The Post Cesarean Section Analgesic Effect of Various Quadratus Lumborum Block Approaches

Original Article

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ABSTRACT

Background: The ultrasound-guided quadratus lumborum block (QLB) is a well-established procedure for administering local anesthetic to the abdominal wall. By injecting the anesthetic from the posterior abdomen, it effectively spreads across the quadratus lumborum muscle as well as blocks the intermuscular nerves.

Objectives: The objective is to examine the impact of three distinct practical ways for quadratus lumborum block, specifically type 2 and 3, as well as their combination.

Methods: This is a prospective cohort study performed on eighty participants, all were followed at the obstetrics & gynecology units at the Faculty of Medicine of Sohag University. According to pre-settled protocol in our hospital, patients who request post CS analgesia are assigned to one of four distinct types of post operative analgesia: Epidural analgesia (EA) only group, the QLB type 2 (QL2 group) plus EA, QLB type 3 (QL3 group) plus EA, QLB type 2 + 3 (QL2+3 group) plus EA.

Results: Assessment of pain was performed in all groups by using the VAS at rest and with movement during the 1st 48 hours after CS and it revealed that pain was lower in the EA only group in comparison to QL groups at rest and in between the QL groups, pain was lower in the QL (2+3) group than QL3 group and QL2 group reported the highest VAS at rest. Moreover, assessment of VAS with mobility during the 1st 48 hours after CS revealed also that pain was lower in the EA only group in comparison to QL groups and in between the QL groups, pain was lower in the QL (2+3) group in comparison to other QL groups.

Conclusion: In conclusion, spinal morphine and different QL block approaches can alleviate post CS pain, in addition, QL (2+3) approach is the most effective strategy for pain management with minimal side effects and complications and may help individuals who did not get enough spinal morphine.

Key Words: Cesarean section, epidural analgesia, quadratus lumborum block.

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INTRODUCTION

The idea of painless Cesarean Section (CS) is widely accepted by patients and becomes more popular with time, recent techniques by anesthetizing the thoracolumbar nerves are possible via abdominal wall block techniques, one of which is the quadratus lumborum block. An efficient method for blocking the abdominal wall is the ultrasound-guided quadratus lumborum block (QLB)[1]. This involves injecting a local anesthetic into the posterior abdomen, which will then diffuse over the quadratus lumborum muscle as well as obstructing the intermuscular nerves, the thoracic paravertebral space and several sympathetic fibers are linked as well with this block[2].

Generally, QLB is effective and can provide a good amount of pain relief because of its shared injection sites as well as liquid distribution pathways, quadratus lumborum block type 1 was formerly thought to as a subtype of the transversus abdominis plane (TAP) block at the triangle of Petit. It has been found in magnetic resonance studies that quadratus lumborum block type 1, being an anterolateral approach, causes the local anesthetic to be less dispersed[3,4].

The impact of epidural analgesia on patient vital signs and fetal condition is well studied since many years and is usually associated with episodes of prolonged fetal bradycardia, however, a return to pre-epidural patterns is highly expected[5]. The fetal heart rate should be monitored during epidural block administration to confirm the return to baseline rate and normal variability. Episodes of fetal bradycardia that return to a normal pattern do not necessitate early delivery[5].

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Prior research has revealed that the QLB can be done by two techniques. The 1st technique is QLB type 2 that involves positioning the injection site below the quadratus lumborum muscle on the back of the abdomen. The 2nd technique is QLB type 3, also known as TM-QLB in which the anesthetic agent is directed towards the anterior border of quadratus lumborum & posterior to psoas major using the "Shamrock Sign" to identify the muscles. This allows the anesthetic agent to spread throughout the thoracic paravertebral area[6,7].

Furthermore, it is generally accepted that QLB type 2 significantly reduced post-Cesarean section pain. But no one has ever compared the results of other QLB methods or their combinations with cesarean sections[8].

The goal of the research was to examine the results of three realistic QLB methods: type 2, type 3, and a mixture of both type (2+3). In the experiment, the impacts were contrasted with those of the traditional epidural analgesia during a CS. We postulated that QLB type 2 and 3 together would be more effective than either type two or three alone in reducing pain after a CS.

PATIENTS AND METHODS

The current study is a prospective cohort study that was conducted on (80) patients in Sohag university hospital who were fulfilling the eligibility criteria and presented to the department of Obstetrics and Gynecology at Sohag University hospital (Egyptian tertiary referral hospital) who are requesting immediate postpartum analgesia. The attending physician had explained the nature of the study and all patients included signed an informed consent.

All participants were subjected to thorough history taking including age, obstetric history, menstrual history, residency, occupation, medical history, surgical history and family history. Clinical examination and full investigations were done as preparation for elective cesarean section.

Participation was contingent upon meeting the following criteria: a normal singleton pregnancy lasting at least 37 weeks, age between (24-40) years, body weight (50-70) kg, as well as having an American Society of Anesthesiologists (ASA) physical status I or II. Individuals with a history of congenital coagulopathy, certain infections, or cognitive impairments that would prevent them from using the verbal rating pain score method or the patient-controlled analgesia (PCA) pump were not involved in the study.

The included patients were assigned into four groups with equal numbers in each: the EA only group, the QL2 group, the QL3 group, & the QL2+3 group.

Intervention

In the operating room, a 16-gauge intravenous cannula was inserted into the non-dominant arm or hand. Experienced doctors administered standard monitoring to all pregnant women, including electrocardiograms, pulse arterial oxygen saturation, respiratory rates, as well as noninvasive blood pressure (NIBP). Additionally, they utilized spinal & epidural anesthetic prior to the left lateral position CS, in addition to peripheral nerve block which was performed at the end of the procedure. In order to access the lumbar epidural area, the epidural needle was inserted at the level of the intervertebral gap that separates the 2nd & 3rd spinal bones.

Upon locating the epidural space through the utilization of the loss of resistance to saline approach, the tip of a spinal needle was inserted through the epidural needle. In order to reach a specific level of sensory block up to the sixth thoracic dermatome, each pregnant woman was administered intrathecal anesthetic consisting of 0.75 percent bupivacaine in a volume of 1.3-1.7 milliliter.

Subsequently, we removed the needle & proceeded to place an epidural catheter through the epidural needle as a precautionary measure in the event of intrathecal anesthetic failure. All operating procedures were executed proficiently by means of the customary approach. Assessment of the fetal condition in the four groups was done to ensure fetal safety.

Following the operation, all participants were promptly moved to the post-anesthesia care unit (PACU). All pregnant women who received QLB were positioned supine, with a 45-degree tilt to the opposite side, to ensure correct placement of the low-frequency convex probe as well as clear visualization of the sonography. The procedure involved performing bilateral Quadratus Lumborum Block (QLB) using a gentle needle (22-G, 120-mm needle for peripheral nerve blocks) inserted in a parallel direction under the guidance of an ultrasound equipment. The ultrasonogram of the abdominal wall can be effectively visualized by manipulating or adjusting the probe's position. Pillows can alleviate the stress in the abdominal wall of women in labor. The entire surgery was executed in perfect adherence to the clinical guidelines.

The investigation involved performing QL2 or QL3 procedures using an anterolateral approach while the patient was in a supine posture, as previously mentioned[9]. The ultrasound transducer was positioned horizontally at the level of L2-3 on both sides of the body. It was adjusted until the "Shamrock sign" created by the QL muscle, psoas major, and erector spinae was visible. The imaging depth was set among 0 as well as 9.9 cm. Needles were inserted from the front-lateral to back-medial direction. An injection of local anesthetic was administered behind the

QL muscle in QL2, but in QL3, it was positioned among the QL muscle and the psoas major. The QL2+3 block can be performed in a single plane with only one puncture on each side[9].

The QL2 as well as QL3 groups were administered 0.2% bupivacaine at a volume of thirty milliliters at the specified sites on each side, resulting in a total of Sixty mL. The QL2+3 group received a 0.2 percent bupivacaine solution of fifteen milliliters at each injection site, with the needle being inserted once on each side. The solution was given after a negative aspiration to rule out vascular puncture[9]. The EA only group received a single dosage of six milliliters of saline solution containing nine milligrams of bupivacaine (0.15%) & 2 mg of morphine via the epidural catheter for postoperative pain management.

Primary outcome measures: Total morphine consumption at specified intervals following operation in addition to postoperative pain assessment by the visual analogue scale (VAS, 0-100 mm) at rest and movement at zero, four, six, twelve, twenty-four hours & forty-eight hours postoperatively were the principal end measures of this research.

The secondary outcome measures: The side effects of the different interventions such as nausea & vomiting as well as itching, weak legs, urine retention, infection & bleeding. Heart rate, oxygen saturation, breathing rate, in addition to non-invasive blood pressure were all monitored.

Ethical Approval

Ethical approval was obtained from the ethical committee of Faculty of medicine, Sohag university under registration number Soh-Med-23-09-6PD The World Medical Association's Code of Ethics (Declaration of Helsinki) for research involving human subjects was followed throughout this project.

Statistical Analysis

Based on a previously published study[10], a sample size of 19 patients in each group was calculated for an alpha error of 0.05, probability (power) of 90%, and expected effect size of 0.6 using sample size software (G*Power Version 3.00.10, Franz Faul, Universität Kiel, Germany). Therefore, 20 patients were included per group. Statistical analysis was performed using the IBM-SPSS version 24 (May 2016). The Shapiro–Wilk test was used to test the normality of included data. Data were expressed as the mean ± SD, median ± IR , or frequency and percentage as appropriate. Parametric and non-parametric analyses were performed on each variable depending on the type of data included. The Kruskall–Wallis test was used for analysis of non-normally distributed continuous data. The chi-square test was used for pair-wise comparison of qualitative parameters among the groups after Bonferroni adjustment. A *P value* of < 0.05 was considered statistically significant.

RESULTS

The study was conducted on 80 patients, 20 patients in each group and there was no statistically significant difference in the baseline characteristics of included patients in all groups as shown in (Table 1).

In addition, the regular assessment of the vital signs of included patients such as systolic blood pressure (SBF), diastolic blood pressure (DBP), heart rate, respiratory rate and oxygen saturation after the intervention revealed no statistically significant difference in between the four groups as shown in (Table 2).

Furthermore, assessment of pain was performed in all groups by using the VAS at rest and with movement during the 1st 48 hours after CS and it revealed that pain was lower in the EA only group in comparison to QL groups at rest and in between the QL groups, pain was lower in the QL (2+3) group than QL3 group and QL2 group reported the highest VAS at rest as shown in (Table 3, Figure 1).

Moreover, assessment of VAS with mobility during the 1st 48 hours after CS revealed also that pain was lower in the EA only group in comparison to QL groups and in between the QL groups, pain was lower in the QL (2+3) group in comparison to other QL groups as shown in (Table 4, Figure 2).

As regard total morphine consumption in between groups, it was lower in the EA only group in comparison to QL groups and in between the QL groups, consumption was lower in the QL2+3 group than the QL2 group and the QL3 group as shown in (Table 5, Figure 3).

However, there was no statistically significant difference in between groups regarding the side effects such as nausea, vomiting, urinary retention, lower limb weakness and the complications such as infection and hematoma formation as shown in (Table 6, Figure 4).

Table 1: Baseline characteristics of included patients.

	QL2 group (n=20)	QL3 group (n=20)	QL(2+3) group (n=20)	EA group (n=20)	f	*P. value*
Age Mean± SD	32±2.66	33±2.67	31.2±2.37	32.4±2.17	1.859	0.1437
Weight (Kg) Mean± SD	60.1±3.34	59.8±3.55	60.04±3.1	59.71±3.18	0.064	0.978
Height (cm) Mean± SD	161.8±5.3	164.5±4.12	163.7±5.01	163.1±6.3	0.944	0.4239
BMI (kg/m^2) Mean± SD	22.1±1.6	22.4±1.64	23.1±1.54	22.9±1.5	1.739	0.1660
Gestation (weeks) Mean± SD	37.9±1.1	37.6±0.8	38.1±1.2	38.5±1.1	4.856	0.074

p. value < 0.05 considered significant f: one-way ANOVA

Table 2: The vital signs of included patients in-between the studied groups.

	QL2 group (n=20)	QL3 group (n=20)	QL(2+3) group (n=20)	EA group (n=20)	f	*P. value*
SBP (mmHg) Mean± SD	103.5±10.2	108.8±19.2	109.8±16.3	108.05±15.8	0.628	0.599
DBP (mmHg) Mean± SD	68.45±4.93	69.65±4.98	75.3± 8.96	76.45±8.2	6.505	0.0006
heart rate (beat/min) Mean± SD	87.85±5.87	86.15±7.96	85.95± 7.8	85.1± 8.26	0.468	0.7055
Respiratory Rate (breaths/min) Mean± SD	15.6±3.03	16.65± 3.2	16.8± 3.04	15.5±2.5	1.067	0.3682
Oxygen Saturation% Mean± SD	97.12±2.50	98.5±1.78	98.14±2.8	97.5±1.95	1.465	0.2308

Table 3: The visual analogue scale of included patients at rest amongst the studied groups.

	QL2 group (n=20)	QL3 group (n=20)	QL(2+3) group (n=20)	EA group (n=20)	f	*P. value*
0 hours Mean± SD	29.6±1.12	23.8±0.65	12.2±0.45	3.4±0.44	5309.5	<0.001*
4 hours Mean± SD	36.2±1.3	24.6±1.43	14.6±1.64	4.5±0.32	2259.3	<0.001*
6 hours Mean± SD	36.9±1.23	24.9±1.02	14.3±1.23	4.53±0.43	3646.6	<0.001*
12 hours Mean± SD	35.5±1.01	23.9±0.88	12.8±1.64	4.23±0.22	2932.2	<0.001*
24 hours Mean± SD	31.5±0.98	23.21±0.34	12.34±0.53	3.1±0.27	4121.3	<0.001*
48 hours Mean± SD	30.9±0.53	23.01±0.12	12.94±1.64	2.98±0.35	2435.2	<0.001*

Table 4: The visual analogue scale of included patients with movement amongst the examined groups.

	QL2 group (n=20)	QL3 group (n=20)	QL(2+3) group (n=20)	EA group (n=20)	f	*P. value*
0 hours Mean± SD	35.4±1.13	40.53±0.75	26.3±1.1	10.8±0.98	3393.1	<0.001*
4 hours Mean± SD	55.6±2.3	42.5±1.63	27.9±1.52	12.5±1.61	2151.5	<0.001*
6 hours Mean± SD	54.9±2.23	42.75±1.72	28.3±1.3	12.9±1.42	2266.2	<0.001*
12 hours Mean± SD	50.32±1.91	40.35±0.98	28.6±1.53	11.9±1.39	2457.2	<0.001*
24 hours Mean± SD	45.36±0.98	40.15±0.54	27.81±1.27	11.5±1.25	4096.8	<0.001*
48 hours Mean± SD	43.5±0.53	39.5±0.62	27.5±0.95	11.1±0.97	2535.1	<0.001*

Table 5: Total Morphine consumption amongst the studied groups.

	QL2 group (n=20)	QL3 group (n=20)	QL(2+3) group (n=20)	EA group (n=20)	f	*P. value*
Total Morphine consumption (mg)	6.1±1.1	5.7±1.2	2.7±1.1	1.3±1.01	88.905	<0.001*

Table 6: postoperative complications amongst the studied groups.

	QL2 group n=20	QL3 group n=20	QL(2+3) group n=20	EA group n=20	X^2	*P. value*
	N (%)	N (%)	N (%)	N (%)		
Nausea	3(15%)	3(15%)	4(20%)	6(30%)	1.875	0.598
Vomiting	2(10%)	1(5%)	1(5%)	3(15%)	1.722	0 .632
Pruritus	4(20%)	3(15%)	4(20%)	5(25%)	0.625	0.890
Urinary retention	3(15%)	1(5%)	3(15%)	3(15%)	1.371	0.712
Lower-limb weakness	2(10%)	1(5%)	3(15%)	2(10%)	1.111	0.774
Infection	0	1(5%)	0	1(5%)	2.051	0.561
Hematoma	1 (5%)	1 (5%)	2 (10%)	3 (15%)	4.281	0.232

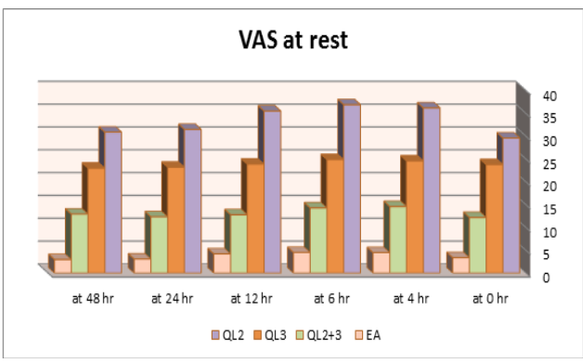

Fig. 1: The visual analogue scale of included patients at rest amongst the studied groups

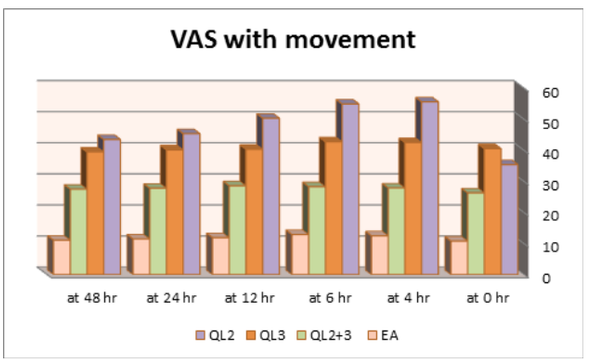

Fig. 2: The visual analogue scale of included patients with movement amongst the examined groups

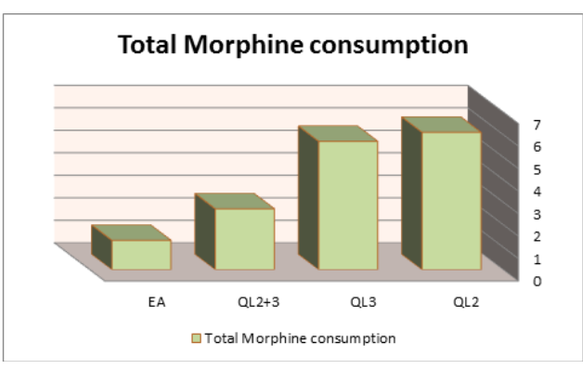

Fig. 3: Total Morphine consumption amongst the studied groups

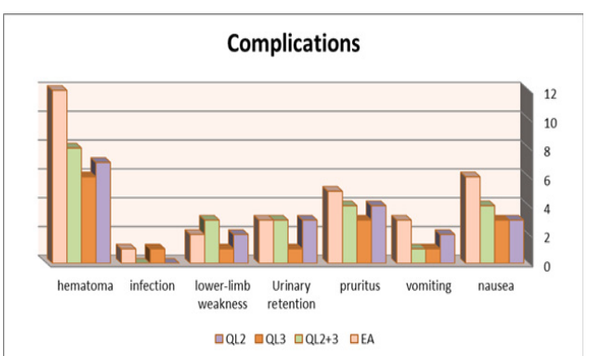

Fig. 4: postoperative complications amongst the studied groups

DISCUSSION

The idea of comparing different techniques for post CS analgesia was previously investigated by others such as Verma *et al*[11] who planned to evaluate the post-CS analgesic effectiveness of QL block against TAP block and Salama *et al*[12], who compared QLB and intrathecal morphine as postoperative analgesics following CS.

The current prospective study showed that epidural analgesia and different QL block approaches are effective in reducing post operative pain in the 1st 48 hours after CS with superior role of QL(2+3) approach in comparison to other approaches with minimal side effects and complications and such results are consistent with previous study by Kang *et al*[13] which was set out to evaluate the efficacy of traditional EA for spinal anesthesia-induced cesarean sections in comparison to three realistic QLB methods.

The current study showed that different techniques of post CS analgesia such as EA and different QL block approaches are neither affecting the fetal condition nor impacting the vital signs of the included patients specially, the heart rate, respiratory rate, systolic blood pressure, diastolic blood pressure, as well as oxygen saturation with no statistically significant difference amongst the four studied groups.

The VAS is a universally accepted method for pain assessment[14] and evaluation of pain by such scale is usually performed both at rest and during movement.

Assessment of VAS at rest in the current study revealed lower pain in the EA only group in comparison to the QL groups with statistically significant difference in between different QL approaches which is consistent with other studies by Kang *et al* and Verma *et al*.[11,13].

However the study by Salama *et al*[12] reported different results which could be explained by different study design and assessment tools.

Furthermore, The EA only group had a lower VAS with mobility than the QL groups with statistically significant difference in between different QL approaches which is consistent with other studies by Kang *et al*[13].

Taking into account the overall amount of morphine consumed, the EA only group had a significantly lower consumption than the QL groups, in addition, the QL(2+3) group had a significantly lower consumption than both the QL2 group as well as the QL3 group and such results were also consistent with the study by Kang *et al*.[13].

However the study by Salama *et al*[12] reported different results which could be explained also by different study design and assessment tools.

The current results are also not consistent with previous study by Blanco *et al*[15] who proved that QL2 block was an effective analgesic method, which can lessen the need for morphine as well as postoperative pain medication after cesarean section and this can be explained by differences in the technique of application of QL2 block anesthetic agent[16].

Furthermore, the overall complication rates and side effects such as vomiting, nausea, urinary retention, pruritus, weakness in the lower limbs, infection, as well as hematoma formation were low with different techniques of post CS analgesia, but both were greater in the EA only group in comparison to the QL groups with no statistically significant difference in between different QL subgroups and such results were also consistent with the study by Kang *et al*.[13].

It is well known that one bolus of epidural morphine after a cesarean section can effectively reduce post CS pain, but with non-preventable side effects specially if higher dose (3mg) of epidural morphine was used in comparison to lower doses (1.5 mg)[17].

One of the limitations of the current study is the small sample size as we found difficulties in patient recruitment as many patients were not pre-minded by the benefits of different types of post CS analgesia.

CONCLUSIONS

In conclusion, spinal morphine and different QL block approaches can alleviate post CS pain, in addition, QL (2+3) approach is the most effective strategy for pain management with minimal side effects and complications and may help individuals who did not get enough spinal morphine. Further studies with bigger sample size are needed to confirm whether such approach is the optimal strategy for post CS analgesia or not.

CONFLICT OF INTERESTS

There are no conflicts of interest.

REFERENCES

1. Singh, N.P., *et al*., Efficacy of Different Approaches of Quadratus Lumborum Block for Postoperative Analgesia After Cesarean Delivery: A Bayesian Network Meta-analysis of Randomized Controlled Trials. Clin J Pain, 2023. 39(11): p. 634-642.

2. Jadon, A., *et al*., Quadratus lumborum or transversus abdominis plane block for postoperative analgesia after cesarean: a double-blinded randomized trial. Braz J Anesthesiol, 2022. 72(4): p. 472-478.

3. Mostafa, M., *et al*., The analgesic effect of transmuscular quadratus lumborum block versus erector spinae plane block for women undergoing elective Caesarean section: A randomized controlled trial. Br J Pain, 2023. 17(5): p. 438-446.

4. Khanna, S., *et al*., Quadratus lumborum block versus transversus abdominis plane block for post Caesarean analgesia: A randomized prospective controlled study. Med J Armed Forces India, 2022. 78(Suppl 1): p. S82-S88.

5. Stavrou, C., G.J. Hofmeyr, and A.P. Boezaart, Prolonged fetal bradycardia during epidural analgesia. Incidence, timing and significance. S Afr Med J, 1990. 77(2): p. 66-8.

6. Yetik, F., *et al*., Comparison of ultrasound-guided quadratus lumborum block-2 and quadratus lumborum block-3 for postoperative pain in cesarean section: A randomized clinical trial. Medicine (Baltimore), 2022. 101(49): p. e31844.

7. Guo, M., *et al*., Anterior Quadratus Lumborum Block at the Lateral Supra-Arcuate Ligament versus Transmuscular Quadratus Lumborum Block for Analgesia after Elective Cesarean Section: A Randomized Controlled Trial. J Clin Med, 2022. 11(13).

8. Bilgin, S., *et al*., Comparison of ultrasound-guided transversalis fascia plane block and anterior quadratus lumborum block in patients undergoing caesarean delivery: a randomized study. BMC Anesthesiol, 2023. 23(1): p. 246.

9. Sato, M., M. Hara, and O. Uchida, An antero-lateral approach to ultrasound-guided lumbar plexus block in supine position combined with quadratus lumborum block using single-needle insertion for pediatric hip surgery. Paediatr Anaesth, 2017. 27(10): p. 1064-1065.

10. Krohg, A., *et al*., The Analgesic Effect of Ultrasound-Guided Quadratus Lumborum Block After Cesarean Delivery: A Randomized Clinical Trial. Anesth Analg, 2018. 126(2): p. 559-565.

11. Verma, K., *et al*., 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): p. 820-826.

12. Salama, E.R., Ultrasound-guided bilateral quadratus lumborum block vs. intrathecal morphine for postoperative analgesia after cesarean section: a randomized controlled trial. Korean J Anesthesiol, 2020. 73(2): p. 121-128.

13. Kang, W., *et al*., Postoperative analgesic effects of various quadratus lumborum block approaches following cesarean section: a randomized controlled trial. J Pain Res, 2019. 12: p. 2305-2312.

14. Delgado, D.A., *et al*., Validation of Digital Visual Analog Scale Pain Scoring With a Traditional Paper-based Visual Analog Scale in Adults. J Am Acad Orthop Surg Glob Res Rev, 2018. 2(3): p. e088.

15. Blanco, R., T. Ansari, and E. Girgis, Quadratus lumborum block for postoperative pain after caesarean section: A randomised controlled trial. Eur J Anaesthesiol, 2015. 32(11): p. 812-8.

16. Carline, L., G.A. McLeod, and C. Lamb, A cadaver study comparing spread of dye and nerve involvement after three different quadratus lumborum blocks. Br J Anaesth, 2016. 117(3): p. 387-94.

17. Singh, S.I., *et al*., The efficacy of 2 doses of epidural morphine for postcesarean delivery analgesia: a randomized noninferiority trial. Anesth Analg, 2013. 117(3): p. 677-685.