How I do it: Surgically inserted transversus abdominis plane (TAP) catheters for flank incisions

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Pain control following major abdominal surgery remains a significant barrier to patient comfort. Although thoracic epidurals have been used to provide analgesia for these surgeries, the transversus abdominis plane (TAP) block is gaining popularity. The TAP catheter insertion method has transformed over the past two decades from a blinded technique to one conducted primarily under ultrasound guidance by anesthesiologists. Recently, however, interest has increased on the potential for direct surgical insertion of catheters into the TAP plane following flank incisions due to anatomical considerations. Proposed advantages include a reduction in operating time, requirement of minimal expertise and increased accuracy of catheter placement. In this report, we describe the rationale and the technique of surgical insertion of TAP catheters following open nephrectomies as performed by urologists at our institution.

Key Words: transversus abdominis plane block, nerve block, open nephrectomy

Introduction

The transversus abdominis plane (TAP) block is a popular analgesic alternative to thoracic epidurals following abdominal surgeries. Rafi et al described the original TAP insertion technique nearly 17 years ago where they utilized the Triangle of Petit which is bounded by the latissimus dorsi muscle posteriorly, external oblique muscle anteriorly, and iliac crest at the base.[1,2] Through this landmark, local anesthetic was delivered blindly between the internal oblique and transversus abdominis muscles to target the somatic fibres of the anterior abdominal wall (T6 to L1).[1,3]

In the era of ultrasound guided regional anesthesia, a variety of TAP block insertion techniques have been described with each having their own advantages and disadvantages.[1] Flank incisions have been a challenge with US guided approaches as the incision traverses a region where the thoraco-abdominal nerves are exiting the corresponding intercostal spaces at the site of surgical incision.[4] As a result, neither the subcostal nor the lateral approaches of US guided techniques can cover the innervation at or proximal to the incision. However, whether these blocks can be performed under direct vision by a surgeon into an open wound at the end of surgery to potentially cover the innervation better remains a matter of interest.

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A video clip is available online at www.canjurol.com

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Other suggested advantages of surgeon-initiated TAP block insertion include an accurate placement of the nerve block catheter, a potential reduction in complications and decreased requirement of anesthetic equipment.[5] Furthermore, US guided TAP catheter insertion may be limited in a busy practice, especially when such expertise or time are unavailable.[6] In this report, we provide a step by step description on the technique of surgically inserted TAP catheter at our institution. This technique has been performed since 2010 for abdominal surgeries requiring flank incisions, such as renal surgeries.

Method and technique

Surgical TAP catheter insertion

We obtained written consent from the patient to describe and record the surgical TAP insertion technique. At our institution, an open nephrectomy procedure is performed under general anesthesia by placing the patient in lateral decubitus position followed by an incision between the posterior and anterior axillary lines below the 11th rib. Before abdominal closure, the transversus abdominis, internal oblique and external oblique muscles are identified, and the transversus abdominis muscle is closed with a single layer suture, Figure 1. A 17-gauge Tuohy needle is inserted inside out through the internal oblique aponeurosis piercing into the skin with the needle tip being directed anteriorly towards the medial aspect of the abdomen, Figure 2a, 2b, 2c. A multi-orificial nerve block catheter (InfiltraLongSono kit; Pajunk Medizintechnologie GmbH, Geisingen Germany or Contiplex, B-Braun, Melsuengen and Germany) is inserted through the tip of the Tuohy needle and the needle is removed, leaving the catheter in situ, Figure 3a, 3b, 3c. The catheter is now placed such that its proximal portion is along the intercostal nerve and its tip is directed to lie at the posterior edge of the closed layers of transversus abdominis and internal oblique muscles, Figure 4. This posterior placement of

Figure 1. Closed transversus abdominis muscle.

Figure 2a, 2b, 2c. Insertion of 17-gauge Tuohy needle through the internal oblique aponeurosis and piercing into the skin with anterior direction of needle tip.

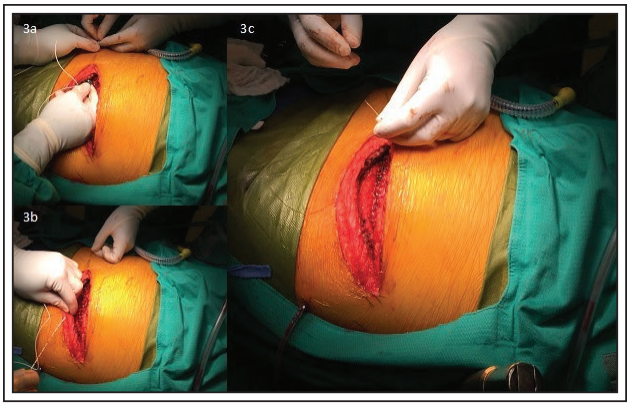

Figure 3a, 3b, 3c. Insertion of a multi-orificial nerve block catheter through the tip of the Tuohy needle and removal of needle.

the catheter tip is intentional such that local anesthetic solution may track towards the proximal portions of the intercostal nerves and potentially cover the lateral cutaneous branches.[3] This part of the catheter insertion technique usually requires less than 2 minutes. The internal oblique and external oblique muscle layers are then closed separately ensuring that the catheter is not in the path of these sutures. Finally, the skin is closed, and the catheter secured using sterile dressing (Epiguard and 3M Tegaderm), Figure 5.

Intermittent versus continuous infusion

Once the wound is closed and dressed, we usually inject an initial bolus of 20 mL 0.25% bupivacaine before waking up the patient. In the recovery area, the TAP

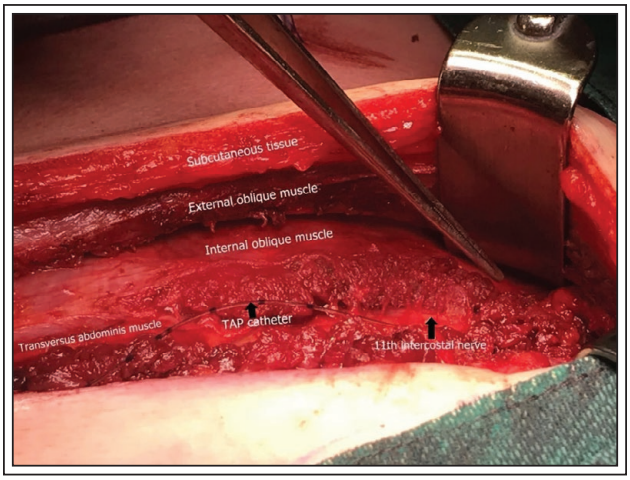

Figure 4. Anatomy of the abdominal wall and final transversus abdominis plane (TAP) catheter placement posterior to wound site.

Figure 5. Overhead view of TAP catheter placement and closure of the abdominal wall and skin.

catheter is connected to an electronic pump (CADD solis) programmed to deliver intermittent boluses of 0.2% ropivocaine at the rate of 15 mL every 4 hours which is continued for 48 hours postoperatively. This is used as part of a postoperative multi-modal analgesia regime in conjunction with a patient-controlled-analgesia of hydromorphone or morphine. Although our institution has used an intermittent bolus regimen for this technique, there are currently limited studies available which directly assess whether continuous infusion can provide superior analgesia. For instance, a small study of 24 participants by Khatibi et al found no difference between the efficacy of an intermittent bolus versus continuous infusion of local anesthetic through a TAP catheter. Their study participants, however, were healthy volunteers and so cold and pressure deficits were used as surrogate outcomes in place of pain reduction.[7] Rao Kadam et al directly compared the analgesic efficacy of these two methods which showed no difference in pain scores, length of stay or patient satisfaction scores but found intermittent bolus to be more cost-effective. Unfortunately, this study consisted of only 20 participants.[8] Therefore, until larger randomized control trials can be conducted to directly compare these two regimens, it remains the institute's preference to deliver local anesthetic either intermittently or through a continuous infusion. Finally, although liposomal local

anesthetic may obviate the need for a catheter, they not only remain unavailable in many countries including Canada,[9] but also have not demonstrated a superior benefit compared to conventional bupivacaine.[10]

Pearls to proper TAP catheter insertion for flank incisions

The key to successful TAP catheter insertion for flank incisions is placing its infusing portion until the proximal part of the catheter lies within the edge of undisturbed TAP plane so that the spread of local anesthetic is to the entirety of the incision and has the potential to track posteriorly into the undisturbed TAP plane. The upper abdominal innervation (T7-T11) travel in their corresponding intercostal spaces and enter the TAP plane between the interdigitations of transversus abdominis and diaphragm at the costal margin.[4] Since the surgical incision mostly overlies the dermatomal territory covered by the lateral cutaneous branches of T7-T11, an anteriorly directed catheter may not reliably cover it while a posteriorly directed TAP catheter with the proximal part within the undisturbed TAP plane is hence needed to cover the entire wound. The lateral cutaneous branches of T6-12 nerves supplying the lateral aspect of the abdominal wall exit the intercostal spaces well before these nerves reach the costal margin[4] and hence a proximal tracking of the local anesthetic is desirable but uncertain with any of the TAP block approaches. This is more certainly missed when the tip is directed anteriorly and may explain the suboptimal analgesia seen in some studies.[11] If performed under US guidance, such precise placement of the TAP catheter tip would be difficult to achieve postoperatively and require greater expertise and time due to change in the structural anatomy, wound edema and dressings while a preoperative insertion is impossible as the catheter will be in the path of surgical incision. Hence, surgically inserted TAP wound infusions may be a simple and site-specific analgesic technique for flank incisions.

Conclusion

Transversus abdominis plane wound infusions are used as an adjunct for postoperative analgesia following nephrectomies. At our institution, surgeon-initiated TAP wound catheter insertion is a time-tested technique which is quick to perform and requires minimal skills. The first step in translating evidence into practice is awareness followed by acceptance and adoption of the practice.[12] We hope that this description will help other institutions to adapt the technique for benefit of the patients undergoing flank incisions. □

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