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Research Article

ULTRASOUND-GUIDED QUADRATUS LUMBORUM BLOCK FOR POST OPERATIVE ANALGESIA IN PATIENT UNDERGOING ABDOMINAL SURGERY

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ABSTRACT

Background: Abdominal surgery is one the most common surgical procedures. Effective postoperative analgesia may help the patients for early ambulation and can reduce the need of opioid which associated with significant adverse effects such as nausea, pruritus and vomiting. Quadratuslumborum block can provide both visceral and somatosensory pain relief. This effect was due to wider spread of the local anesthetic beyond the transversusabdominis plane into the paravertebral space. **Case Illustration:** We reporta case report of patient who had previously diagnosed withovarian cyst and underwentsalphingoophorectomy. We had done quadratuslumborum block procedure during the surgery for post operative analgesia using combination of ropivacaine plain and methylprednisolon. We found satisfactory pain control with Numeric Rating Scale around 1-2 during the 24 hours observation and no use of opioid analgesia in the patient. **Discussion:** There are different types of QuadratusLumborum Block (QLB) according to the position of the needle tip and the approach of the needle. Several approaches have been described for QLB. Lateral approach where local anesthetic is injected at the anterolateral border of the quadratuslumborum muscle, posterior approach where local anesthetic is injected at the junction of quadratuslumborum muscle with the transversalis fascia. Transmuscular QLB is where the needle is inserted between the quadratuslumborum muscle, penetrating the ventral fascia of the QL muscle ad the local anesthetic is injected between the QL muscle and psoas major muscle. recovery room to 24 hours after surgery. **Conclusion:** The quadratuslumborum block is safe to executeand provides effective abdominal wall and visceral analgesia. It can decrease the intensity of pain and opioid requirement when used within 24 hours after abdominal surgery.

Keywords: quadratuslumborum, block, postoperative, analgesia, abdominal surgery

INTRODUCTION

Postoperative acute pain occurs in more than 80% of operation patients, and approximately 75% of operation patients experience the moderate or higher pain. Evidence shows that less than half of operation patients claim that postoperative pain is effectively relieved. Inadequate negative control of pain affects the quality of life, function and function recovery, risk of postoperative complications, and risk of long-term postoperative pain. Proper postoperative analgesia can reduce pain, encour 3 patients to cough and get out of bed, reduce the occurrence of lower extremity thrombosis and pulmonary complications and improve postoperative satisfaction. Postoperative analgesia using traditional opioids often causes constipation, nausea, vomiting and other adverse reactions, thus limiting its clinical application. Regional analgesia techniques combined with intravenous self-controlled analgesia can effectively reduce the dosage and adverse effects of opioids, which is conducive to rapid recovery after surgery. (1)

CASE ILLUSTRATION

A 47-year-old female presented at our hospital for elective salphyngoophorectomy due to ovarian cyst. She complained pain in her abdomen and also gradually increasing abdominal swelling since 4 months before. She denied any genitourinary or gastrointestinal symptomps. The patient have no history of other disease.

The blood pressure was normal (BP 128/86mmHg, HR 73 bpm). The blood test were normal. Chest x-ray (Figure.1) was normal.

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Echocardiography was also normal (Figure.2). the lumbosacral x-ray found that there is no metastatic process, but there is some lumbalspondylosis in L5-S1 (Figure.3). In the abdominal ultrasonography found that there was a cyst in left adnexa, but no sign of metastatic nodul in the liver. There was no free fluid in peritoneal cavity.

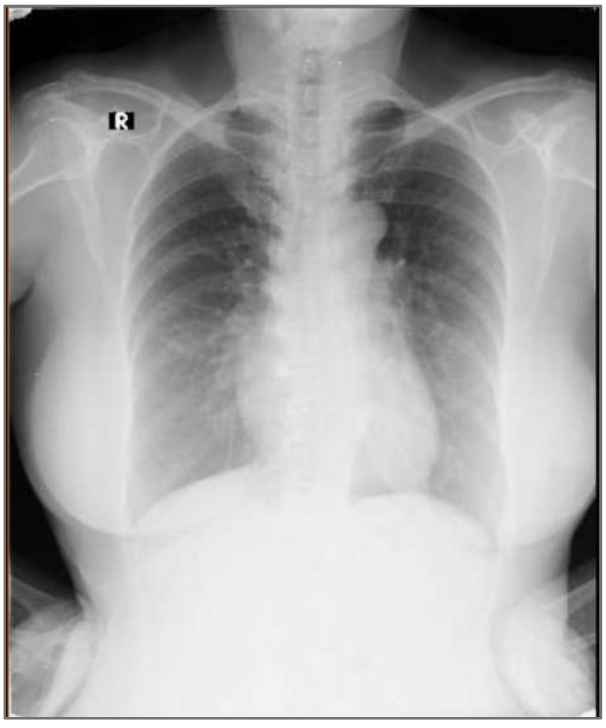

Figure 1. Preoperative chest x-ray of patient

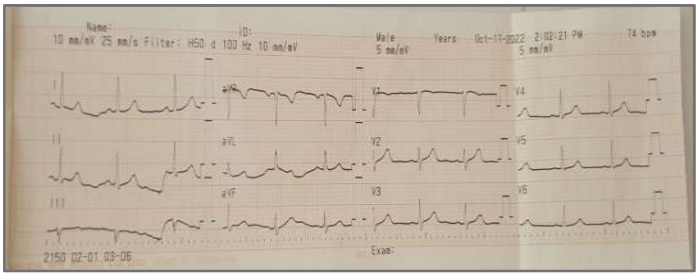

Figure 2. The preoperative echocardiography of patient

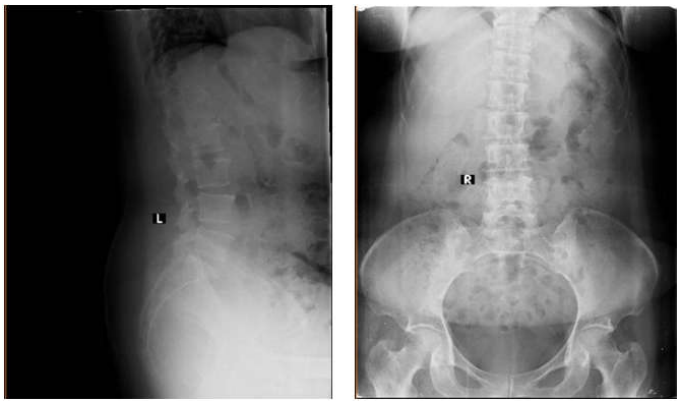

Figure 3. The preoperative lumbosacral xray of patient

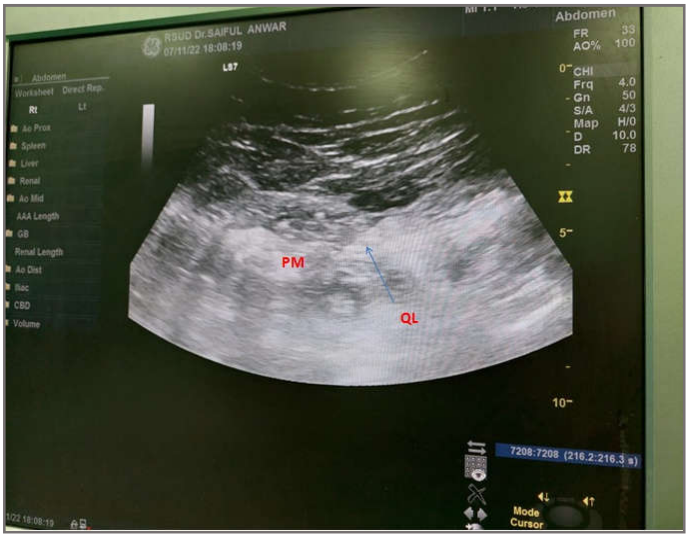

Figure 4. The process of quadratuslumborum block

The patient underwent the surgery under spinal anesthesia. Premedication was performed with ranitidine 50 mg and metoclopramide 10 mg was given intravenously one hour before surgery. Standard monitoring including electrocardiogram, pulse oximetry and non-invasive blood pressure was applied in operating room. We did quadratuslumborumblock forpost operative analgesia. The patient was placed in the lateral decubitus position and the probe of ultrasonography was positioned horizontally in the anterior axillary line halfway between the subcostal margin and iliac crest after sterilization of the skin and draping, to locate the triple abdominal muscle layers, then the probe was relocated subsequently to the posterior axillary line until the quadratuslumborum muscle could be visualized with its attachment to the lateral edge of the transverse process of the L4 vertebral body. With the psoas major muscle places anteriorly, the erector spinae muscle posteriorly and the quadratuslumborum muscle adherent to the apex of the transverse process, this is a well-recognizable pattern of a shamrock with three leaves. A stimuplex was inserted in plane relative to the ultrasound probe passing in posterior to anterior direction through the QL muscle to reach the border between the QL and psoas major muscle. After confirmation of negative blood aspiration, 2 ml of normal saline for hydro-dissection sign was injected to verify the needle tip and then local anesthesia was injected. We gave ropivacain 0,375% and metilprednisolon62,5mg with total volume 20 cc. We did the quadratuslumborum block in two sides of the abdomen.

She received 8 mg ondancentron for post operative nausea and vomiting prophylaxis. The procedure was otherwise uneventful and took 2 hours to complete. Following recovery from anesthesia in the post anesthesia care unit, the patient reported no pain. We added ketorolac 30 mg iv every 8 hours as combination analgesia to QLB post operatively and do the regular check for patient's pain score in 6 hours, 12 hours, and 24 hours after the surgery using numeric rating scale(NRS) and visual analog scale as the measurement method We have got NRS around 0-3during the 24 hours observation. The patient can mobile the next day after the surgery. No side effects noted during this period until she was discharged from our hospital two days later.

DISCUSSION

Salpingoophorectomy is a surgical procedure frequently associated with severe or moderate postoperative pain. The numeric rating scale for this procedure is 7-8. After this procedure, the pain maybe of neurpathic or inflammatory origin. The inflammatory pain is due to the stimulation of peripheral nociceptors by the inflammation mediators (cytokinesmendothelin, bradykinin, prostaglandin E2, leukotrienes). Neuropathic induced by the injury of afferent sensory nerves lying across the surgical fields.

Many regional anesthetic modalities have been employed by healthcare providers to offer analgesia for the thorax, abdomen, and pelvis. While each of these modalities has numerous applications, their usefulness is restricted by a few contraindications.[1,2]Truncal nerve blocks were first used in clinical practice as part of perioperative pain treatment over 40 years ago. The ilioinguinal-iliohypogastric (II-IH) block and the rectus sheath block were the most commonly employed in pediatric anesthesia. The transversusabdominis plane (TAP) block was introduced in everyday practice in the early years of the twenty-first century, offering a significantly larger field of analgesia. These blocks were initially done without ultrasound guidance, utilizing landmark approaches. However, the clinical usage of truncal block techniques has evolved throughout time, with the introduction of ultrasound into anesthesiology practice driving their spread. Although ultrasonography can successfully detect anatomical markers, the blocks of the anterior abdominal wall differ in terms of both the distribution of local anesthetics and the area of coverage. The transversalis fascia plane block and the quadratuslumborum block (QLB) were created in the quest for greater analgesia coverage and long-lasting postoperative analgesia.[3]

The QLB was created in response to the fact that, as ultrasound imaging for regional anesthetic has grown more common, the injection location of the TAP block has shifted anteriorly on the abdominal wall, as opposed to the original landmark approach, which is at the Triangle of Petit. Because of the loss of local anesthetic extension into the paravertebral and epidural area, the efficacy and duration of the TAP block have been impaired by shifting the injection point farther anterior.[4] When compared to ultrasound-guided TAP blocks, the QLB includes injecting the local anesthetic into a more posterior site, allowing for cephalad dissemination to the thoracic paravertebral region.[5]

The QLB has been approached in four distinct ways (**Figure 5**). Two require the application of local anaesthesia to the QL muscle (QLM). Local anaesthetic is placed anterolateral to the QLM, lateral to the transversusabdominis muscle, in the QLB1. The QLB2 needs the injection of local anaesthesia more posterior on the QLM, between the muscle and the thoracolumbar fascia. The transmuscular or QLB3 approach, in which the needle is inserted through the QLM and local anaesthetic is implanted between the psoas muscle and the QLM, and the intramuscular injection of local anaesthesia into the QLM, have also been reported.[6]

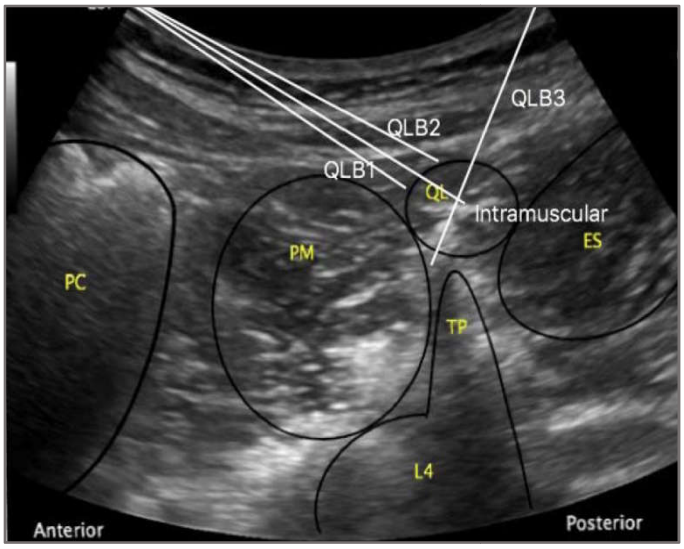

Figure 5. Needle trajectories are shown in white for the QLB1, QLB2, QLB3 and intramuscular approaches. ES, erector spinae; L4, fourth lumbar vertebra; PC, peritoneal cavity; PM, psoas major; QL, quadratuslumborum; TP, transversus process.[6]

The quadratuslumborum muscle (QLM) is an axial muscle located in the deep posterior abdominal wall that serves as an auxiliary muscle of inspiration as well as spine stabilization. Its purpose is to maintain the thorax during breathing, hence it originates from the inner lip of the posteriomedial iliac crest and inserts into the transverse process of L1-4 and the medial border of the 12th rib. On each side of the vertebral body, the psoas major is located anterior to the quadratuslumborum. The erector spinae muscles, which include multifidus, longissimus, and iliocostalis, are located. The anterior abdominal wall muscle group, which includes the transversusabdominis, internal oblique, and external oblique muscles, is located lateral and posterior to the quadratuslumborum (**Figure 6**). The kidney, paranephric fat, posterior renal fascia, and anterior thoracolumbar fascia/transversalis fascia are located lateral and anterior to the quadratuslumborum. The quadratuslumborum and psoas muscles are located posterior to the diaphragm's lateral and medial arcuate.[7]

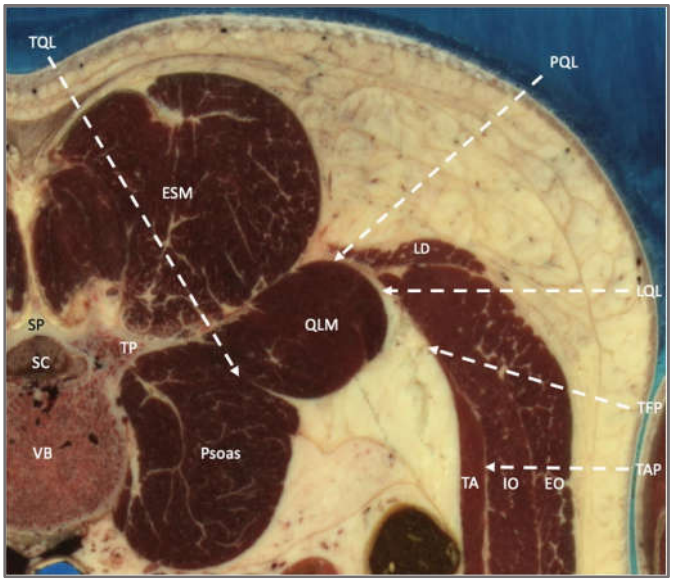

Figure 6. Cross-section of the posterior abdominal wall at L4 vertebral level showing the relationship of quadratuslumborum muscle (QLM) to the transverse process (TP), erector spinae group of muscles (ESM), and the latissimusdorsi muscle (LD). Spinal cord (SC) is also shown along with the three abdominal muscles: the transversusabdominis (TA), internal oblique (IO), and external oblique (EO) muscles. The various approaches to QLB [lateral QLB (LQL), anterior/transmuscular QLB (TQL), and posterior QLB (PQL)] are shown in dashed arrows along with transversusabdominis plane block (TAP) and the transversalis fascia plane block (TFP).[7]

The thoracolumbar fascia surrounds the quadratuslumborum. The erector spinae muscle is surrounded by the posterior thoracolumbar fascia. The middle thoracolumbar fascia is located between the erector spinae and the quadratuslumborum, whereas the anterior layer is located between the quadratuslumborum and the psoas major.[8]In a two-layer model, the anterior thoracolumbar fascia is connected with the transversalis fascia, the deep fascia of the belly. The anterior thoracolumbar fascia/transversalis fascia structure is distinct and may be critical to our understanding of the pattern of dissemination following injections posterior to the QLM. The transversalis fascia is divided into two layers: the inner layer is continuous with the endothoracic fascia in the thorax, while the outside layer merges with the diaphragm's arcuate ligaments. The endothoracic fascia may act as a conduit for the cephalad diffusion of local anesthesia from the belly to the thoracic paravertebral region.[9]While there is a pathway for injectate placed on the ventral part of the QLM to reach the thoracic paravertebral region, whether this is clinically important has to be investigated further. Another crucial anatomical factor is that the psoas major muscle is ventro-medially positioned, adjacent to the QLM. While housing the lumbo-sacral plexus, the psoas major muscle is usually divided by a fascial layer between the posterior 1/3 and anterior 2/3 of the muscle, permitting continuity with the transversalis fascia across the ventral part of the quadratuslumborum. This might be a route for local anesthetic distribution from the QLB to the lumbar plexus.[7]

According to current randomized studies and case reports, quadratuslumborum blocks have been utilized for a variety of surgical procedures, including cesarean section,[10]gynecological,[11] and lower abdominal operations.[12] It has also been utilized for colostomy closure analgesia, hernia repairs , gastrectomy, and nephrectomy.[13]It has been utilized in hip arthroplasty, above knee amputation in conjunction with sciatic block, iliac crest bone transplant, and iliac and acetabulum fracture.For femoral-popliteal bypass, it has been utilized in combination with lumbar plexus and sciatic nerve blocks.[14] A case

report on the use of this block of lumbar laminectomy and fusion has been published. It has also been shown that a posterior quadratuslumborum block can be used for breast restoration employing transverse rectus abdominis flaps.[15]

In two randomized controlled studies, posterior quadratuslumborum block was demonstrated to minimize morphine needs for 48 hours when compared to placebo and TAP block following cesarean procedures. Two more randomized controlled studies utilizing lateral quadratuslumborum block demonstrated decreased opiate use following cesarean sections.[16] In another randomized controlled experiment, lateral quadratuslumborum block was reported to lower Visual Analogue Scale (VAS) pain score and 24-h opioid use when compared to femoral nerve block for hip hemiarthroplasty for femoral nerve fracture.XIn laparoscopic gynecological surgery with posterior quadratuslumborum block, pain ratings on the Numeric Rating Scale (NRS) were reduced.A randomized control trial in the pediatric age range for inguinal hernia surgery/orchiopexy found that posterior quadratuslumborum block required less rescue analgesia than TAP block. Transmuscularquadratuslumborum blockade was shown to reduce duration of stay and intraoperative opioid use in patients having total hip arthroplasty.[17]

The QLB is contraindicated in the same way as other fascia plane blocks, such as the transversusabdominis plane block or the fascia iliaca plane block, are. The following are absolute contraindications:[1]

a. Refusal of the patient
b. True allergy to local anesthetics
c. The patient is at risk of local anesthetic toxicity since he or she has already received the maximum recommended local anesthetic dose.
d. Local infection

There is debate regarding whether QLB or other plane blocks can be done safely during coagulopathy or in a patient taking anticoagulants. Some practitioners believe that plane blocks with altered coagulation are harmless.[2] The most recent evidence-based guidelines for regional anesthesia use in patients receiving antithrombotic or thrombolytic therapy published by the American Society of Regional Anesthesia and Pain Medicine caution against deep regional anesthetic procedures in anticoagulated patients because multiple case reports found that such situations resulted in significant morbidity.[18]

Transversusabdominis plane (TAP) blocks the sensory afferent nerves run between the abdominal muscles and controls postoperative incisional pain.Somatic pain after upper and lower abdominal surgery can be controlled by QLB.QLB can be performed for all generations (adult, pediatrics, and pregnant). QLB is considered to be an easy technique to learn as it is easy to get the key sonoanatomic markers for QLB and it is a superficial fascial block between posterior abdominal wall muscle (QL and erector spinae). QLB type 2 (posterior approach) is safer than QLB type 1 (anterolateral) or the transmuscular approach (in between QL and psoas muscles). QLB does not aim to target a nerve but rather a fascial plane that is very bright, hyperechoic, and easily dissected. More superficial point of injection i safer (bowel injury and intraperitoneal injection are less because the needle tip is separated from the peritoneum by the QL muscle) with better ultrasonographic resolution.[19]

Blanco *et al*.,reported that QLB was better than TAP block after cesarean section as it was associated with longer analgesic time (exceeding 24 h), less opioid consumption, and wider spread of analgesia. TAP block affected from T10 to T12 dermatomes while QLB covered from T7 to T12 dermatomes, and they explained their results by the spread of local anesthetics drugs either into the paravertebral space or in the thoracolumbar plane (which contains mechanoreceptors and high-density network of sympathetic fibers), this extensive spread with the QLB produced analgesia for somatic and visceral pain.[10]The spread of local anesthetics during QLB to paravertebral space was reported by Carney *et al*.,recorded that the dermatome segments from T4 to L2 were covered by single shot QLB and they proved that by injecting contrast solution posteriorly which accumulated at the lateral border of QL, then spread in the posterior-cranial fashion to the anterior aspect of the QL and psoas major to paravertebral space.[4]

Murouchi *et al*., investigated the relationship between the local anesthetics blood level and the efficacy of the QLB type 2 and TAP block in adults, and they found that in TAP block, the local anesthetic blood levels were higher than QLB type 2, but the analgesic effect was better with QLB type 2 than with TAP block, and this result was explained by the following, during QLB, some of the administered drug is thought to move from the intermuscular space into the paravertebral space which is filled with adipose tissueand the local tissue perfusion of the adipose tissue is low which results in low absorption speed of a local anesthetic into the blood.[19]

Generally, the quadratuslumborum block be termed after the anatomical position of the needle tip in respect to the quadratuslumborum muscle. As a result, the terms lateral, posterior, and anterior quadratuslumborum block methods is suggested to be used. In-plane approaches with anterior-posterior, posterior-anterior, and caudal-cranial trajectories are shown in **Figure 7.**[19]

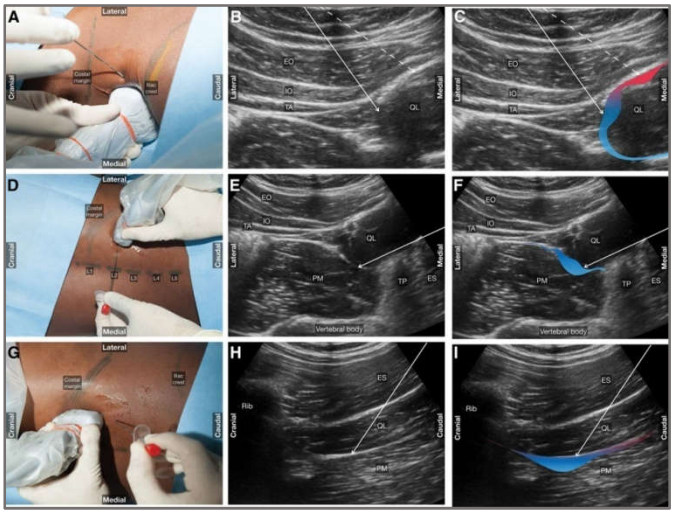

Figure 7. Photographs and ultrasound images for different quadratuslumborum block approaches. (A–C) Lateral or posterior quadratuslumborum blocks. Transverse transducer and anteroposterior needle trajectory are shown. The external image and ultrasound images show the ultrasound probe position with a solid arrow indicating the needle trajectory for a lateral quadratuslumborum block and the dashed line indicating the needle trajectory for a posterior quadratuslumborum block approach. The red-/blue-shaded area represents the spread of the local anesthetic. (D–F) Anterior quadratuslumborum 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. (G–I) Anterior quadratuslumborum 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, quadratuslumborum; TA, transversusabdominus; TP, transverse process.[19]

Needle Size and Gauge

The typical needle length would be 80 to 150 mm, depending on the patient's body habitus. The precise gauge would be determined by whether the injection technique was single or continuous.[19]

Injectate

Local anesthetic dose of 0.2 to 0.4 ml/kg of 0.2 to 0.5% ropivacaineor 0.1 to 0.25% bupivacaineis advised per side. To ensure harmful limits are not exceeded, the operator must alter dose, especially while doing bilateral blocks. There is no comparison evidence on the efficiency of adjuvants in quadratuslumborum blocks; however, the use of epinephrine may have advantages in slowing absorption and identifying and minimizing unintentional intravascular injection. Standard safety measures should be taken while conducting regional anesthetic blocks.[19]

Positioning

Depending on physician choice, patient mobility, and anticipated needle trajectory, the patient can be positioned supine with a lateral tilt, lateral, sitting, or prone. A posterior-anterior trajectory, for example, will require the patient to be lateral, prone, or sitting

Lateral QuadratusLumborum Block

This can be done in-plane by inserting a needle lateral (anterior) to the ultrasonic transducer with an anterior-to-posterior needle trajectory. After the needle point enters the transversusabdominisaponeurosis, local anesthetic is placed at the lateral border of the quadratuslumborum muscle. In comparison to placebo, lateral quadratuslumborum block has been proven to be opioid-sparing for post-cesarean section analgesia.[19]

Posterior QuadratusLumborum Block

This can be conducted in-plane utilizing an anterior-to-posterior or posterior-to-anterior route. A local anesthetic is injected into the quadratuslumborum muscle's posterior surface, between the quadratuslumborum and erector spinae muscles. This method was employed in two randomized controlled studies that found quadratuslumborum block to be more opioid-sparing than placebo or transversusabdominis plane block following caesarean delivery.[19]

Anterior QuadratusLumborum Block

This can be done in-plane, with a needle inserted medial to the ultrasound transducer and a posterior-to-anterior trajectory. An in-plane technique with an anterior-to-posterior trajectory can also be employed. The subcostal oblique anterior route is another alternative; the needle is inserted caudal to the transducer, and the trajectory is in-plane, caudal-lateral to cranial-medial. Local anesthetic is injected into the tissue plane between the quadratuslumborum and psoas muscles. The needle trajectory employed in these versions differs (anterior-to-posterior; posterior-to-anterior; caudal-to-cranial), but they all inject into the same plane.[20]It is fair to assume that different quadratuslumborum blocks have distinct modes of action based on cadaveric and clinical findings. In addition to the thoracic paravertebral area, anterior quadratuslumborum block injectate may travel to the lumbar nerve roots and branches. The therapeutic impact of posterior quadratuslumborum blocks appears to be demonstrated by injectate diffusion over the middle thoracolumbar fascia intertransverse region. Although clinical studies indicate a more broad dispersion, lateral quadratuslumborum blocks are related with injectate dissemination to the transversusabdominis muscle plane and subcutaneous tissue. There is inadequate data to advocate one method and transducer location over another for certain patient groups and surgery types at this time.[19]

Lower extremity weakness has been described with quadratuslumborum block, resulting in delayed mobility and a longer hospital stay. Local anesthetic delivery to lumbar plexus nerve roots or branches via paravertebral spread or transversalis fascia is most likely responsible for hip flexor (psoas and iliacus) and knee extensor paralysis (quadriceps). Quadriceps weakness has been linked to anterior quadratuslumborum block, followed by posterior and lateral approaches. There is inadequate evidence on the appropriate technique of the block, as well as the concentration or amount of local anesthetic to be utilized to avoid this problem.[21]The dissemination of local anesthetic in the paravertebral areas has been linked to hypotension. Other concerns should include local anesthetic toxicity due to the considerable volume employed, particularly in bilateral blocks. Keep in mind the complexities associated with the deeper block's technical limitations and limited visibility, resulting in harm to neighboring structures. Potential consequences include pleura, kidney, retroperitoneal hematoma, and nerve root injury. To avoid infection or abscess formation, strict aseptic precautions should be followed.[22]

CONCLUSION

The transversal fascia plane block and the quadratuslumborum block (QLB) were created in the quest for greater analgesia coverage and long-lasting postoperative analgesia. The QLB has been approached in four distinct ways. quadratuslumborum blocks have been utilized for a variety of surgical procedures, including cesarean section, gynecological, lower abdominal operations, colostomy closure analgesia, hernia repairs, gastrectomy,nephrectomy, hip arthroplasty, above knee amputation in conjunction with a sciatic block, iliac crest bone transplant, and iliac and acetabulum fracture. The absolute contraindications include refusal of the patient, true allergy to local anesthetics, and the patient is at risk of local anesthetic toxicity since he or she has already received the maximum recommended local anesthetic dose and local infection. Lower extremity weakness has been described with quadratuslumborum block, resulting in delayed mobility and a longer hospital stay.

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