)</td>
<td>m 0 (0)</td>
<td>m 2.4 (2.2)</td>
</tr>
<tr>
<td>Patient satisfaction</td>
<td>9</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>(VAS 0–10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

m: movement; NSAID = nonsteroidal anti-inflammatory drug; r: rest. Pain score is a mean (SD) 0–10 visual analogue scale. CS = cesarean section.
used large volumes (and doses) of local anesthetic without evaluating smaller volumes. Moeschler et al. 12 in a cadaveric study, determined that anterior-posterior and transverse spread of contrast did not correlate with an increasing volume of injected contrast, which differed from the relationship to cranial-caudal spread. An important objective of a continuous infusion technique is to deliver the lowest effective dose of drug, preventing rises in plasma concentration associated with boluses and fixed dosing intervals.

TAP block analgesia is typically used in a multimodal approach including opioids to control visceral pain. In gynecological oncology surgery there is extensive abdominopelvic visceral stimulation. Griffiths et al.13 found no analgesic benefit in patients undergoing these procedures. However in this case series the continuous technique appeared to effectively control both somatic and visceral pain and other analgesic requirements were absent or low. Possible retrograde spread of solution to the paravertebral space with this approach might have contributed to sympathetic blockade and explain the findings of this series and early TAP studies.1,14 Further, it is not known to what extent systemic absorption and redistribution of local anesthetic contributes to analgesia.

We have found that the technique is suitable in the care setting and that patients require little extra analgesia. The optimal site of insertion of TAP catheters, the ideal volume and concentration of infused local anesthetic and optimal infusion rate, are yet to be determined.

**Conflict of interest**

The authors declare no conflicts of interest.

**References**