Lumbar Transversus Abdominis Plane (TAP) Block: Does volume make a difference?

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Background

- An important component of pain after abdominal surgery derives from the incision itself.
- Afferent nerves course through the neurofascial plane between the internal oblique and transversus abdominis muscles.
- Nerves supplying the anterior abdominal wall are derived from T6-L1.
Background

- The lumbar Transversus Abdominis Plane (TAP) block was described by Rafi in 2001 as a means of blocking the distal nerve endings from T6-L1 dermatomes as they pass through the Petit triangle.
- Ultrasound-guided technique was then described by Hebbard.

Reg Anesth Pain Med 2007; 32:399-404
Background

Advantages of Ultrasound vs. Blind Technique

• Triangle of Petit technically difficult to palpate in obese patients.

• Cadaveric study has shown that the Triangle of Petit is more posterior than the literature suggests.
  *Zorica B. Anesthesia and Analgesia 2009; 109:981-985*

• **US** guidance reduces the block time and number of attempts, and decreases the block onset time.
  *UltScand 2008; 52: 727–37*
Background

Cadaveric studies have demonstrated variable dye spread after lumbar TAP.

McDonnell et al.
- “double pop” blind technique in 3 fresh unfixed cadavers (20 cc methylene blue dye).
- result: Deposition of dye in TAP plane between iliac crest and inferior costal (nerve or dermatomal involvement not defined)

Regional Anesthesia and pain Medicine. 2007; 32:399-404

Tran et al
- US guided technique in 10 frozen unembalmed cadavers, defrosted before injection (20 cc aniline blue dye )
- results: Segmental nerves involved: T10 (50%), T11 (100%), T10 (100%), L1 (93%).

BJA 2009; 102(1):123-127
Observational studies

McDonnell et al.
- ‘double pop’ blind technique in 3 volunteers (20 cc lidocaine 0.5% bilaterally)
- Result: Sensory block at 2 hrs: T7-L1 by pin prick.
  Regional Anesthesia and Pain Medicine. 2007; 32:399-404

Shibata et al.
- Expert opinion, not published
- US guided TAP block in 26 patients undergoing laparoscopic gynecologic surgery.
- Results: Sensory block at 30 minutes: T10 max
  Anesthesia and Analgesia. 2007; 205(3): 883
Bottom line from observational studies and cadaveric studies

• The lumbar TAP block is currently suggested for infraumbilical incisions (T10 to L1)
Because it is thought that the lumbar TAP block only reliably blocks to T10 dermatome, Hebbard described an alternative ‘oblique subcostal’ TAP block.

At the level of xiphoid process local anesthetic is first injected between transversus abdominis and rectus abdominis, following which the needle is moved infero-lateral between the TAP to reach more nerves.

20 blocks showed a mean block height (by ice) as a proportion of the distance between xiphoid process and pubis of 0.86 (0.82-0.90)
Subcostal TAP Block

Problems with this technique:
- It is not a single shot technique – requires excessive needle movement under ultrasound guidance, which may increase the risk of neurovascular or GI injury
- No studies have validated its clinical utility and safety
Subcostal vs. Lumbar

Lee et al.

• Comparison of extent of sensory block following subcostal and lumbar US guided approaches
  - Observational study
  - Total of 81 blocks in 50 patients
  - Local anesthetics
    20 cc Ropivacaine 0.5% if bilateral
    20 cc Ropivacaine 1% if unilateral
Subcostal vs. Lumbar

Results:

- Subcostal: Highest level reached: T8
- Posterior/Lumbar: Highest level reached: T10

Conclusion:

Using 20 cc of local anesthetic, the lumbar approach appears more appropriate for lower abdominal surgery and the subcostal approach is better suited to upper abdominal surgery.

Anesth Intensive Care: 2010;38:452-460
What is the current TAP block EBM?

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<th>TAP block procedure</th>
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LOR, loss of resistance; PCA, patient-controlled analgesia; UL, ultrasound; VAS, visual analogue scale; post-op, post-operatively.
What is the current TAP Block EBM?

- 2010 systematic review of 7 lumbar TAP RCTs exploring postoperative pain relief (180 blocks performed):
  - TAP block is a key component of **multimodal postoperative analgesia**
  - significantly decreased pain scores in 4/7 from 0-6hrs
  - after appendectomy, bowel surgery, and abdominal hysterectomy, significantly decreased pain scores at 24 hrs. The hysterectomy group had decreased pain scores beyond 48hrs
  - significantly decreased 24hr PCA morphine consumption in 6/7
  - significantly decreased sedation scores in ¾
  - significantly decreased morphine consumption in US guided group vs. blind technique.
  - trend towards decreased PONV
What is the study about?

- Typically, **20ml of local anesthetic** (ropivacaine, levobupivacaine) is injected per side, with concentrations based on toxic dose.
- There are currently no studies about the value of increasing the local anesthetic **volume** in order to block more dermatomes and in turn extending the use of the **lumbar** TAP block to a wider range of surgical procedures (supraumbilical incisions)
Question to be Addressed

- Does increasing the volume of local anesthetic increase the spread to higher dermatomes using an ultrasound-guided lumbar TAP block?
Clinical Rationale

• Lumbar TAP block may offer an alternative to epidural use with supraumbilical incisions (current gold standard), particularly in patients who may have contraindications to neuraxial anesthesia (ex. coagulopathy)

• Additionally, if the block is reliably increased with increasing volumes, the need for an additional oblique subcostal block may be eliminated
Research Proposal

• Prospective, randomized, controlled, double blind trial, using abdominal hysterectomies as the surgical model, comparing three volumes of local anesthetics during ultrasound-guided lumbar TAP block and assessing sensory block level as the primary outcome.
Outcome Goals

Primary – determine differences in dermatomal spread by response to cold-sensation to ice and pin prick

Secondary – Pain scores using VAS, opioid consumption, PACU discharge time, post-operative nausea and vomiting (PONV), failure rate, and patient satisfaction
Methodology

3 patient groups
1. 20mls of 0.5% ropivacaine per side
2. 30mls of 0.33% ropivacaine per side
3. 40mls of 0.25% ropivacaine per side

Recruitment to occur at St. Joseph’s pre-operative clinic

All patients will receive the lumbar TAP block under US guidance post-surgery, asleep before extubation (as described by Hebbard)
Post-block Assessment

- Evaluation 2 hrs after block using cold response to ice and loss of pinprick sensation
- Followed for 48 hrs by APS using a pain diary and LIKERT-score for satisfaction. Block level will be assessed at 6, 12, 24, and 48hrs
- All patients will receive a multi-modal approach to pain including PCA morphine, acetaminophen, and NSAIDs. Neuromodulators and long acting opioids will be avoided.
Inclusion/Exclusion Criteria

Inclusion Criteria:
• ages 18 and 70 years, capable of completing a consent form, without previous use of opioids and no previous abdominal wall surgeries, scheduled for abdominal hysterectomy

Exclusion Criteria:
• coagulopathy, local or systemic infection, allergy to local anesthetics, inability to fill an informed consent and BMI > 30.
Research Team

Dr. M. Forero
Dr. A. Heikkila

***Research assistant and epidemiological support required
Pilot Study

A pilot study, following the identical study design, will be performed to assess:
- feasibility
- safety
- recruitment and consent rate
- sample size
The Future of the TAP Block

1. Need to determine procedure specific volumes and concentrations
2. Need to determine the analgesic duration of a single injection and the role of continuous infusion techniques
3. Need to determine if single-injection TAP blocks or continuous infusions offer comparable analgesia to epidurals
4. Need to determine its efficacy with supraumbilical incisions
Questions for you and for us

• Number of patients in pilot study
• Funding and support
Appendix 1

- Tran and Hebbard (2009) – cadaveric study, 20ml of dye injected into triangle of petit (US-guided), T10 (50%), T11 (100%), T12 (100%), L1 (93%)
- McDonnell (2007) – cadaveric and 3 living volunteers, 20ml 0.5% lidocaine (blind), loss of cotton wool and pinprick from T7-L1.
- Lee and Hebbard (2010) – US-guided, sensory block T10-L1 with lumbar TAP block, 20ml of 1% ropivacaine if one sided or 40ml of 0.5% if bilateral
**Table 1**

Randomized-controlled studies of a TAP block in post-operative pain.

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