Continuous lumbar transversus abdominis plane block may spread to supraumbilical dermatomes

Les blocs lombaires continus du plan transverse de l'abdomen pourraient diffuser vers les dermatomes sus-ombilicaux

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Abstract

Purpose *The transversus abdominis plane block is an interfascial block intended to target nerves supplying the abdominal wall. It has been shown to reduce pain and postoperative opioids in abdominal surgeries. We present the case of a high-risk patient in whom bilateral continuous lumbar transversus abdominis plane blocks provided effective postoperative analgesia following infraumbilical midline laparotomy.*

Clinical features *A 59-yr-old woman with coronary artery disease, severe peripheral vascular disease, and mild to moderate obstructive sleep apnea underwent a total abdominal hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymph node dissection via an infraumbilical midline laparotomy. Bilateral ultrasound-guided lumbar transversus abdominis plane blocks with catheters were sited intraoperatively. Using only a continuous local anesthetic infusion in the postoperative period, the patient required no systemic opioids or acetaminophen for 81 hr. A sensory block level of T6-L1, higher than that reported following a single-shot technique, remained for 24 hr following infusion discontinuation and finally normalized after 33 hr.*

Conclusions *Lumbar transversus abdominis plane blocks with continuous infusions may offer an effective alternative to epidural blockade and systemic opioids in high-risk patients. Additionally, given the extensive somatosensory block, this technique may have an analgesic role following abdominal incisions involving not only the infraumbilical region but also supraumbilical sites.*

Résumé

Objectif *Le bloc du plan transverse de l'abdomen est un bloc interfascial qui cible les nerfs innervant la paroi abdominale. Il a été démontré qu'il réduisait la douleur et les besoins postopératoires en opioïdes lors d'une chirurgie abdominale. Nous présentons le cas d'une patiente à risque élevé chez qui des blocs lombaires continus du plan transverse de l'abdomen ont procuré une analgésie postopératoire efficace après une laparotomie sous-ombilicale médiane.*

Éléments cliniques *Une femme de 59 ans souffrant de maladie coronarienne, de maladie vasculaire périphérique grave et d'apnée du sommeil obstructive légère à modérée a subi une hystérectomie abdominale totale, une salpingo-ovariectomie et un évidement ganglionnaire pelvien par laparotomie sous-ombilicale médiane. Des blocs bilatéraux lombaires échoguidés du plan transverse de l'abdomen ont été positionnés pendant l'opération. En utilisant seulement une perfusion d'anesthésique local en période postopératoire, la patiente n'a pas eu besoin d'opioïdes systémiques ou d'acétaminophène pendant 81 h. Un bloc sensitif au niveau T6-L1, plus haut que celui rapporté après une technique à injection unique, s'est maintenu pendant 24 h après l'interruption de la perfusion, puis s'est finalement normalisé après 33 h.*

Conclusion *Les blocs lombaires du plan transverse de l'abdomen suivis de perfusions continues pourraient*

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constituer une alternative efficace aux blocs périduraux et aux opioïdes systémiques chez les patients à risque élevé. En outre, étant donné l'étendue importante du bloc somatosensoriel, cette technique pourrait jouer un rôle analgésique après des incisions abdominales réalisées non seulement dans la région sous-ombilicale, mais également dans les zones sus-ombilicales.

The lumbar transversus abdominis plane (TAP) block is a novel technique which targets nerves supplying the abdominal wall. The objective of the block is to inject local anesthetic into the TAP, a potential space between the internal oblique and transversus abdominis muscles, and thereby block eight spinal nerves that innervate the abdominal muscles and overlying skin. The block can be performed using surface landmarks using a “double-pop” technique, but ultrasound (US) guidance is becoming increasingly popular as it enables real-time direct visualization of the relevant muscle layers and the location of the injected local anesthetic. Although the evidence is limited to date, a recent meta-analysis of randomized trials of abdominal surgery and the TAP block involving five studies and 236 patients showed that this technique reduced morphine consumption at 24 and 48 hr.¹ Further studies are necessary to compare this block with other regional techniques like epidural analgesia and local infiltration. Recently, the use of TAP blocks with indwelling catheters has been described in the literature with promising results.² We report a somatosensory block by loss to cold sensation and successful postoperative pain management for a patient with several cardiorespiratory comorbidities. The procedure was performed by way of US-guided bilateral lumbar TAP blocks with continuous local anesthetic infusions. Written informed consent and institutional ethics board approval were obtained prior to publication of this case.

Case description

A 59-yr-old female with stage II endometrial adenocarcinoma was scheduled to undergo total abdominal hysterectomy, bilateral salpingo-oophorectomy, and removal of left-pelvic sidewall lymph nodes via an infra-umbilical midline laparotomy.

Her cardiovascular history was remarkable for hypertension, type II diabetes mellitus, and severe coronary and peripheral artery disease. She had a previous myocardial infarction, coronary artery bypass grafting, and percutaneous angioplasty with stenting. Her cardiovascular status was currently stable without angina or dyspnea, and her

condition was optimized with medical therapy. Her severe peripheral vascular disease had required bilateral lower limb amputations. The most recent amputation was complicated by a Methicillin-resistant *Staphylococcus aureus* stump infection and an infected common femoral artery graft. Other comorbidities included diabetic retinopathy and nephropathy, obesity (body mass index = 40 kg·m⁻²), and untreated obstructive sleep apnea (OSA) with an apnea/hypopnea index of 14.3 and occasional severe desaturations.

A preoperative echocardiogram demonstrated extensive anteroapical akinesis and hypokinesis of the inferior wall, moderate diastolic dysfunction, and systolic function compromise (ejection fraction = 40%). Single photon emission computed tomography (SPECT) with dipyridamole stress showed evidence of previous transmural anteroseptal and apical infarction without evidence of current ischemia. The patient's baseline serum creatinine was 140 mg·L⁻¹. Her medications included ramipril, atorvastatin, acetylsalicylic acid, bisoprolol, clopidogrel (on hold for surgery), furosemide, gabapentin, hydromorphone contin, metformin, insulin aspart, detemir, risedronate, vancomycin, moxifloxacin, and domperidone.

The intraoperative and postoperative plans were discussed with the surgical team, and we decided to perform bilateral TAP blocks with indwelling catheters and continuous local anesthetic infusion for postoperative analgesia. We elected to proceed in this fashion to avoid epidural sympathetic blockade and the associated complications linked to hypotension in this high-risk patient. Furthermore, this technique could reduce postoperative opioid use, an attractive option given the patient's untreated OSA.

We applied standard American Society of Anesthesiologists (ASA) anesthesia monitors plus a pre-induction right radial arterial line. General anesthesia was induced using fentanyl, propofol, and rocuronium. The patient's trachea was intubated, anesthesia was maintained with desflurane, and surgery proceeded as planned. Morphine 3 mg *iv* was given 30 min before the end of surgery, and non-steroidal anti-inflammatory drugs were avoided in light of the patient's diabetic nephropathy.

We performed US-guided lumbar TAP blocks at the end of the operation while the patient was still anesthetized. Under sterile technique, a 12 MHz linear US transducer (GE Logiq E, Wauwatosa, WI, USA) was placed cephalad between the inferior costal margin and anterior superior iliac spine in the anterior-axillary line. A 17G Tuohy needle (Smiths Medical Portex® epidural mini-pack, St. Paul, MN, USA) was advanced using an in-plane approach from medial to lateral and placed between the internal oblique and transversus abdominis muscles. Hydro-dissection was used to confirm proper needle tip position prior

to slow injection of 0.5% ropivacaine 20 mL. Following this, a 20G epidural catheter was advanced 5 cm distal to the needle tip without resistance. The needle was then removed and the catheter secured using a clear occlusive dressing. The identical procedure was then performed on the opposite side. The patient's trachea was extubated, and she was then transferred to a monitored recovery area for the next four hours. She reported pain scores of 0 (out of 10) at rest and during movement in the postanesthesia care unit, and in fact, she requested to be placed in a seated position. She did report nausea, which was controlled with ondansetron and dimenhydrinate. Orders were written for gabapentin 300 mg *tid*, acetaminophen 975 mg *qid prn*, and morphine *prn* for breakthrough pain.

The patient was discharged to the step-down unit asymptomatic and in stable cardiorespiratory condition. She was followed by the Acute Pain Service (nurses/consultants) for a total of 72 hr, with her pain scores and block height evaluated every four hours. The first sensory assessment was performed seven hours following surgery. The abdominal wall dermatomes were outlined with a marking pen to allow for consistent assessments by different evaluators. A continuous infusion of 0.125% bupivacaine at 5 mL·hr⁻¹ per side using separate infusion pumps (Cardinal Health, Alaris® PCA Module, Model 8120, San Diego, CA, USA) was started in the recovery room and continued for 48 hr. The block extension, as measured by loss to cold sensation, was consistently T6-L1 bilaterally until 72 hr, with regression to T10-L1 at 76 hr and finally only a bilateral T12 block at 81 hr. Gabapentin *tid* was provided in the postoperative period, but morphine and acetaminophen were never requested by the patient. The patient was discharged home at 72 hr in stable condition, and a home visit made that night showed that the patient was continuing to recover well.

Discussion

This report is novel in its detailing of the somatosensory block extension characteristics following continuous bilateral lumbar TAP blocks from initiation to the hours following catheter removal. This report highlights the effectiveness of providing post-laparotomy analgesia with continuous lumbar TAP blocks in a high-risk patient with cardiorespiratory disease.

Pain after extensive abdominal surgery is typically classified as severe pain. Current trends in postoperative pain management after laparotomy include epidural analgesia and/or patient controlled analgesia (PCA) with opioids. The secondary effects of such strategies include hypotension and respiratory depression, respectively, and

they have the potential to complicate the perioperative course in high-risk patients with cardiorespiratory disease.

The TAP block was first described by Rafi³ as a blind "double-pop" technique through the Petit triangle. Hebbard⁴ introduced the US-guided TAP technique six years later. Ultrasound-guided TAP blocks have the advantage of real-time performance, and they are particularly useful in obese patients in whom the blind technique is technically difficult. An additional advantage of the US-guided technique is that it may decrease complication rates, such as hepatic injuries, previously described with the blind technique.⁵ Prolonged TAP blocks using indwelling catheters and continuous local anesthetic infusions have been described in a few cases, i.e., for postoperative pain management in renal transplant recipients, abdominal midline surgical incisions, and inguinal hernia repairs, with promising results.^{2,6,7}

The TAP block is an interfascial block, and the target nerves cannot be visualized under US. The nerve distribution in the plane has been previously described in cadaveric dissections, and these studies suggest that lumbar blocks would be more appropriate for lower abdominal surgeries. Injection of aniline blue 20 mL into the lumbar TAP is likely to involve only the T10-L1 nerve roots, implying that the lumbar technique is best suited for infraumbilical incisions.^{8,9} Subcostal TAP blocks, described by Hebbard,¹⁰ are thought to target higher dermatomes, making it a better option for supraumbilical incisions.

Despite the cadaveric studies, debate remains with respect to the somatosensory block height that can be achieved with a single local anesthetic injection at the lumbar TAP level. McDonnell¹¹ reported a T7-L1 sensory block using 0.5% lidocaine on three volunteers, while Shibata¹² found a maximum block height of only T9. This discrepancy persists largely because no studies have assessed block height as a primary outcome. In fact, none of the five TAP block randomized control trials have tested dermatome block extension.¹

Since the TAP block is a compartmental block, it is likely to be affected by multiple variables, including local anesthetic volume, concentration, infusion time, and site of injection. Patient factors, including height and weight, are also likely to contribute. Large studies are required to address these questions.

This case describing the use of bilateral lumbar TAP blocks with indwelling catheters suggests the feasibility of this approach as an alternative to epidural anesthesia and PCA. Not only does this technique serve to benefit patients with cardiorespiratory comorbidities, it would benefit patients with coagulation disorders in whom neuraxial anesthesia is contraindicated. In our case, the patient required no opioids in the postoperative period, which was optimal given her OSA history. The lack of postoperative

opioids is interesting in that TAP blocks are believed to block only somatic components and the parietal peritoneum. In this case, a component of visceral blockade might be caused by a systemic rather than a local analgesic effect of the local anesthetic, as previously suggested.¹³ This positive outcome with a TAP block for gynecological cancer surgery contrasts with the results recently published from a randomized trial of 65 patients who received a TAP block or placebo for similar surgery. In that trial, there were no differences in pain scores or morphine consumption between treatment groups.¹⁴ This result may be explained by the fact that the authors included heterogeneous gynecologic surgeries and supraumbilical incisions. It is known from cadaveric and observational studies that a single shot lumbar TAP block with 20 mL of local anesthetic is ineffective in blocking supraumbilical dermatomes.^{9,12} Griffiths' results may have also been influenced by block failure, as there was no description of block distribution. A significant percentage of patients included in that study were obese, a known factor for block failure, even under US guidance. In our report, we tested the somatosensory block height above the umbilicus during continuous lumbar TAP blockade in our patient with a body mass index of 40 kg·m⁻².

Additionally, this case is interesting in the context of sensory block height with lumbar TAP blocks. For the 48 hr during which the infusion was running, the patient had an extensive abdominal wall block involving T6-L1 bilaterally. This observation suggests that block extension may be affected by the variables of volume and infusion time. Further, we report a slow reversal of sensory block following catheter removal. The patient reported sensory block reversal progressing caudally from T6, although the last level lost was T12. This latter finding could be linked to the final position of the catheter tip. The complete disappearance of sensory block was noted at 81 hr, 33 hr after infusion discontinuation and catheter removal. This observation supports those previously reported by Carney¹⁵ regarding the effectiveness of the TAP block 48 hr post-total abdominal hysterectomy. This prolonged duration may be explained by the low vascularity of the interfascial plane and the subsequent slow local anesthetic reuptake.¹⁵

In summary, US-guided TAP blocks with catheter insertion for continuous local anesthetic infusion may be an effective alternative to epidural lumbar anesthesia in patients with significant cardiovascular and respiratory comorbidities. A surprisingly dense and long-lasting sensory block of the abdominal wall was achieved with no complications. The sensory block level obtained in this case suggests that a continuous lumbar TAP block may provide effective analgesia for large abdominal incisions

involving both infraumbilical and supraumbilical sites. It may be useful to consider randomized controlled trials to evaluate the safety and efficacy of continuous infusion TAP blocks vs conventional treatments (epidural and PCA) for patients undergoing abdominal surgeries.

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Competing interests None declared.

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