Chapter

Ultrasound-Guided Regional Analgesia for Post-Cesarean Pain

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Abstract

Pain management after a surgical intervention is one of the fundamental pillars for optimal patient recovery. In obstetric patients, this management may affect the mother and the newborn. The gold standard for analgesic management is the use of intrathecal morphine due to its long-lasting effect; however, adverse effects related to the use of opioids are evidenced, whether administered intrathecally or systemically in case of contraindication to the neuraxial approach or if a long-acting opioid is not available. Cesarean sections have been associated with moderate-to-severe postoperative pain. Multimodal analgesic management seeks to minimize the undesirable effects on the mother-newborn binomial in order to increase maternal satisfaction. The most studied regional blocks for this surgery are the transversus abdominis plane block and the ilioinguinal-iliohypogastric block, which shows contradictory evidence at the time of evaluate pain where there is no significant difference compared with intrathecal morphine, but there were fewer side effects with the TAP block group when assessing pruritus, nausea, and vomiting. Quadratus lumborum and erectus spinae plane block demonstrate its usefulness with better pain management compared with TAP block regardless of them having a higher level of complexity due to the visceral pain control; but there is no evidence with methodologic quality enough that demonstrates better outcomes compared with intrathecal morphine.

Keywords: post-Cesarean pain, TAP block, ilio-inguinal, iliohypogastric block, ESP block, quadratus lumborum block

1. Introduction

Proper pain management after a surgical intervention is the fundamental pillar for optimal recovery, as in obstetric patients this aspect affects not only the mother but also the newborn. The gold standard for postoperative analgesic management is the use of intrathecal morphine since it has a long duration. However, adverse effects related to the use of opioids are evidenced, whether administered intrathecally or systemically in case of contraindication to the neuraxial approach, or if a long-acting opioid is not available. Cesarean sections have been associated with moderate-to-severe postoperative pain; therefore, improper management of analgesia would lead to chronic post-surgery pain, problems in breastfeeding, and the mother-newborn relationship, and it has even been considered a trigger for postpartum depression. Based on the foregoing, multimodal analgesic management seeks to minimize the undesirable effects on the mother-newborn binomial in order to increase maternal satisfaction and that the relationship between the mother and her newborn is not altered, since the regional analgesia techniques have gained territory by reducing the consumption of analgesics in the immediate postoperative period, and also are easy to perform procedures. Among the most studied we will review the more important aspects of the abdomen transverse plane (TAP), quadratus lumborum and erectus spinae plane blocks [1–7].

2. Transversus abdominis plane block

The TAP block had been described for the first time as an abdominal wall block based on anatomical landmarks to introduce local anesthetic (LA) into the TAP through the Petit triangle using the loss of resistance technique. The first ultrasound-guided TAP was described in 2007, since then it uses have become popular in upper and lower abdominal surgeries, although it has not been fully integrated into routine clinical practice [8].

The anterolateral abdominal wall consists of four muscles: rectus abdominis, external oblique, internal oblique, and transversus abdominis. The innervation of the abdominal wall and the underlying parietal peritoneum depends on the intercostal nerves (T7–T12) and the first lumbar root (L1). After their spinal emergence, the spinal nerves give a posterior branch and a lateral branch (which usually emerges at the level of the mid-axillary line) and ends in an anterior branch that joins in the linea alba with the anterior branches of the contralateral hemi body. The terminal branches of these nerves travel in the abdominal wall within a neurofascial plane located between the internal oblique muscle and the transversus abdominis muscle, and this space is named the transversus abdominis plane (TAP) [9].

The use of ultrasound allowed the development of new approaches, such as the subcostal, lateral, posterior or combinations such as dual TAP in which the possibilities of TAP block use have been increased [8].

There are three reported TAP block approaches: the posterior one, by anatomical landmarks in Petit's triangle, described by Rafi and McDonnell for analgesia of the lower abdominal quadrants (dermatomes from T11 to L1); the ultrasound-guided subcostal approach, described by Hebbard in 2008 for periumbilical and upper-quadrant analgesia of the abdomen (T10 to T6 dermatomes), and the lateral approach [10].

The subcostal approach targets the compartment of the transverse plane of the abdomen in the anterior abdominal wall, below the costal margin, anywhere between the xiphoid process and the anterior superior iliac spine. The lateral approach is directed to the compartment of the transverse plane of the abdomen in the lateral abdominal wall between the mid-axillary and anterior axillary lines. Finally, the posterior approach is directed to the compartment of the transverse plane of the abdomen at the level of Petit's lumbar triangle or the anterolateral aspect of the quadratus lumbar muscle (**Figures 1**–**3**) [11].

To perform these interfascial blocks, the abdomen is exposed between the ribs margin and the iliac crest, and it is recommended to use the high-frequency linear transducer (6–15 MHz), because the anatomical structures are relatively shallow [12].

Regarding the subcostal approach, initially a linear ultrasound probe with a sterile sheath is placed under the xiphoid process to view the linea alba. The probe is then directed obliquely down the costal margin while keeping the rectus

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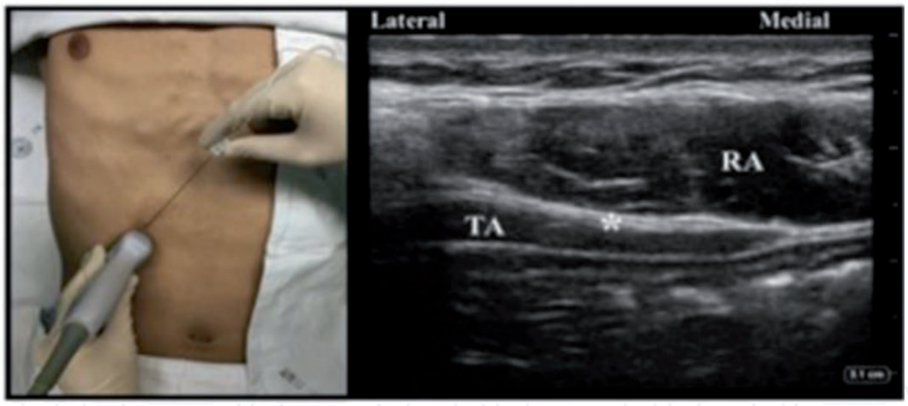

Figure 1.
Transversus abdominis plane block. Subcostal approach [11].

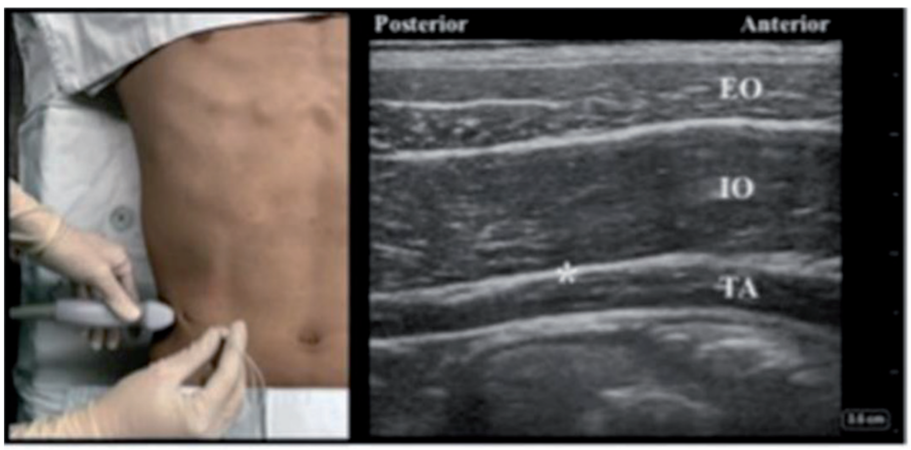

Figure 2.
Transversus abdominis plane block. Lateral approach [11].

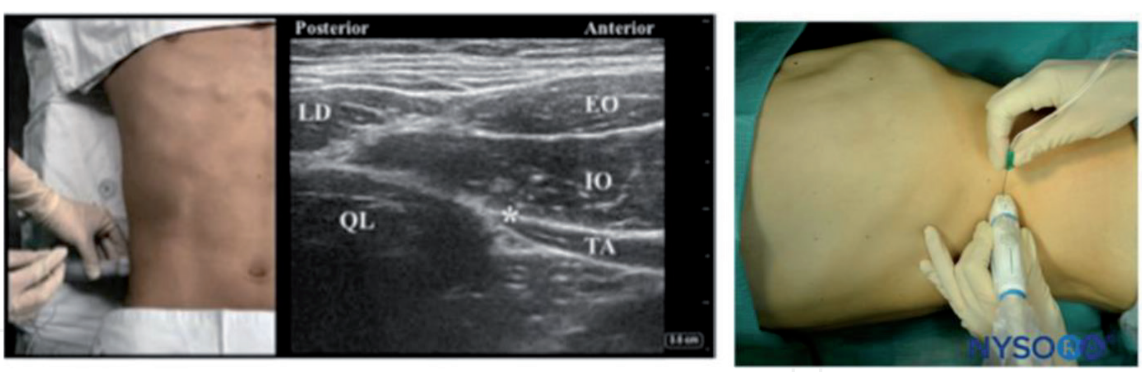

Figure 3.
Transversus abdominis plane block. Posterior approach [11].

abdominis muscle in view. The transverse abdominis muscle is seen below the rectus abdominis muscle. The probe is advanced further until the semilunaris (curved tendon intersection found on both sides of the rectus abdominis muscle) is seen. An echogenic needle is inserted into the plane until the tip of the needle reaches the fascia between the rectus abdominis and transverse abdominis muscles, while the local anesthetic is injected, the needle is advanced laterally, producing a lateral extension of the local anesthetic [13]. For the posterior approach TAP block, the linear transducer is positioned in the axial plane at the mid-axillary line and moved posteriorly to the most posterior limit of the TAP between the internal oblique and transverse abdominal muscles. The target is the rearmost end of the TAP. The needle is inserted in the mid-axillary line and advanced posteriorly until reaching the posterior end of the TAP [14].

The three muscle layers of the abdominal wall are identified: the external oblique muscle (most superficial), the internal oblique muscle (most prominent layer), and the transversus abdominis muscle. A 0.80 × 100 mm 21G short bevel needle is inserted in plane with the transducer. The insertion point is made slightly away from the transducer to allow better visualization of the needle. It is important to deposit the local anesthetic in a deep place in the fascia in such a way that it separates the internal oblique muscles from the transverse abdominis muscle, thus performing a "hydrodissection" (1–2 mL of saline solution or local anesthetic) that adequately exposes the plane. A total of 20 mL of local anesthetic is injected into the plane of each side [12].

Among RCTs comparing TAP versus intrathecal morphine, it has been demonstrated that there were no significant differences in VAS in pain at rest or in movement, nor any significant reduction in time to opioid rescue. It is well known that TAP prolonged the time to opioid rescue by 50%, increased early VAS at rest and on the move, and reduced PONV and pruritus in the TAP group. In the RCTs that compared TAP versus placebo TAP in Cesarean section with spinal anesthesia without intrathecal morphine, there is a decrease in opioid consumption in the first 24 h (18 mg vs. 13.5 mg; $p < 0.05$) and in the time to the first opioid rescue (2 h vs. 3 h, $p = 0.019$). However, no significant differences were found in VAS at rest or movement, as well as in the incidence of side effects of opioids. Baaj et al. demonstrated a significant reduction in opioid consumption in the first 24 h (25.89 mg vs. 62 mg, $p > 0.05$), as well as a 25% decrease in VAS at rest and in movement during the first 24 h, and a decrease in PONV [8].

In a study by Lopez et al. [9], 41 patients were included, 20 in the TAP group, and 21 in the group wound infiltration (WI). The analgesic efficacy obtained in both groups was similar, with a higher demand for additional analgesia in the postoperative period in the WI group at 10, 30, and 60 min, becoming statistically significant at 60 min. By means of a home telephone call at 24 h, a higher consumption of rescue analgesia was found in this group ($p < 0.05$). There were no differences in side effects or complications related to the ultrasound-guided regional technique. The degree of patient satisfaction with the anesthetic technique was similar for both groups. In the same way, Gao carried out a study where 100 patients who underwent Cesarean section were randomly classified into two groups. After surgery, one group underwent ultrasound-guided TAP block and the other group underwent patient-controlled intravenous analgesia (PCIA), and no significant differences were found in VAS scores between the groups ($p > 0, 05$). However, the incidence of postoperative complications in the TAP group was significantly lower than in the PCIA group ($p < 0.05$). Furthermore, patient satisfaction in the TAP group was significantly higher than in the PCIA group ($p < .05$) [15]. Also, in a study conducted by Dereu et al. [16], where patients undergoing Cesarean section were randomly assigned to one of two groups (quadruple blind): 100 mg of intrathecal morphine (ITM) was added to local spinal anesthetic or a bilateral TAP block with 20 ml of 0.375% ropivacaine +75 μg of clonidine on each side. About 24 hours after blocking, there was no significant difference between the ITM and TAP groups in the total number of patients who presented PONV: 17/92 patients and 27/88 patients in the TAP and ITM groups, respectively ($p = 0.065$). Pain scores at 6 h and cumulative morphine consumption at 24 h were lower in the ITM group ($p < 0.0001$ for morphine consumption at 24 h). The incidence of hypotension was higher in the TAP group. Maternal satisfaction was high and not different between the groups. As in the study by Ashok Jadon et al. [17], 139 mothers undergoing Cesarean section were randomized to receive a TAP block with 20 mL of 0.375% ropivacaine or 20 mL of saline. All subjects received a standard spinal anesthetic and diclofenac was administered for postoperative pain, found as a result that the median time to first analgesic request was prolonged in the TAP group compared with the control group ($p < 0.0001$); 11 h (8.12) and 4 h (2.5.6), respectively. The median doses of tramadol consumed in the TAP group was 0 (0.1) compared with 2 (1.2) in the control group ($p < 0.0001$). At all study points, pain scores both at rest and on movement were lower in the study group ($p < 0.0001$). Maternal satisfaction with pain relief was also higher in the study group ($p = 0.0002$).

Kakade and Wagh [18] evaluated the feasibility of TAP for postoperative analgesia after Cesarean section found that the duration of postoperative analgesia was significantly longer in the TAP block group compared with the control group (without block).

3. Ilioinguinal/iliohypogastric block

Both the iliohypogastric (IH) and ilioinguinal (II) nerves arise from L1 and emerge from the upper part of the lateral border of the psoas major muscle. Nerve II is smaller and runs caudal to nerve IH. Both nerves pass obliquely anterior to the quadratus lumbar and the iliac muscle and pierce the transverse abdominis muscle near the anterior part of the iliac crest. In the anterior abdominal wall, both nerves travel in the transverse abdominal plane. The IH nerve provides skin sensitivity to the groin region, and the II nerve provides skin sensitivity on the upper medial aspect of the thigh.

3.1 Blocking technique

The patient is placed in a supine position exposing the lower abdomen, the iliac crest and the groin area are the margins to be located, and the anterior superior iliac spine (ASIS) is marked. A high-frequency linear transducer is used, which is located obliquely along a line that joins the ESIA and the umbilicus, immediately superior and medial to the ESIA, to obtain a cross-sectional view of the nerves, performing an inspection from the iliac crest to the lower abdomen.

An attempt should be made to identify the three muscle layers: external oblique, internal oblique, and transverse abdominis, finding nerves II and IH inside the plane between the internal oblique, and the transverse abdominis on the ASIS. Many times, at this level the external oblique is visualized as a thin aponeurotic layer (**Figure 4**).

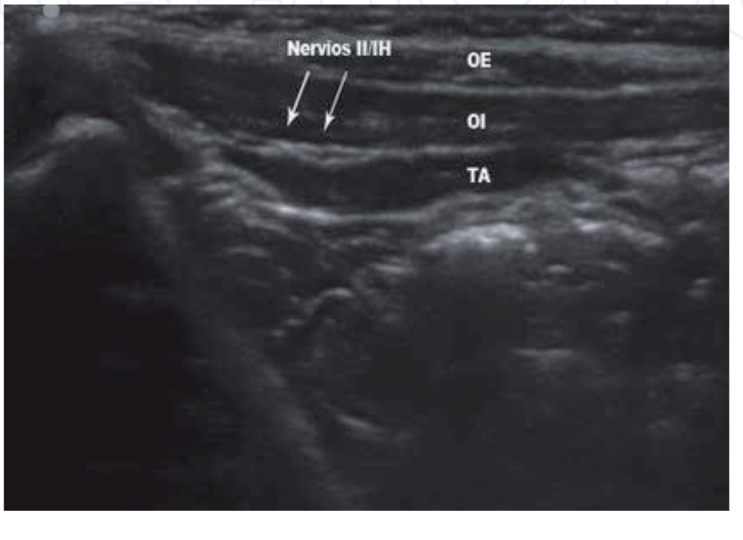

Figure 4.
Ilioinguinal/iliohypogastric nerve [19].

There is conflicting evidence when IL and IH nerve blocks are compared with TAP blocks. One study found significantly higher cumulative mean consumption of tramadol in 24 hours (63 mg vs. 27 mg) in the combined ILIH group compared with the TAP blocks, but there was no difference in time to first request for analgesia or in postoperative pain scores between groups. In a prospective non-randomized trial combining nerve blocks were associated with a reduction in cumulative consumption of tramadol in 24 h (37.25 mg vs. 52.45 mg) and a prolonged time to first analgesic request (14.09 h vs. 10, 71 h) compared with TAP blocks after elective Cesarean section. In both studies, there were no significant differences in pain scores between the groups at any time [19]. According to the study by Jin et al. [20], the score and cumulative morphine consumption were compared between the two groups (TAPB, transverse abdominal plane block; IHINB, iliohypogastric/ilioinguinal nerve block). Regarding the VAS score, there was no significant difference between the two groups in the first 12 h (all $p > 0.05$). However, the VAS score of the IHINB group was significantly lower than that of the TAPB group at 24 and 48 h after surgery ($p < 0.001$ for each). Similar to the VAS score, the cumulative total morphine consumption in the two groups was comparable at 12 h, while it was significantly lower for the IHINB group at 24 and 48 h after surgery ($p < 0.05$ and $p < 0.001$, respectively).

4. Quadratus lumborum block muscle

4.1 Anatomy

The quadratus lumborum muscle is part of the posterior abdominal wall and is located dorsal to the iliopsoas muscle. It has its origin in the posteromedial iliac crest in the iliolumbar ligament, and it inserts on the medial border of the twelfth rib (T12) and in the transverse processes of the first and fourth lumbar vertebrae (L1–L4), in the medial third of the iliac crest. Posterior to the quadratus lumborum muscle is the erector spinae muscle group, which consists of the multifidus, longissimus, and iliocostalis (**Figure 5**) [21–23].

The ventral branches of the spinal nerves (including the subcostal and iliohypogastric nerves) run between the quadratus lumborum muscle and its anterior fascia (**Figure 6**).

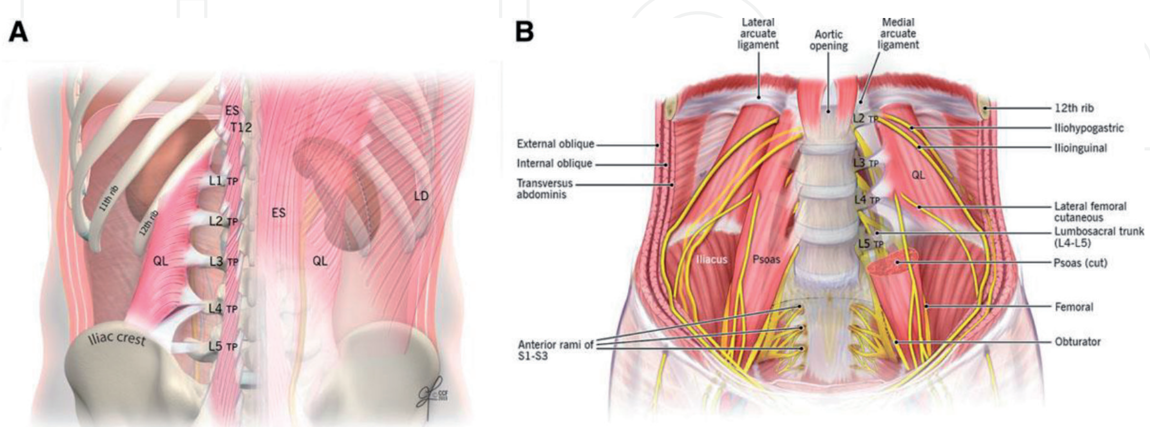

Figure 5.
Quadratus lumborum block. Anatomical concepts, mechanisms, and techniques. (A) A posterior diagram illustration of the musculature of the posterior abdominal wall. The quadratus lumborum muscle originates from medial border of the twelfth rib and lumbar vertebrae transverse processes and inserts into the posteromedial iliac crest. (B) An anterior schematic illustration of the musculature of the posterior abdominal wall. On the left, the psoas muscle has been removed to reveal the ventral rami of the spinal nerve roots and branches passing anterior to the quadratus lumborum muscle. ES, erector spinae; LD; latissimus dorsi; QL, quadratus lumborum; TP, transverse process (Cleveland Clinic Center for Medical Art & Photography © 2018).

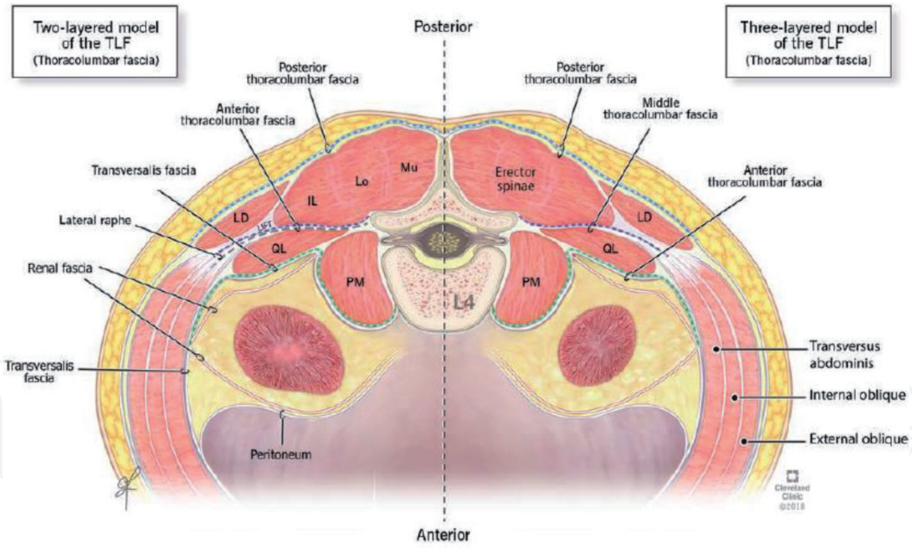

Figure 6.
A schematic illustration of cross-section at L4 level showing the quadratus lumborum muscle with the different layers of the thoracolumbar fascia. On the left, the two-layer model is depicted, where the purple dashed line represents the anterior layer of the thoracolumbar fascia, and the green dashed line represents the transversalis fascia. On the right, the three-layer model is depicted, where the purple dashed line represents the middle layer of the thoracolumbar fascia, and the green dashed line represents the anterior layer of the thoracolumbar fascia. The blue dashed line represents the posterior thoracolumbar fascia. IL, iliocostalis; LD, latissimus dorsi; Lo, longissimus; Mu, multifidus; PM, psoas major; QL, quadratus lumborum; TLF, thoracolumbar fascia. Reprinted with permission, Cleveland Clinic Center for Medical Art & Photography © 2018. All Rights Reserved. showing the quadratus lumborum muscle with the different layers of the thoracolumbar fascia.

The quadratus lumborum muscle is surrounded by the thoracolumbar fascia (FTL) that comprises the multilayer fascia and aponeurosis with the two proposed models [21–23]:

1. Two layers: includes the erector spinae (posterior) and quadratus lumborum muscles (anterior or transversalis fascia). The transverse fascia separates the muscular layers of the kidney, which is located in the retroperitoneal abdominal space.

2. Three layers: the erector spinae muscles (posterior layer or FTL), erector spinae and quadratus lumborum muscles (intermediate layer), and the quadratus lumborum muscles and psoas (anterior layer), the anatomical relationships of the psoas major are important since housing the lumbosacral plexus and being so intimately located can become a route for local anesthetic to the lumbar plexus.

Knowledge of the anatomy of the thoracolumbar anterior fascia is important to understand the propagation after administration of the local anesthetic. The transverse fascia is divided into two layers: the inner layer that continues with the endothoracic and allows a cephalic spread of the local anesthetic (thoracic paravertebral space), and the outer layer that mixes with the arcuate ligaments of the diaphragm [21, 23, 24]. The abdominal aorta gives rise to the lumbar arteries from which the abdominal branches emerge, and these run lateral and posterior to the quadratus lumborum muscle.

4.1.1 Neurovasculature

On the ventral aspect of the quadratus lumborum muscle are the iliohypogastric, ilioinguinal, and subcostal nerves enveloped by the transversalis fascia. The sensory dermatome level involves T12–L2. There may be spread to the lateral femoral cutaneous nerve, the obturator, and the femoral nerve within the psoas (L4 and L5). On the dorsal aspect of the quadratus lumborum plane are the dorsal branches of the spinal nerves that innervate the erector spinae muscle and the sympathetic nerve fibers that innervate the muscles of the abdomen and innervate the thoracolumbar fascia [21–23].

4.1.2 Propagation and mechanisms of action

Dam et al. [25] documented that the block at the level of the iliac crest (L4) is spread in a thoracic paravertebral manner up to T9 and T10, as well as the approach at the level of L3 extended toward the thoracic paravertebral space.

4.2 Technique

The nomenclature for defining quadratus lumborum block is based on the anatomical location of the needle tip in relation to the quadratus lumborum muscle. Thus, we have a) lateral, b) posterior, and c) anterior quadratus lumborum. All blocks must be carried out under standard security and aseptic measures [23, 26]. Patient position can be prone, lateral, or sitting depending on patient and physician preferences.

Vision through ultrasound must be direct and with hydrodissection using a curvilinear low-frequency probe since it is a deeper block. The typical length of the needle used is 80–150 mm.

The most commonly used local anesthetics are 0.2–0.5% ropivacaine or 0.1–0.25% bupivacaine. The typical volume used varies from 0.2 to 0.5 mL/kg on each side.

4.2.1 Lateral or posterior quadratus lumborum block

The needle is placed lateral to the ultrasound probe in the anterior part in a posterior direction, and it crosses the external oblique (EO), internal oblique (LE), and transverse abdominal (TA) muscle. The final position of the needle is lateral to the quadratus lumborum (QL) (**Figures** 7 and **8**) [23, 26].

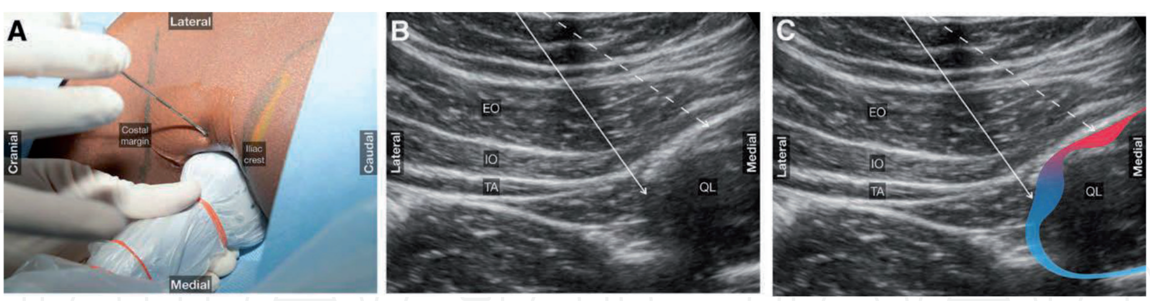

Figure 7.
Lateral or posterior quadratus lumborum blocks. Transverse transducer and anteroposterior needle trajectory are shown. The external image and ultrasound images show the ultrasound probe position with a solid arrow indicating the needle trajectory for a lateral quadratus lumborum block and the dashed line indicating the needle trajectory for a posterior quadratus lumborum block approach. The red-/blue-shaded area represents the spread of the local anesthetic.

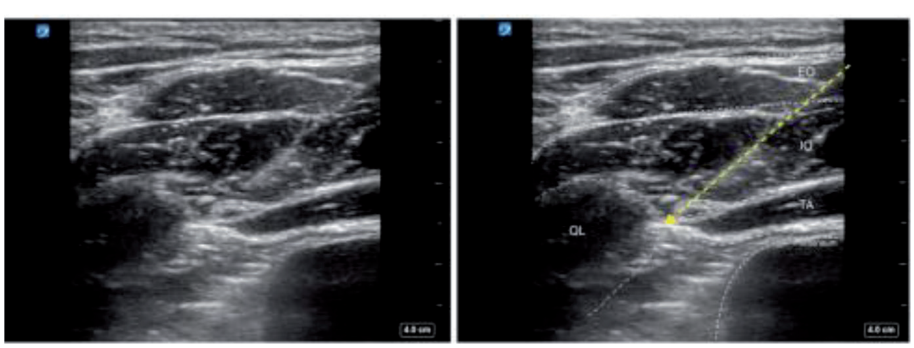

Figure 8.
Quadratus lumborum block: A technical review.

4.2.2 Anterior quadratus lumborum block

An in-plane approach is performed using an anterior-posterior or posterior-anterior trajectory. The target of the local anesthetic is the posterior surface of the quadratus lumborum muscle. The position of the needle tip is between the erector spinae (ES) and the quadratus lumborum muscle (**Figures 9** and **10**) [21, 23, 26].

4.2.3 Subcostal block of the quadratus lumbar

Insertion of the needle is caudal to the transducer in a lateral or medial cranial direction, the deposit of the local anesthetic is between the quadratus lumbar and the psoas muscles (**Figure 11**) [23, 26].

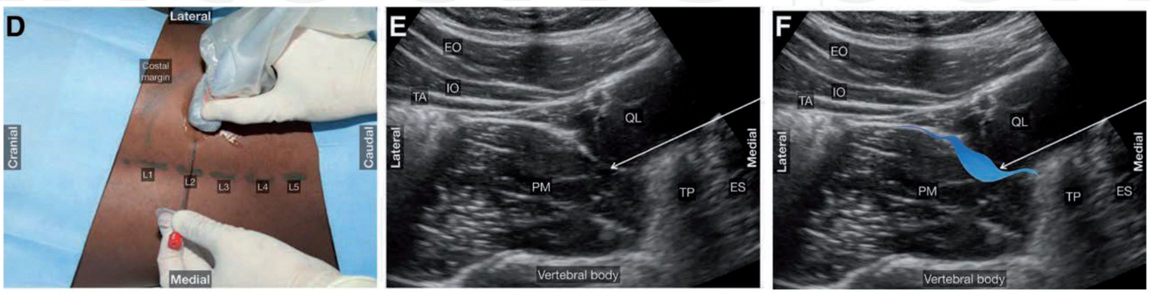

Figure 9.
Anterior quadratus lumborum block: transverse oblique paramedian approach. Transverse transducer and posteroanterior needle trajectory are shown. The external image and ultrasound images show the ultrasound probe position with an arrow indicating the needle trajectory. The blue-shaded area represents the spread of the local anesthetic.

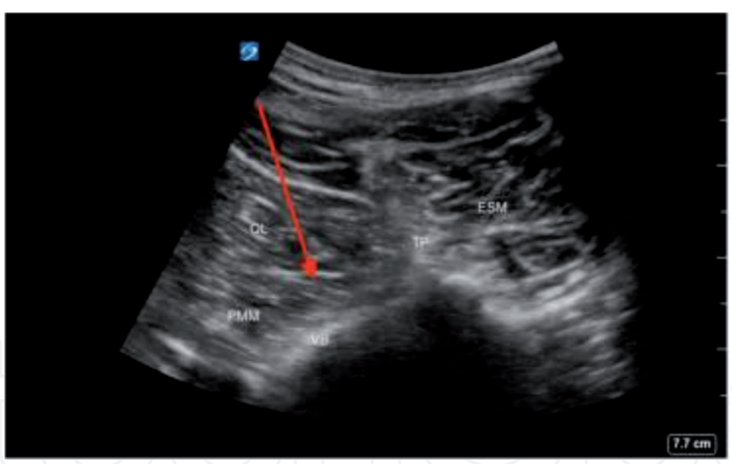

Figure 10.
Quadratus lumborum block: A technical review.

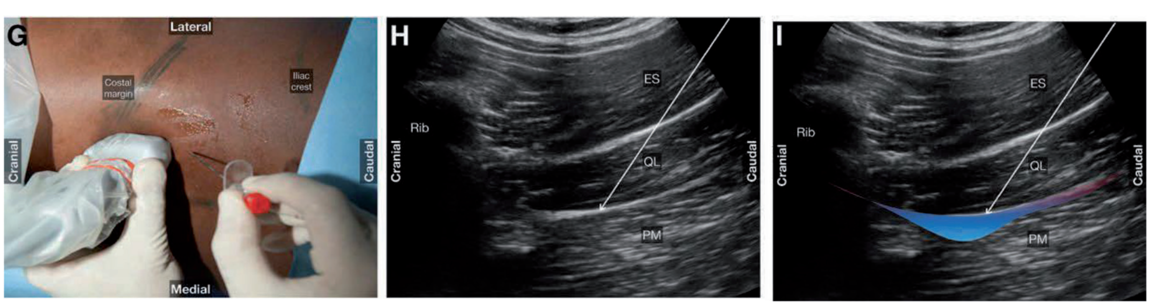

Figure 11.
Anterior quadratus lumborum block: subcostal approach. Parasagittal oblique transducer and caudal-to-cranial needle trajectory are shown. The external image and ultrasound images show the ultrasound probe position with an arrow indicating the needle trajectory. The blue-shaded area represents the spread of the local anesthetic. EO, external oblique; ES, erector spinae; IO, internal oblique; PM, psoas major; QL, quadratus lumborum; TA, transversus abdominus; TP, transverse process.

4.3 Indications

It is indicated for lower abdominal surgeries, including Cesarean section, colostomy closure, hernia repair, gastrectomy, nephrectomy, hip replacement, above-knee amputation, iliac crest bone graft, and iliac and acetabulum fracture [23, 26, 27].

It has been shown that posterior quadratus lumborum block with 0.125% bupivacaine reduces opioid needs for 12 h postoperatively compared with placebo in patients who were administered the combination of bupivacaine 15 mg plus fentanyl 20 mμ. Similarly, Mieszkowski et al. [28] showed that the group that received the quadratus lumborum block (bupivacaine 0.375%, 24 mL) decreased the consumption of opioids (morphine 4 mg) vs. the placebo group that received the standard anesthetic technique (bupivacaine 0.5% 12.5 mg plus 20 mcg fentanyl).

While intrathecal morphine is the current standard drug, quadratus lumborum block offers superior pain control with fewer side effects. The study by Pangthipampai et al. [29] compared the pain-free period after Cesarean delivery among women in labor who received spinal block with 0.2 mg IT morphine, 0.2 mg IT morphine and bilateral QLB (bupivacaine 0.25% 25 ml), or alone. Using bilateral QLB (bupivacaine 0.25% 25 mL), it was concluded that quadratus lumborum block together with IT morphine had a longer pain-free period compared with standard IT morphine alone, but that quadratus lumborum block without association did not provide inferior pain compared with standard IT morphine. However, research by Irwin et al. [30] describes that there was no difference in pain scores up to 48 h after this block (40 ml of 0.25% levobupivacaine) or sham block after undergoing elective Cesarean section under spinal anesthesia and IT morphine.

4.4 Complications

- Lower limb weakness with delayed mobilization and prolonged hospital stays.
- Quadriceps weakness.
- Hypotension that may be related to the spread of the local anesthetic in the paravertebral spaces.
- Caution should be exercised with the toxicity of local anesthetics due to the volume used, especially in cases of bilateral blockade.
- Injury to the pleura, kidney, retroperitoneal hematoma, and nerve roots.

5. Erector spinae plane block

The erector spinae plane block (ESP) is an interfascial analgesic block first described by Forero in 2016 for the treatment of neuropathic thoracic pain. A vast body of scientific literature related to this procedure has been developed, thus increasing the indications for this analgesic blockade given the analgesic efficacy and relative ease at the time of reproducing said procedure in different patients, even more so now that a multimodal approach to pain management is performed [31, 32].

The anatomical basis for performing this block is in the paravertebral musculature, in the thoracolumbar fascia on the transverse processes and the muscular group called the erector spinae made up of the spinalis, longissimus thoracis, and iliocostalis muscles, in addition to the transverse-spinal muscles and levatores rostrum. The deposit of local anesthetic at this level generates its diffusion toward the vertebral and epidural space as well as the intercostal space, thus managing to cover the dorsal and ventral branches of the spinal nerves from their emergence at the level of the site of injection as well as a diffusion toward cranial and caudal between three and four levels demonstrated by Chin et al. [33] in cadaveric studies, reason for achieving both somatic analgesia of the posterior and antero-lateral thoracoabdominal wall, as well as visceral [34, 35].

Regarding the technique, it should be considered that since it is an invasive procedure, the patient must be previously monitored in addition to complying with the standard of asepsis and antisepsis of each institution. Once this prerequisite has been carried out, the block can be performed with the patient awake or under general anesthesia if applicable, always guided by ultrasound to achieve greater effectiveness when blocking the area. However, there is a description of the block by means of anatomical references. The positioning of the patient will depend on the patient's state of consciousness, being possible to perform the procedure in a sitting position, lateral decubitus, or prone.

Performing the ESP block by anatomical reference takes as its starting point palpation of the spinous processes of the level to be blocked, for gynecological/obstetric abdominal procedures such as Cesarean section. It is performed at the T9 level, and then, it is displaced 3 cm laterally to try to palpate the transverse processes, the site where we are going to perform the puncture perpendicular to the skin with a G22 needle or a G18 Tuohy needle until the transverse processes are located at an approximate distance of 2–4 cm deep, although this could vary if we take into account the physiological changes that occur in pregnant women [2, 31, 32, 34, 35]. The injection of the local anesthetic is performed prior to negative aspiration to avoid inadvertent intravascular injections, interspersed with boluses of 5 mL of anesthetic solution. Similarly, to carry out this ultrasound-guided procedure, the transducer is placed in an axial direction at the level of the spinal process and later, the transverse processes are traced and we turn the transducer in a longitudinal direction and thus observe the muscular distribution of the erector spine and its deep fascia visualized in a hyperechoic way on the acoustic shadow generated by the transverse process. The administration of the anesthetic solution is carried out in the same way as for anatomy references, injections of 5 mL after negative aspirations until an average volume of between 15 and 20 mL or 0.2 mL/kg per side is completed to visualize how the deep fascia is distended (**Figure 12**) [2, 31, 32, 34, 35].

The indications for performing this block fall into a very wide range since there is a number of bibliographies in which better analgesic control and a decrease in the requirement of opioid analgesics is reported in the postoperative period in various thoracic and abdominal surgeries. However, to date the administration of intrathecal morphine remains the gold standard for analgesic management for

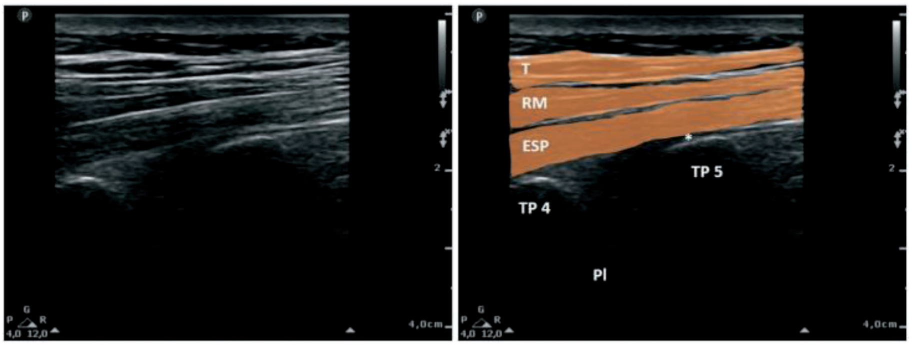

Figure 12.
*Sonoanatomy of ESP Block at the T5 level. TP: transverse processes, T: trapezius muscle, RM: rhomboid major muscle, ESP: erector spinae muscle, Pl: pleura. * Needle point [3, 4].*

elective cesarean sections, as recommended in the PROSPECT study [3], where they place regional blocks as an alternative for cases in which there is a contraindication to approach the neuraxis and consequently, the administration of IT morphine or an IT opioid is not available. Although it is true, most of the references point to a benefit in performing the ESP block for analgesic management. This bibliography is mostly case reports or case series and there are very few studies with a high level of evidence to support the widespread use of regional analgesia in Cesarean sections [2, 36, 37].

Hamed et al. [38] compared IT morphine at a dose of 100 μg with the execution of the ESP block without IT opioid administration, in 140 studied patients no statistically significant difference was found in the perception of pain during the 24 hours after surgery, both at rest and with Valsalva maneuvers (cough), or in reducing the consumption of postoperative opioid analgesics. However, the study reports methodological limitations that could be biasing the result, but the usefulness is emphasized as a multimodal analgesic management in obstetric patients.

In prospective studies in which ESP block was compared with TAP block, such as the one by Malawat et al. [7], as well as by Boules et al. [39], superiority is defined for ESP block for analgesic management and reduction of the requirement postoperative analgesic in series of 60 patients analyzed in each study (ropivacaine 0.2%,2 mL/kg in each puncture). However, there was an important difference in the duration of analgesic effects, reaching around 43 h of analgesia with ESP vs. 12 h with TAP block in the report by Malawat contrasting with that described by Boules, who stated that the ESP block provided 12 h of analgesia compared with 8 h of the TAP block.

Complications or adverse effects with this regional block are rare, especially if it is performed guided by ultrasonography. Despite this, there are reports of unexpected motor blockade of the lower limbs due to the spread to the paravertebral and epidural space, latent risk of pneumothorax due to an inadvertent pulmonary puncture, as well as allergic reactions or cases of poisoning by local anesthetics when administering an excessive dose since a high volume of anesthetic solution is administered or an inadvertent injection into a blood vessel. It is important to perform all these procedures in a place that has the resolution capacity in case of any complication, as well as the personnel trained to carry them out [2, 38, 40].

6. Discussion

Cesarean delivery is one of the oldest and best established surgical procedures in the history of medicine and is currently the most common major surgery performed on humans anywhere in the world. Postoperative pain management after Cesarean section fairly varies from non-obstetric surgeries; women need to recover rapidly to take care of their newborn baby. Ideal pain treatment is mandatory for the success of immediate-term and long-term rehabilitation after Cesarean delivery. There is growing evidence that perioperative pain management has consequences extending well beyond the immediate recovery period. Unalleviated acute postoperative pain is a striking risk factor for the development of chronic post-Cesarean pain.

Undoubtedly, the gold standard has for decades been the use of intrathecal morphine in doses ranging from 50 to 100 mμ. Multimodal analgesia or balanced analgesia has significantly improved the management of acute post-Cesarean pain, being the combination of drugs mandatory to achieve satisfactory and effective pain relief with reduced side effects. Paracetamol, NSAIDs, magnesium sulfate, alpha2 agonists, dexamethasone, and ketamine are some of the non-opioid drugs used in multimodal analgesia.

There are numerous post-Cesarean regional analgesia techniques that have been studied for decades; from epidural analgesia with or without opioids, intrathecal morphine, intraperitoneal instillation, or surgical wound infiltration with local anesthetics have demonstrated analgesic effectiveness. The advent of ultrasound-guided regional blocks has come to revolutionize post-Cesarean analgesia, showing to be a very safe, effective technique with fewer side effects than other analgesia modalities.

The TAP block has been shown to be the most effective block reducing pain, reducing the use of rescue analgesics and increasing the satisfaction of postpartum women [8, 9, 15]. The posterior approach produces better analgesia than the lateral approach. The addition of dexamethasone, clonidine, or dexmedetomidine prolongs the analgesic effect of this block and reduces the doses of rescue analgesics [17, 18]. The addition of alpha2 agonists induced mild sedation. When ilioinguinal and iliohypogastric nerve blocks are combined with TAP blocks, better analgesia is obtained and the need for salvage opioids is reduced [19, 20].

Another alternative is the quadratus lumborum block [27–29]. Although there are very varied results, there are studies that found better analgesia than with TAP block, but it is not superior to epidural analgesia or intrathecal morphine. More research is required comparing this type of analgesic block with the most commonly used blocks.

Erector spinae plane block is another possibility of ultrasound-guided analgesia as it produces satisfactory pain reduction when compared with intraspinal morphine and TAP block [38, 39].

7. Conclusion

At the present review, we show several data about the efficacy of the regional analgesic block alternatives to manage the post-Cesarean section pain. The most studied technique is the TAP block due to ease of replication and its effectiveness. But there has been developed new techniques that require a little more experience to perform them and guarantee a better analgesic outcome like the quadratus lumborum block or the ESP block. Nevertheless, the gold standard for the pain management after Cesarean section still remains the intrathecal morphine, with the use of regional analgesic techniques just as adjuvants or when intrathecal morphine is not available. The most recent studies have lack of statistical power to demonstrate if any of these techniques is superior to intrathecal morphine, so they remain like a powerful tool in the multimodal analgesic regimen.

Regional analgesia is a complementary technique to programs to improve recovery after Cesarean delivery, considerably reducing hospital stay, facilitating the integration of the mother-newborn pairing, and surely reducing the incidence of chronic post-Cesarean pain.

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