Current Anesthesiology Reports (2021) 11:12–17
https://doi.org/10.1007/s40140-021-00436-7

OBSTETRIC ANESTHESIA (LR LEFFERT, SECTION EDITOR)

The Role of Truncal Blocks in Obstetric Anesthesia

Jaime Aaronson [1] · Robert White [2]

Accepted: 2 February 2021 / Published online: 18 February 2021

Abstract

Purpose of Review This review provides a framework for managing post-cesarean delivery pain in the age of enhanced recovery after surgery (ERAS). In doing so, it highlights the role that truncal blocks play in obstetric anesthesia. The value of transversus abdominus plane block (TAP) and quadratus lumborum block (QLB) to optimize post-cesarean delivery pain is discussed.

Recent Findings TAP block and QLB have been compared with each other and with controls, with and without neuraxial morphine. In the absence of neuraxial morphine, TAP block and QLB are superior to controls, but when intrathecal morphine is used, they do not provide additional benefit.

Summary There is indeed a role for truncal blocks in obstetric anesthesia. Both TAP block and QLB provide analgesia after cesarean delivery. They are not, however, universally beneficial; they are best incorporated when neuraxial morphine is not used, or to rescue pain not well-controlled with standard multimodal analgesia.

Keywords Transversus abdominus plane (TAP) block · Quadratus lumborum block (QLB) · Post-cesarean delivery analgesia · Enhanced recovery after surgery (ERAS) · Enhanced recovery after cesarean (ERAC)

Introduction

Is there a role for truncal blocks in obstetric anesthesia? If yes, what exactly is the role? In order to answer these questions, comprehensive knowledge of best practices for post-cesarean delivery analgesia is needed. It is generally accepted that optimal pain management after cesarean delivery is most likely to be achieved using a multimodal analgesic approach. In the era of enhanced recovery after surgery (ERAS) protocols, this includes the use of neuraxial morphine as well as scheduled, non-opioid, oral analgesics such as acetaminophen and non-steroidal anti-inflammatory drugs. The use of multimodal analgesia following cesarean delivery is key to reduce pain, improve mobilization, and both decrease in-hospital opioid use, as well as opioid use after discharge (https://soap.org//SOAP-Enhanced-Recovery-After-Cesarean-Consensus-Statement.pdf).

In some cases, there may be obstacles to achieving post-cesarean analgesia in the recommended way. Procedure-related factors include size of the skin incision, uterine exteriorization, parietal peritoneal closure, and repeated surgical procedure [1]. The complexity of surgery (e.g., cesarean hysterectomy) likely plays a role in the severity of postoperative pain as well. Patient-related factors include a contraindication to neuraxial anesthesia, chronic pain, or the presence of an existing opioid use disorder. To make things more complicated, and we see this in our own practice, there may also be women for whom a standard multimodal analgesic regimen does not provide adequate pain control, even when no pre-existing risk factors are identified.

Adequate post-cesarean pain management, although not simple, is critical. Women who undergo cesarean delivery rank avoidance of pain during and after surgery as their highest anesthetic-related priority [2]. Moreover, there are serious negative consequences to poor postoperative analgesia, which include chronic pain, greater opioid use, delayed functional recovery, impaired maternal-fetal bonding, and postpartum depression [3]. Effective non-

Search Strategy: A PubMed search was conducted using the following key words: Transversus abdominus plane block, quadratus lumborum block, post-cesarean delivery analgesia, postoperative analgesia, cesarean delivery, enhanced recovery after surgery, and enhanced recovery after cesarean.

This article is part of the Topical Collection on *Obstetric Anesthesia*

✉ Jaime Aaronson
jak9060@med.cornell.edu

[1] Department of Anesthesiology, Weill Cornell Medicine, 1283 York Avenue, Suite 16-16087, New York, NY 10065, USA

[2] 525 East 68th Street, New York, NY 10065, USA

opioid (or at least opioid-sparing) options to relieve pain that is not well controlled with standard therapies are, therefore, indicated.

Given the complexity of pain in the setting of cesarean delivery, as well as the implications for both short- and long-term outcomes, it turns out that there is indeed a role for truncal blocks in obstetric anesthesia. Truncal blocks for post-cesarean analgesia include transversus abdominus plane (TAP) block and quadratus lumborum block (QLB), both of which are fascial plane blocks that offer an alternative option for pain management. The indications for these blocks are similar; yet, there remains debate as to the superiority of one technique over the other. One caveat, though, to incorporating truncal blocks of either kind into practice is expertise in regional anesthesia techniques.

ERAS/ERAC

Enhanced recovery after surgery (ERAS) is not a new concept; it was first developed in the setting of colorectal surgery in the early 2000s [4–6], but has since been adapted to benefit patients undergoing many different surgeries. The goal of enhanced recovery protocols is to standardize the perioperative care of patients, beginning even before admission to the hospital. Enhanced recovery after cesarean (ERAC), like other ERAS protocols, is composed of interventions that begin in the preoperative period and continue through the duration of the postoperative course [7•, 8–10].

One essential component of ERAC is the use of multimodal analgesia to optimize pain control. To this end, a low-dose, long-acting neuraxial opioid (usually preservative-free morphine, 50–150 μg) is the backbone of a successful ERAC protocol. When scheduled non-steroidal anti-inflammatory drugs and acetaminophen are used in addition to neuraxial morphine, adequate post-cesarean pain management is achievable for most patients. When neuraxial morphine is not or cannot be given, truncal blocks should be offered; ideally, pre-emptive use of regional analgesia is best when suboptimal pain control is likely, but can also be performed for rescue analgesia in the postoperative period [1]. Lastly, it is important to remember that although designed for planned surgery, ERAC, including the use of truncal blocks, can also be adapted for patients who undergo unplanned cesarean delivery.

Transversus Abdominus Plane Block

The transversus abdominus plane (TAP) block was first described two decades ago as a blind, landmark-based technique [11]. It is a sensory nerve block, achieved by depositing local anesthetic in the neurofascial plane between the internal oblique and transversus abdominus muscles. Over time, the technique itself has evolved; this includes, for example, the use of ultrasound guidance to inject local anesthetic in the desired location. However, the intended goal of the TAP block has remained the same since its inception—to alleviate postoperative pain originating from the anterior abdominal wall. Questions, nevertheless, remain as to the optimal dose of local anesthetic needed, as well utility of adjuvant medications to achieve post-cesarean analgesia.

TAP block was not initially intended to provide analgesia to obstetric patients, yet has since been used for many years to provide pain relief after cesarean delivery. Perhaps, the greatest advantage of TAP block in this setting (and others) is the lack of side effects associated with its use. In addition, the risk for complications with TAP block is low [12]. TAP blocks, however, are still not the panacea of post-cesarean pain management despite these well-recognized benefits. One major pitfall is that TAP blocks do not mitigate visceral pain—a key contributor to acute post-cesarean pain. Furthermore, available data suggests that the greatest analgesic effect is seen in women who receive TAP blocks in the absence of intrathecal morphine [13]. In practice, then, TAP block should be offered to women who cannot have intrathecal morphine due to allergy or intolerance, or who undergo general anesthesia for whatever the reason may be.

Because there is value in TAP blocks for a certain subset of obstetric patients, it is necessary to consider the dose of local anesthetic needed to achieve adequate pain control. In a meta-analysis of high- (bupivacaine equivalents, > 50 mg per block side) versus low-dose (bupivacaine equivalents, < 50 mg per block side) local anesthetic TAP block for post-cesarean delivery analgesia, there was no difference in postoperative opioid consumption or pain scores [14]. The dose of local anesthetic is also important because of the potential for local anesthetic systemic toxicity (LAST), either by direct intravascular injection or delayed absorption at the injection site. Notably, pregnant patients appear to be at higher risk for refractory cardiac arrest in the setting of local anesthetic overdose (bupivacaine > lidocaine), which should raise the level of concern when regional blocks are performed for post-cesarean pain management [15]. In one report, two cases of local anesthetic systemic toxicity occurred after placement of ultrasound-guided TAP blocks for post-cesarean analgesia, both of which required bag mask ventilation and lipid emulsion therapy [16]. In a study of 30 pregnant patients undergoing elective cesarean delivery under spinal anesthesia and bilateral ultrasound-guided TAP blocks with ropivacaine (2.5 mg/kg) for postoperative pain management, 12 patients were found to have toxic levels at some time after block placement [17]. All things considered, low-dose local anesthetic TAP block (e.g., bupivacaine 0.25%, 20 ml per side) appears to be preferable.

Although studied in other settings, the value of adding adjuvant medication to the local anesthetic for TAP block after cesarean delivery is not entirely clear. In one study, adding

clonidine to a TAP block with bupivacaine did not affect wound hyperalgesia index, and it did not improve short- or long-term pain scores in women undergoing elective cesarean delivery [18]. In another study, TAP block performed with clonidine and local anesthetic also did not significantly reduce the incidence of post-operative nausea and vomiting compared with intrathecal morphine [19]. Yet, there is some data to suggest that a combination of clonidine (75 mcg or 1 mcg/kg) and local anesthetic in TAP blocks increases the duration of post-operative analgesia and decreases post-operative analgesic requirement [20, 21]. Dexamethasone (4–8 mg per side) has also been studied, but again not extensively in the obstetric population; like clonidine, it may prolong the analgesic duration of a TAP block [22, 23]. Randomized controlled trials to examine the superiority of dexamethasone versus clonidine as an adjuvant to TAP block for post-cesarean analgesia do not exist, but would be of interest. Given that there is little in the way of side effects with either dexamethasone or clonidine as an adjuvant, one might make the argument to add one or the other for whatever benefit, even if small, exists.

In order to prolong the duration of TAP block, one might also consider the use of catheters. Other theoretical benefits include superior analgesia and an opioid-sparing effect, and in general, serious complications are rare with catheter techniques [24]. The most common local anesthetics used are bupivacaine (0.125% at 0.25 mg/kg per hour to 0.375% up to 2 mg/kg every 8 h), ropivacaine (0.1% at 10 ml/h to 0.35% at 4–5 ml/h), and levobupivacaine (0.25% at 4–5 ml/h) [25]. There is no consensus, however, regarding mode of delivery (bolus vs. continuous), type of local anesthetic, or dosing regimen with TAP catheters, and for this reason, variation in practice exists. It is probably worth noting, too, that there is little data for TAP catheters in the obstetric population; there is one case series [26], but randomized clinical trials to compare TAP catheters to single-shot TAP blocks, or any other alternative, for post-cesarean pain management do not exist.

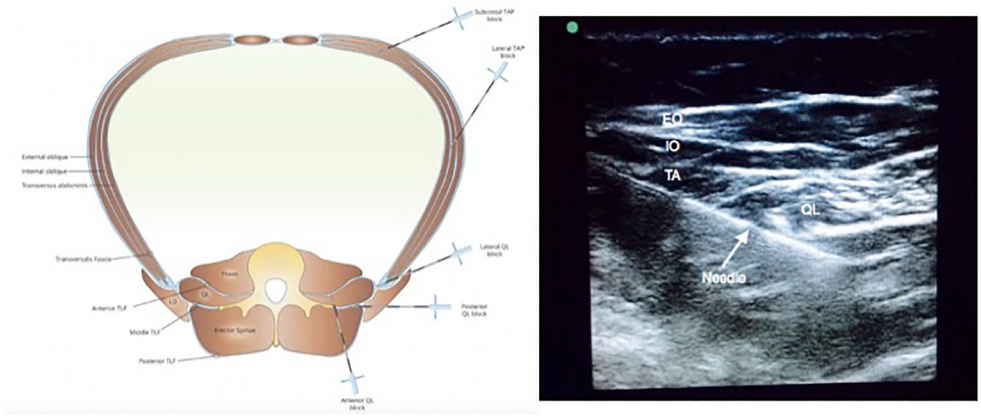
The use of liposomal bupivacaine (LB)—an extended release formulation—to increase the duration of TAP block analgesia after cesarean delivery has been studied. In one multicenter, randomized, double-blind, controlled trial, women undergoing elective cesarean delivery were randomized to TAP block with LB (LB-TAP; 266 mg) plus bupivacaine HCl (50 mg) or bupivacaine HCl (50 mg) alone 28 [27]. LB-TAP plus bupivacaine HCl as part of a multimodal analgesia protocol with intrathecal morphine resulted in reduced opioid consumption after cesarean delivery. In another study, women undergoing cesarean delivery received either LB-TAP or incisional infiltration with LB (LB-II) [28]. Women receiving LB-TAP reported higher pain scores than women receiving LB-II on postoperative day 0, but the groups did not differ in regards to pain scores on postoperative days 1 or 2, and morphine equivalents were similar between groups. Additional studies to determine the effectiveness of LB-TAP are needed; however, the cost of LB will likely remain a rate-limiting step in its use, at least for the time being.

Looking at the available data, there is undoubtedly a role—albeit limited—for TAP blocks in the management of post-cesarean delivery pain. Even intraoperative surgeon-administered TAP blocks have been shown to be efficacious, while also taking less time to perform [29]. The limitations of TAP block in the obstetric population, though, are exposed when compared with intrathecal morphine—the 'gold standard' for post-cesarean pain management. It is true that intrathecal morphine is associated with unwanted side effects, including nausea, vomiting, urinary retention, and pruritus [30]. Equally, if not more concerning, is the risk, although low, of dose-dependent respiratory depression with intrathecal morphine [31]. Yet, even in the face of a negative side effect profile, neuraxial morphine provides superior pain relief when compared with TAP block [32–34]. To summarize, TAP blocks are not without benefit, but are best reserved for patients who either do not receive intrathecal opioids or who require rescue analgesia despite use of a multimodal approach to pain management.

Quadratus Lumborum Block

The quadratus lumborum block (QLB) is a superficial fascial block carried out by injection of local anesthetic between the posterior abdominal wall muscles, namely, the quadratus lumborum and erector spinae [35]. Similar to its TAP block counterpart, the QLB was not initially studied in the obstetric population, yet it too is emerging as a useful tool for postoperative pain relief after cesarean delivery. It may, it seems, even have some advantages over the TAP block.

In practice, there is actually more than one approach to the QLB—anterolateral (QLB type 1), posterior (QLB type 2), and transmuscular (QLB type 3) (Fig. 1) [36, 37] (https://www.asra.com/asra-news/article/198/transversus-abdominis-plane-versus-quadr). QLB type 1 is thought to closer resemble the TAP block, and for several reasons, QLB type 2 might be the preferred technique for post-cesarean analgesia. With QLB type 2, local anesthetic spreads posterior to the quadratus lumborum muscle and expands beyond the middle layer of the thoracolumbar fascia in the lumbar interfacial triangle; therefore, it may be that QLB provides not only somatic, but also visceral, analgesia and, therefore, superior analgesia overall [38]. Although it has been argued that TAP block is technically easier to perform, with QLB, the needle is inserted in a superficial fashion, thereby conferring an added safety measure against intraperitoneal injection and bowel injury. There are also no reports of local anesthetic systemic toxicity with QLB in the obstetric population to date, although it possible that they simply have not been published.



a b

Fig. 1 **a** Relevant cross-sectional muscular and fascial anatomy at the mid-lumbar level. LD, latissimus dorsi; QL, quadratus lumborum; TAP, transversus abdominis plane; TLF, thoracolumbar fascia. Reprinted from https://www.asra.com/asra-news/article/198/transversus-abdominis-plane-versus-quadr, with permission from Dr Kariem El-Boghdadly. **b** Ultrasound anatomy of quadratus lumborum block, type 2. EO, external oblique; IO, internal oblique; TA, transversus abdominus. Reprinted from Rev Bras Anestesiol, Volume 67, Issue 4, Sebbag I, Qasem F, Dhir S, Ultrasound guided quadratus lumborum block for analgesia after cesarean delivery: case series, Pages 418-421, 2017, with permission from Elsevier

A limited number of randomized controlled trials have compared QLB and TAP block [24, 39]. In a recent systematic review and meta-analysis that included 31 trials, QLB and TAP block were compared with each other or with control, with or without intrathecal morphine. In the absence of intrathecal morphine, QLB and TAP block were found to be equivalent and superior to control, but appear to provide limited additional benefit when intrathecal morphine is used [40••]. Again, this data supports the utility of truncal blocks on the Labor and Delivery floor, but highlights the notion that it is probably only beneficial in certain circumstances.

Another recent systematic review with meta-analysis and trial-sequential analysis (TSA) examined the analgesic efficacy of QLB versus controls, TAP block and neuraxial morphine, or when used in addition to neuraxial morphine in women undergoing cesarean delivery [41••]. In this study, QLB was found to improve post-cesarean delivery pain, but only in patients who did not receive neuraxial morphine; due to limited data, meta-analysis and TSA were not performed to compare QLB and TAP block. There was heterogeneity in technique and subgroup analysis according to QLB approach was not performed. Despite some evidence in favor of better analgesia with QLB vs. TAP block, it seems that the final decision relies on additional investigation.

Conclusion

There is indeed a role for truncal blocks in obstetric anesthesia. Regional techniques, including TAP block and QLB, can provide post-cesarean analgesia either in place of neuraxial morphine or to rescue pain that is otherwise not well-controlled. It is important to remember, however, that one of the biggest limitations of regional anesthesia for post-cesarean pain management when compared with neuraxial morphine is probably the duration of action (12 h vs. up to 24 h, respectively). Unlike neuraxial morphine, truncal blocks are not associated with nausea, vomiting, sedation, respiratory depression, or pruritus; but, not even a better side effect profile can tip the scale in a new direction, at least for the time being. Until additional studies are performed, perhaps including the use of either adjuvants or longer acting local anesthetics or both, neuraxial morphine as part of a multimodal analgesic regimen will remain the gold standard for post-cesarean delivery pain management.

Declarations

Conflict of Interest Jaime Aaronson, MD and Robert White, MD declare they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as:
- • Of importance
- •• Of major importance

1. Landau R, Bollag L, Ortner C. Chronic pain after childbirth. Int J Obstet Anesth. 2013;22(2):133–45.

2. Carvalho B, Cohen SE, Lipman SS, et al. Patient preferences for anesthesia outcomes associated with cesarean delivery. Anesth Analg. 2005;101:1182–7.
3. Carvalho B, Butwick AJ. Postcesarean analgesia. Best Pract Res Clin Anaesthesiol. 2017;31(1):69–79.
4. Anderson AD, McNaught CE, MacFie J, et al. Randomized clinical trial of multimodal optimization and standard perioperative surgical care. Br J Surg. 2003;90(12):1497–504.
5. Kehlet H, Wilmore DW. Evidence-based surgical care and the evolution of fast-track surgery. Ann Surg. 2008;248(2):189–98.
6. Khoo CK, Vickery CJ, Forsyth N, et al. A prospective randomized controlled trial of multimodal perioperative management protocol in patients undergoing elective colorectal resection for cancer. Ann Surg. 2007;245(6):867–72.
7.• Ituk U, Habib AS. Enhanced recovery after cesarean delivery. F1000Res. 2018;7:F1000 Faculty Rev-513. **This is an important review article that highlights evidence-based perioperative interventions that should be considered for an enhanced recovery after surgery (ERAS) protocol for scheduled cesarean delivery. The authors provide support for why ERAS protocols are important and discuss proposed components for the preoperative, intraoperative, and postoperative phases of care**.
8. Wilson RD, Caughey AB, Wood SL, Macones GA, Wrench IJ, Huang J, et al. Guidelines for antenatal and preoperative care in cesarean delivery: enhanced recovery after surgery society recommendations (Part 1). Am J Obstet Gynecol. 2018;219(6):523.e1-523.e15.
9. Caughey AB, Wood SL, Macones GA, Wrench IJ, Huang J, Norman M, et al. Guidelines for intraoperative care in cesarean delivery: Enhanced Recovery After Surgery Society Recommendations (Part 2). Am J Obstet Gynecol. 2018;219(6):533–44.
10. Macones GA, Caughey AB, Wood SL, Wrench IJ, Huang J, Norman M, et al. Guidelines for postoperative care in cesarean delivery: Enhanced Recovery After Surgery (ERAS) Society recommendations (part 3). Am J Obstet Gynecol. 2019;221(3):247.e1–9.
11. Rafi AN. Abdominal field block: a new approach via the lumbar triangle. Anaesthesia. 2001;56(10):1024–6.
12. Abrahams M, Derby R, Horn JL. Update on Ultrasound for Truncal Blocks: A Review of the Evidence. Reg Anesth Pain Med. 2016;41(2):275–88.
13. Champaneria R, Shah L, Wilson MJ, Daniels JP. Clinical effectiveness of transversus abdominis plane (TAP) blocks for pain relief after caesarean section: a meta-analysis. Int J Obstet Anesth. 2016;28:45–60.
14. Ng SC, Habib AS, Sodha S, Carvalho B, Sultan P. High-dose versus low-dose local anaesthetic for transversus abdominis plane block post-Caesarean delivery analgesia: a meta-analysis. Br J Anaesth. 2018;120(2):252–63.
15. Santos AC, Bucklin BA. Local Anesthetics and Opioids. In: Chestnut DH, Wong CA, Tsen LC, et al., editors. Chestnut's Obstetric Anesthesia: Principles and Practice. 6th ed: Elsevier; 2020.
16. Weiss E, Jolly C, Dumoulin JL, Meftah RB, Blanié P, Laloë PA, Tabary N, Fischler M, Le Guen M. Convulsions in 2 patients after bilateral ultrasound-guided transversus abdominis plane blocks for cesarean analgesia. Reg Anesth Pain Med 2014;39(3):248-251.
17. Griffiths JD, Le NV, Grant S, Bjorksten A, Hebbard P, Royse C. Symptomatic local anaesthetic toxicity and plasma ropivacaine concentrations after transversus abdominis plane block for Caesarean section. Br J Anaesth. 2013;110(6):996–1000.
18. Bollag L, Richebe P, Siaulys M, Ortner CM, Gofeld M, Landau R. Effect of transversus abdominis plane block with and without clonidine on post-cesarean delivery wound hyperalgesia and pain. Reg Anesth Pain Med. 2012;37(5):508–14.
19. Dereu D, Savoldelli GL, Mercier Y, Combescure C, Mathivon S, Rehberg B. The impact of a transversus abdominis plane block including clonidine vs. intrathecal morphine on nausea and vomiting after caesarean section: a randomised controlled trial. Eur J Anaesthesiol. 2019;36(8):575–82.
20. Singh R, Kumar N, Jain A, Joy S. Addition of clonidine to bupivacaine in transversus abdominis plane block prolongs postoperative analgesia after cesarean section. J Anaesthesiol Clin Pharmacol. 2016;32(4):501–4.
21. Acharya R, Baksi R, Mohapatra P. Comparative analysis of duration of postoperative analgesia between levobupivacaine and levobupivacaine with clonidine after ultrasound-guided transversus abdominis plane block in patients undergoing lower segment cesarean section. Anesth Essays Res. 2018;12(4):943–8.
22. Gupta A, Gupta A, Yadav N. Effect of dexamethasone as an adjuvant to ropivacaine on duration and quality of analgesia in ultrasound-guided transversus abdominis plane block in patients undergoing lower segment cesarean section - a prospective, randomised, single-blinded study. Indian J Anaesth. 2019;63(6):469–74.
23. Akkaya A, Yildiz I, Tekelioglu UY, et al. Dexamethasone added to levobupivacaine in ultrasound-guided tranversus abdominis plain block increased the duration of postoperative analgesia after caesarean section: a randomized, double blind, controlled trial. Eur Rev Med Pharmacol Sci. 2014;18(5):717–22.
24. Ilfeld BM. Continuous peripheral nerve blocks: a review of the published evidence. Anesth Analg. 2011;113(4):904–25.
25. Sanderson BJ, Doane MA. Transversus abdominis plane catheters for analgesia following abdominal surgery in adults. Reg Anesth Pain Med. 2018;43(1):5–13.
26. Bollag L, Richebe P, Ortner C, Landau R. Transversus abdominis plane catheters for post-cesarean delivery analgesia: a series of five cases. Int J Obstet Anesth. 2012;21(2):176–80.
27. Nedeljkovic SS, Kett A, Vallejo MC, et al. Transversus abdominis plane block with liposomal bupivacaine for pain after cesarean delivery in a multicenter, randomized, double-blind, controlled trial. *Anesth Analg*. 2020;131(6):1830–9.
28. Kindig M, Mouch A, Adams D, Maxwell R, Yaklic J. Liposomal bupivacaine decreases pain scores and narcotic use after cesarean delivery [19E]. Obstet Gynecol. 2020;135:54S–5S.
29. Narasimhulu DM, Scharfman L, Minkoff H, George B, Homel P, Tyagaraj K. A randomized trial comparing surgeon-administered intraoperative transversus abdominis plane block with anesthesiologist-administered transcutaneous block. Int J Obstet Anesth. 2018;35:26–32.
30. Gehling M, Tryba M. Risks and side-effects of intrathecal morphine combined with spinal anaesthesia: a meta-analysis. Anaesthesia. 2009;64(6):643–51.
31. Bauchat JR, Weiniger CF, Sultan P, et al. Society for obstetric anesthesia and perinatology consensus statement: monitoring recommendations for prevention and detection of respiratory depression associated with administration of neuraxial morphine for cesarean delivery analgesia. Anesth Analg. 2019;129(2):458–74.
32. Kanazi GE, Aouad MT, Abdallah FW, et al. The analgesic efficacy of subarachnoid morphine in comparison with ultrasound-guided transversus abdominis plane block after cesarean delivery: a randomized controlled trial. Anesth Analg. 2010;111(2):475–81.
33. McMorrow RC, Ni Mhuircheartaigh RJ, Ahmed KA, et al. Comparison of transversus abdominis plane block vs spinal morphine for pain relief after Caesarean section. Br J Anaesth. 2011;106(5):706–12.
34. Loane H, Preston R, Douglas MJ, Massey S, Papsdorf M, Tyler J. A randomized controlled trial comparing intrathecal morphine with transversus abdominis plane block for post-cesarean delivery analgesia. Int J Obstet Anesth. 2012;21(2):112–8.

35. Blanco R, Ansari T, Riad W, Shetty N. Quadratus lumborum block versus transversus abdominis plane block for postoperative pain after cesarean delivery: a randomized controlled trial [published correction appears in Reg Anesth Pain Med. 2018;43:111]. Reg Anesth Pain Med. 2016;41(6):757–62.
36. Kang W, Lu D, Yang X, Zhou Z, Chen X, Chen K, et al. Postoperative analgesic effects of various quadratus lumborum block approaches following cesarean section: a randomized controlled trial. J Pain Res. 2019 Jul 25;12:2305–12.
37. Sebbag I, Qasem F, Dhir S. Bloqueio do quadrado lombar guiado por ultrassom para analgesia pós cesariana: série de casos [Ultrasound guided quadratus lumborum block for analgesia after cesarean delivery: case series]. Rev Bras Anestesiol. 2017;67(4):418–21.
38. Blanco R, Ansari T, Girgis E. Quadratus lumborum block for postoperative pain after caesarean section: a randomised controlled trial. Eur J Anaesthesiol. 2015;32(11):812–8.
39. Verma K, Malawat A, Jethava D, Jethava DD. Comparison of transversus abdominis plane block and quadratus lumborum block for post-caesarean section analgesia: a randomised clinical trial. Indian J Anaesth. 2019;63(10):820–6.
40.•• El-Boghdadly K, Desai N, Halpern S, et al. Quadratus lumborum block vs. transversus abdominis plane block for caesarean delivery: a systematic review and network meta-analysis [published online ahead of print, 2020 Jul 4]. Anaesthesia. 2020. https://doi.org/10.1111/anae.15160. **This is a very important systematic review and metaâ€ analysis to compare transversus abdominis plane (TAP) and quadratus lumborum (QLB) blocks. Notably, the authors conclude that TAP and QLB are superior to control in the absence of intrathecal morphine, but provide limited additional benefit over inactive control when intrathecal morphine is also used**.
41.•• Tan HS, Taylor C, Weikel D, Barton K, Habib AS. Quadratus lumborum block for postoperative analgesia after cesarean delivery: a systematic review with meta-analysis and trial-sequential analysis [published online ahead of print, 2020 Jul 29]. J Clin Anesth. 2020;67:110003. **This is a very important systematic review with meta-analysis and trial sequential analysis that investigated the analgesic efficacy of QLB versus controls, TAP block and neuraxial morphine, or when added to neuraxial morphine in women undergoing cesarean delivery. The authors found that QLB improves post-cesarean delivery analgesia in parturients not receiving neuraxial morphine, but provides no significant analgesic benefit to those who do**.