

Intrathecal Dexmedetomidine versus Transversus Abdominus Plane Block (TAP) for Postoperative Analgesia after Cesarean Section: Review article

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ABSTRACT

Background: The quadratus lumborum block (QLB), slow-release local anaesthetics, and non-pharmacological methods are only a few of the innovative pain-management strategies that have been developed to treat caesarean-related pain. As a part of the multimodal analgesic strategy, the transversus abdominis plane (TAP) block has been utilised for post-operative pain reduction following a variety of abdominal procedures. The somatic analgesia it produces is adequate, and the visceral blockage is minimal or nonexistent. While, less effective than neuraxial morphine, TAP blocks have less side effects such as nausea and itching. The lateral TAP block approach can result in post-Caesarean delivery analgesia that lasts for up to 24 to 48 hours after surgery. The α_2 -agonist dexmedetomidine is very selective. **Objective:** To highlight Intrathecal Dexmedetomidine versus TAP block for postoperative analgesia after Caesarean section (CS).

Methods: Searches in Google, Google scholar, and PubMed were conducted for Dexmedetomidine, QLB, TAP block, and Caesarean delivery. The authors also reviewed references from pertinent literature, although they only included the most recent or comprehensive study from July 2000 to May 2022. Documents in languages other than English have been disqualified due to lack of translation-related sources. Dissertations, oral presentations, unpublished manuscripts, conference abstracts, and other papers that did not pertain to significant scientific research were excluded.

Conclusion: We came to the conclusion that the addition of dexmedetomidine to bupivacaine in TAP block increased the length of time before the first dose of rescue analgesia was sought, as well as decreased and lowered postoperative VAS ratings recorded at all-time points, and it also increased the length of motor block.

Keywords: Dexmedetomidine, QLB, TAP block, Cesarean section.

INTRODUCTION

The QLB, slow-release local anaesthetics, and non-pharmacological methods are only a few of the innovative pain-management strategies that have recently been developed to treat caesarean-related pain⁽¹⁾. As a part of the multimodal analgesic strategy, the TAP block has been utilised for post-operative pain reduction following a variety of abdominal procedures. It produces a good level of somatic analgesia with little to no visceral blockage. A posterior abdominal wall block called a QLB block, which Blanco first described in 2007, allows local anaesthetic to spread behind the quadratus lumborum muscle (QLM) into a triangle-shaped area called the lumbar interfascial triangle, which is next to the middle layer of the thoracolumbar fascia (TLF)⁽²⁾.

Role of opioids in postoperative analgesia after Cesarean section: Systemic administration is typically utilised after general anaesthesia and in locations where long-acting preservative-free opioids are unavailable or their use is not well-understood. Intramuscular and intravenous delivery of opioids via these routes can be done sporadically, on demand, or continuously⁽³⁾.

• Neuraxial opioids:

Maternal mortality related to anaesthesia has decreased as a result of the introduction of neuraxial anaesthetic procedures. The American Society of Anaesthesia (ASA) recommendations for anaesthesia advise against using intermittent parenteral boluses in favour of neuraxial opioids, with or without salvage

doses. Although IV opioids are not any more effective in managing pain than oral opioids are, they do tend to have more side effects⁽⁴⁾. Respiratory depression is one of the most serious side effects connected to the usage of neuraxial opioids. Obstetric patients who have a high BMI, have used opioids in the past, are receiving magnesium sulphate infusions, or have respiratory comorbidities are more likely to have respiratory depression in these circumstances⁽⁵⁾.

• Neuraxial administration of non-opioid analgesics

When decreasing the amount of the opioid and hence its adverse effects, the use of neuraxial adjuvant non-opioid drugs has been a subject of significant attention. It has been proven that the analgesic effect can last longer⁽⁶⁾. In the event of epidural administration, pruritus decreases in addition to the local anaesthetic dose that is needed, and the risk of hypotension, sedation, or negative foetal consequences is not noticeably increased⁽⁷⁾.

• Systemic opioid

Patient-controlled analgesia (PCA) is a strategy for self-administration of the drug that avoids the patient nurse-injection loop, saving important time in the management of acute pain and lowering the peaks and troughs of plasma drug concentrations, leading to increased patient satisfaction⁽⁸⁾. An opioid called morphine is more likely than other opioids to enter breast milk in quantities that might be dangerous for the unborn child. The second drug is oxycodone, whose dosages are dangerously high. The drug with the lowest rates of passing is fentanyl⁽⁹⁾.

• **Regional techniques include:**

1. Transverse abdominis plane block
2. Quadratus lumborum block
3. Ilioinguinal-iliohypogastric block

Transverse abdominis plane (TAP) block:

While less efficacious than neuraxial morphine, TAP blocks have less side effects such as nausea and pruritus⁽¹⁰⁾. When combined with neuraxial morphine, these blocks typically do not appreciably improve the overall pain control of post-Cesarean delivery patients. TAP blocks (or continuous TAP catheters) could be helpful, but, if neuraxial morphine is not advised, if the patient is under general anaesthesia, or if they have a higher opioid tolerance. Large volumes of local anaesthetic (LA) are injected during TAP blocks, which raises concerns in pregnant individuals since they are more likely to have LA toxicity⁽¹¹⁾.

One option for TAP blocks is as follows :

- Bupivacaine 0.25% with epinephrine, 15 to 20 mL each side, for single injection blocks.
- Bupivacaine 0.1% at 8–10 cc/hr is infused after 15–20 mL each side of bupivacaine 0.25% with epinephrine for continuous block⁽¹²⁾.

Indications of TAP block

1. The TAP block is a quick and easy treatment that can be added to the therapy of postoperative pain in gynecologic and abdominal surgery⁽¹³⁾.
2. Urologic surgery that affects the T6 to L1 distribution.
3. Surgical operations such as laparoscopic cholecystectomy, abdominal hysterectomy, open appendectomy, and large bowel resection⁽¹⁴⁾.
4. The TAP block is effective for many various laparoscopic operations, including the treatment of abdominal and inguinal hernias, radical prostatectomy, nephrectomy, and many others^(15,16).

5. Midline incisions can be treated with bilateral TAP blocks. The use of this method is also advantageous for surgical operations in which anticoagulated individuals are not eligible for epidural anaesthesia.
6. When extended analgesia is required, a continuous TAP block approach including catheter insertion has been reported⁽¹⁶⁾.

Contraindications:

There are extremely few contraindications to TAP block. Absolute indications for avoidance include:

1. Infection at the injection site.
2. An uncooperative or procedure-rejecting patient.
3. Local anaesthetic allergy⁽¹⁷⁾.

Duration of TAP block:

Depending on the block method, the TAP block's relative effectiveness for transverse lower abdominal incisions may vary. Both the posterior injections in the Petit triangle and the lateral injections at the midaxillary line approaches have shown effectiveness right away in the postoperative period. It is debatable if either approach can induce analgesic benefits that last longer (≥ 12 h) following lower transverse incision surgery. The lateral TAP block approach can result in extended post-Caesarean analgesia that lasts for 24-48 h after surgery⁽¹⁸⁾.

- **US-guided lateral TAP block:** Figure (1) depicts the probe location of the lateral US-guided TAP block.
- **US-guided posterior TAP block:** Transversus abdominis tapers off and becomes aponeurosis posteriorly at this level of scanning. The quadratus lumborum is depicted posteromedial to the aponeurosis. The injection location is near the quadratus lumborum and is superficial to the aponeurosis⁽²⁰⁾ (Figure 2).

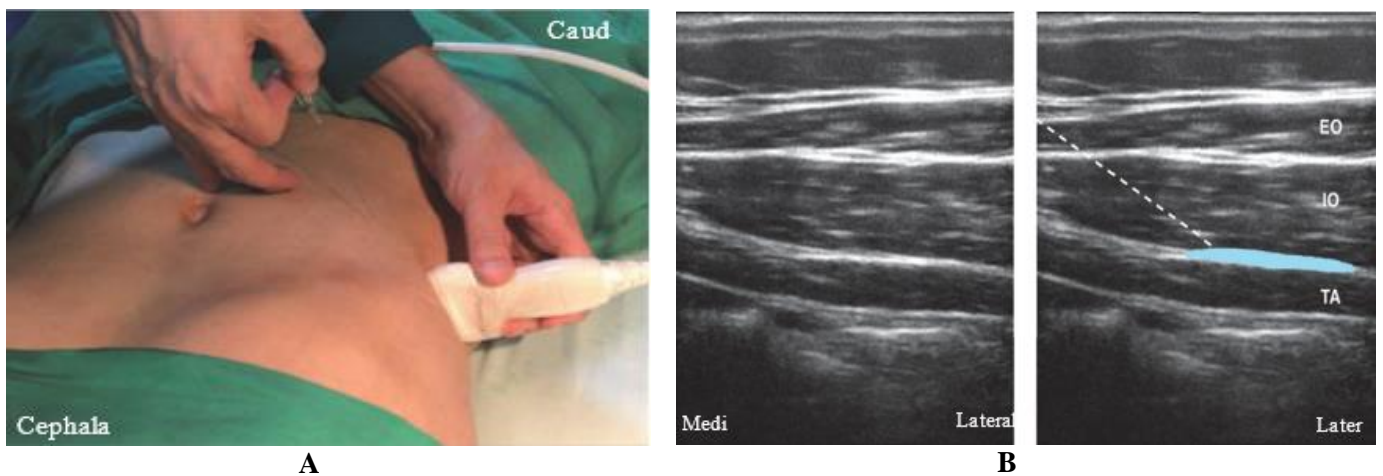


Figure (1): TAP block approach from the side. (A) The location of the probe and the needle trajectory. The probe is located close or at the midaxillary line, which connects the costal margin to the iliac crest. The needle has been put into the plane. (B) Corresponding ultrasound images. The TAP is located between the internal oblique and the transversus abdominis. To cover the lower TAP plexus, the local anaesthetic is placed in this plane. The needle trajectory is depicted by a white dashed line. The light blue region represents the site of local anaesthetic deposition. TA is for transversus abdominis; IO stands for internal oblique; and EO stands for external oblique⁽¹⁹⁾.



Figure (2): TAP block's posterior approach. (a) The location of the probe and the needle trajectory. The probe is inserted between the costal border and the iliac crest, posterior to the midaxillary line. The needle has been put into the plane. (b) Corresponding ultrasound images. Posteriorly, transversus abdominis tails off and turns into aponeurosis. The quadratus lumborum can be seen posteromedial to aponeurosis. The injection site is at the TAP between internal oblique and transversus abdominis posterior to the midaxillary line and near the aponeurosis. White dashed line needle trajectory. Light blue area the deposition site of local anesthetic. TA transversus abdominis; IO internal oblique; EO external oblique; QL quadratus lumborum ⁽¹⁹⁾.

Analgesic effect of TAP block in post Cesarean delivery pain:

Lower segment caesarean section (LSCS) is a significant surgical surgery that causes varying degrees of post-operative discomfort. Pain management following LSCS is critical to allow for early mobility and good neonatal care. Because of the changed physiology and the likelihood of medication transmission through breast milk, achieving appropriate pain management is challenging. Despite the availability of a variety of medications and modes of administration, we have yet to develop a safe and effective technique of pain management following LSCS ⁽²¹⁾. Patient-controlled analgesia (PCA) can also be used to give opioids intravenously or epidurally. PCA gives patients control over their pain treatment, which increases their happiness with the therapy. However, opioids' chief downsides remain drowsiness, nausea and vomiting, pruritus, and, in rare cases, respiratory depression ⁽²¹⁾.

Another issue in this population is secretion into breast milk. Paracetamol and NSAIDs can only provide additional forms of analgesia and are insufficient on their own. Due to past difficulties, peripheral nerve block methods such as TAP block were presented as an effective component of multimodal analgesia following CS ⁽²¹⁾.

These techniques not only effectively reduce pain, but they also remove some of the negative side effects associated with the administration of systemic opioids or central neuraxial blocks. The US guided

TAP block is a successful post-operative analgesic treatment for lower abdominal procedures. When administered as part of a multimodal analgesic regimen for pain treatment following CS, TAP block lowers discomfort, increases the time to first analgesic request, and minimises the need for additional opioid analgesics ⁽²¹⁾.

Dexmedetomidine: Dexmedetomidine is a very specific α 2-agonist. It was authorised for human use by the FDA in 1999 ⁽²²⁾.

Pharmacodynamics: Dexmedetomidine works by binding to G-protein coupled α 2-adrenergic receptors located in the central, peripheral, and autonomic nervous systems, as well as many important organs and blood vessels. Analgesic effects are primarily mediated through receptors found on neurons in the superficial dorsal horn of lamina II, which suppress the production of pro-nociceptive transmitters such as substance P and glutamate, as well as spinal interneuron hyperpolarization ⁽²²⁾.

Pharmacokinetics: Due to substantial first pass metabolism, dexmedetomidine has a poor bioavailability; however, the sublingual route has a high bioavailability of roughly 84%. By glucuronidation and aliphatic hydroxylation, both of which are mediated by cytochrome P-450, dexmedetomidine is completely biotransformed into inert metabolites. 95% of these metabolites are eliminated in the urine, and 4% in the faeces. Due to slower rates of metabolism in hepatic failing patients, the dosage must be changed ⁽²²⁾.

Clinical effects include:

- 1. Cardiovascular system:** Dexmedetomidine has biphasic effects on blood pressure, causing an initial brief increase and a reflex drop in HR due to activation of α 2 receptors in vascular smooth muscles ⁽²³⁾.
- 2. Central nervous system:** Dexmedetomidine induces a decrease in intracranial pressure along with a decrease in cerebral blood flow and oxygen metabolic demand ⁽²⁴⁾.
- 3. Respiratory system:** Even at larger dosages, dexmedetomidine does not impede breathing or gas exchange and has no depressive effects on respiratory function; nonetheless, it may cause moderate hypercapnia ⁽²⁵⁾.
- 4. Endocrine and renal system:** Dexmedetomidine inhibits the stress response to surgery by activating peripheral α 2-receptors and limiting catecholamine release ⁽²⁶⁾.

Adverse effects:

Hypotension, bradycardia, dry mouth, nausea, desaturation, pulmonary edoema, atelectasis, and other adverse effects are frequent ones. Dexmedetomidine infusions given over an extended period of time may cause receptors to become more active, which might result in the development of withdrawal symptoms

upon abrupt cessation, including anxiety, agitation, headaches, and hypertensive crisis. individuals with extensive cardiac block and ventricular dysfunction should not use it, and pregnant individuals are at category C risk ⁽²⁷⁾.

CONCLUSION

We came to the conclusion that the addition of dexmedetomidine to bupivacaine in TAP block increased the length of time before the first dose of rescue analgesia was sought, as well as decreased and lowered postoperative VAS ratings recorded at all-time points, and it also increased the length of motor block.

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