COMPARISON BETWEEN QUADRATUS LUMBORUM BLOCK VERSUS TRANSVERSUS ABDOMINIS PLANE BLOCK FOR PAIN RELIEF AFTER CESAREAN DELIVERY UNDER ULTRASOUND GUIDANCE

Marwa F. Negm[1*], Sahar Y. O. Azab[2], Amira Ibrahim Lashin[3]

Article History: Received: 19.10.2022 **Revised:** 05.12.2022 **Accepted:** 15.12.2022

Abstract:

The main benefit of QL block over TAP block is the extension of local anesthesia into the thoracic paravertebral space, which lessens post-cesarean section discomfort and narcotic use. The period of no pain following cesarean section among parturient using the two procedures was compared in this study.

Methods: Ninety parturient ASA II participated in a double-blind, prospective, randomized study with three equal groups for elective cesarean section under spinal anesthesia.; **Group C** received a saline injection under ultrasound guidance. **Group T** A dose of 0.2 ml/kg of 0.25% bupivacaine was given using an ultrasound-guided TAP block, and **Group Q** A dose of 0.2 ml/kg of 0.25% bupivacaine was given using an ultrasound-guided QL block. The NRS for post-operative pain, the hemodynamic parameters, the first analgesic request, total analgesic use, block time, and patient satisfaction are all noted.

Results: Compared to patients in other groups, group T patients reported less severe postoperative pain with longer intervals between requests for analgesia.

Conclusion: the QLB for analgesia after CS is superior to the TAP block but it's a more difficult technique.

Keywords: Transversus abdominis plane block (TAPB), cesarean section (CS), Quadratus lumborum block (QLB), Ultrasound-guided.

1 M.B.B.Ch. MSc. faculty of medicine for girls – Al Azhar University.

2 Professor of Anesthesia, ICU, and pain management. faculty of medicine for girls Azhar University. Cairo-Egypt

3 Lecturer of Anesthesia, ICU, and pain management. faculty of medicine for girls Azhar University. Cairo-Egypt

* Correspondence: Mero_negm2007@yahoo.com, Amira.lashin@azhar.edu.eg

DOI: 10.48047/ecb/2022.11.12.138

1. INTRODUCTION

Optimal analgesia with minimal adverse effects is the aim of postoperative pain control following cesarean section [1]. Both somatic (resulting from the abdominal wall incision) and visceral (having its origin in the uterus) components are present in pain during cesarean section (CS) [2]. Regional nerve blocks are now an essential part of multimodal analgesia regimens due to the widespread usage of ultrasound imaging. They provide comparable pain relief to opioids while having lower rates of side effects. Multimodal analgesia and non-opioid systems have been created to improve recovery after surgery [3]. An effective peripheral nerve block known as the transversus abdominis plane (TAP) block involves administering a regional anesthetic to the transversus abdominis plane to numb the somatic nerves that feed the anterior abdominal wall [4]. The TAP block continues to appear to be preferred for usage with abdominal procedures because of its adequate somatic analgesia, which lowers the need for additional analgesics after surgery, lessens the severity of pain, and is convenient to use. [3, 5].

The Quadratus Lumborum Block (QLB) is the result of ultrasonographic research into a novel TAP block strategy. The expansion of local anesthetic agents into the thoracic paravertebral region from the transversus abdominis plane, which has the potential to create widespread analgesia and extend the effects of an administered local anesthetic, gives it an advantage over TAPB [6]. But for anesthesiologists to carry out, the QLB approach is more challenging than the TAPB. [7, 8].

The purpose of this study was to evaluate the analgesics and the simplicity of the QLB and TAP blocks following CS.

2. METHODS

After getting institutional clearance from the hospital's ethics council, the randomized controlled prospective double-blinded trial was conducted over 24 months in the Department of Anesthesia, ICU, and Pain Management at Al-Zahra University Hospital. It was decided to randomly divide 90 pregnant women between the ages of twenty-one and thirty-five who had physical condition II according to ASA classification into three groups

(30 patients each). They were scheduled for elective cesarean sections under spinal anesthesia.

Exclusion criteria included: Patient with ASA physical status ≥ III, BMI ≥ 35, history of chronic pain, opioid abuse, or Diabetes, known to have allergic reactions to the used drugs in the study, the needle puncture site for the block has a local infection, patients with coagulation disorder or thrombo-cytopenia were excluded from our study. Additionally, people who find it difficult to understand the numerical rating scale for pain evaluation, those who took much prolonged time to complete the operation which required sedation or turning to general anesthesia (GA), or any patient whom they all were excluded since they declined to take part in our study.

The MedCalc® software version 12.3.0.0 was used to compute the sample size, and "Ostend, Belgium" was utilized as the reference location. A previous study by Verma et al., (2019) [9] revealed that the QL group required more rescue analgesic time than the TAP group did (mean SD: 68.771.74h vs. 13.31.21h) (P-Value 0.001) based on a statistical calculator with a 95% confidence range, an 80% power, and a 5% error rate. A significant reduction in analgesic need was also observed in the QL group (P-Value 0.001). The sample size was calculated using these numbers based on this premise, and this resulted in a minimal sample size of 57 cases, which was sufficient to detect this difference. We divided the 90 patients into three groups, each with a 20-person capacity: QL group (n=20), TAP group (n=20), and Control group (n=20) assuming a 5% drop-out rate to ensure and enhance the results.

Patients fasted for 8 hours before CS, except for clear drinks (2 hours only).

During the preoperative visit, all patients received instruction on how to evaluate their pain using the Numerical Rating Scale (NRS) (zero reflects zero pain to 10 the worst possible pain)

In the preparation unit after the insertion of a wide bore cannula (18G), all patients in the study were pre-medicated with the injection of metoclopramide 10 mg IV.

ECG, NIBP, and pulse oximetry were used prior to spinal block. A spinal block using 0.5% hyperbaric bupivacaine and 25-microgram fentanyl was carried out on the patient while they were seated, between the intervertebral spaces L3–4 or L4-5.

At the end of surgery in the post-anesthetic care unit (PACU), prior to the onset of any postoperative pain:

1- **Group C**: patients underwent bilateral ultrasound-guided saline injections.
2- **Group T:** ultrasound-guided TAP block by 0.2 ml/kg of 0.25% bupivacaine was given bilaterally on each side.

A high-frequency 5–10 MHz linear probe was positioned between the iliac crest and the subcostal boundary, roughly laterally toward the anterolateral section of the abdominal wall, while the patients were lying in the supine position. The injection site was located between the aponeurosis of the internal oblique and transversus abdominis muscles. After confirming negative aspiration to guarantee accurate positioning of the needle in the intended plane, 2 ml of saline was administered. After the correct location of the needle insertion was confirmed, bupivacaine 0.25% (0.2 ml/kg) was delivered bilaterally with intermittent aspiration.

3- **Group Q:** ultrasound-guided QL block by 0.2 ml/kg of 0.25% bupivacaine was given bilaterally on each side.

While the patients were lying supine, a bellow was placed under the side on which we executed the block. A needle was punctured in the plane from the posterior edge of the convex probe until it reached the posterior border of the QL muscle. With the ability to go back if necessary to get a better view, a low-frequency convex probe with a range of 2 to 5 MHz was vertically positioned above the iliac crest. The needle tip was located at the posterior border of the QL muscle after crossing the facial line to ensure the spread of bupivacaine through the thoracolumbar fascia. When the tip of the needle was in the targeted zone, 2 ml saline was injected after ensuring negative aspiration to ensure a good location of the needle then the studied solution was injected with intermittent aspiration bilaterally on each side. It was noted that some of the cases in this group found it hard to obtain the optimum sonographic view in a tilted supine position, so around 10 cases were repositioned to a lateral position to obtain a good sonographic view for block performance, especially in cases with truncal obesity and full flanks. All parturients got frequent doses of diclofenac (75 mg IM/12 h) and paracetamol (1 g IV/6 h) after surgery. Only breakthrough pain (pain that is 4–10 on the numeric rating scale) was treated with a single 0.05 mg kg dose of intravenous morphine.

Assessment parameters

1- Patient data: age and BMI.
2- Postoperative hemodynamics assessments (HR, MAP, and SPO2) at 2, 6, 12, and 24 hours were recorded.
3- Assessment of the pain-free period post CS using a Numerical rating scale (NRS) at 2, 6, 12, and 24 hours
4- First requirement of rescue analgesia and Total morphine consumption
5- patient satisfaction score:

a. 0 not satisfied,
b. 1 partially satisfied,
c. 2 completely satisfied.

6- Duration of peripheral nerve block administration

Statistical Evaluation

The statistical package for social sciences (SPSS Inc., Chicago, Illinois, USA), version 23.0, was used to analyze the data that had been collected. The median and IQR (interquartile range) served to present non-normally distributed variables (non-parametric data), whilst the mean, standard deviation (SD), and ranges were chosen to present normally distributed variables (parametric data). Additionally, qualitative characteristics were shown as percentages and figures. To determine whether the data was normal, the Kolmogorov-Smirnov and Shapiro-Wilk tests were performed.

3. RESULTS

Regarding the demographic information (Age and BMI), the groups in our study did not differ statistically significantly. (Table 1). Regarding hemodynamic changes (heart rate, MAP, O_2 saturation), Between groups, the measured times did not show any statistically significant difference (fig. 1, 2, 3). Analysis of the patients' results regarding the numerical rating scale showed a significant pain score difference between the three groups across all of the examined timeframes (2, 6, 12, 24 hrs.). Pain scores showed increased rates, but the most increase was in group C followed by group T and then group Q according to NRS score (Fig 4).

As a measure of the effectiveness and success of the peripheral block, the interval between the first request for a rescue analgesic and that request dose was submitted and recorded in hours. Our results showed that the Need for analgesia was faster in Group C, followed by Group T than in Group Q (Table 2) (figure 5). Also, there was a significantly higher mean value of morphine consumption in group C, followed by group T, and the lowest mean value in group Q according to total opioid consumption (figure 6). Without insignificant difference, there was an increase in the number of patients who were completely satisfied in group Q, followed by group T, and the lowest frequency in group C (figure 7). Duration of block administration was measured in minutes as an indicator of the ease of the technique where the mean value was statistically greater in group Q, followed by group T, and the lowest mean value in group C (figure 8)

Table (1): Comparison of several groupings based on demographic data

Demographic data	**Group (C) "n=30"**	**Group (T) "n=30"**	**Group (Q) "n=30"**	**F-test**	**p-value**
Age (years)					
Mean±SD	23.70±4.19	23.60±4.80	24.63±4.61	0.472	0.625
Range	21-33	21-34	21-34		
BMI [wt/ (ht)^2]					
Mean±SD	30.34±3.32	29.04±2.61	28.59±2.52	3.078	0.051
Range	25.1-34.9	24.4-33.6	25.1-34.7		

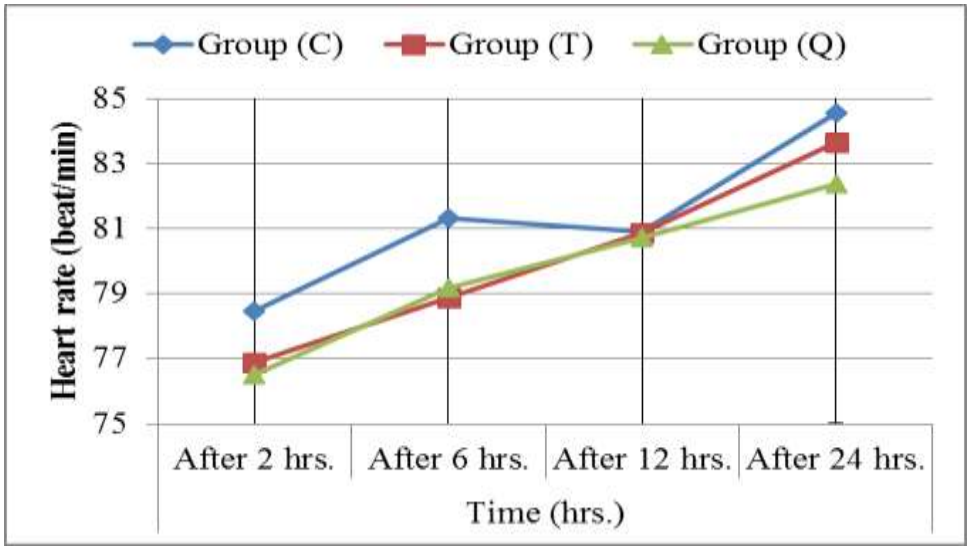

Figure (1): Comparison of groups based on heart rates.

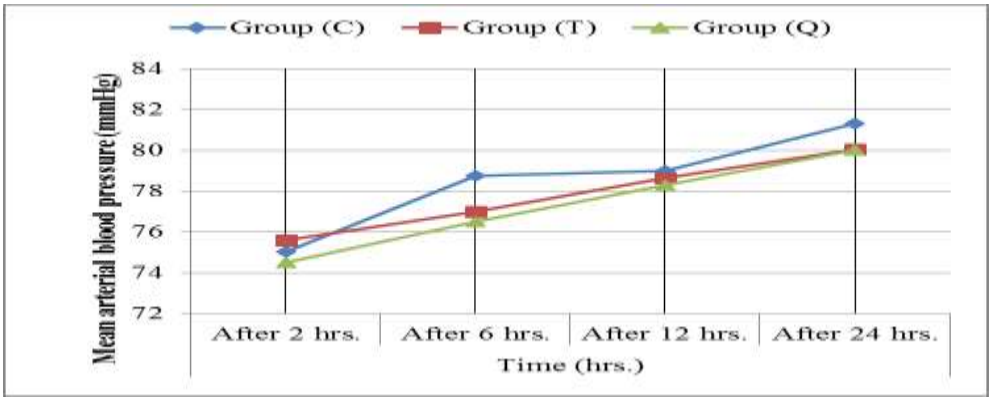

Figure (2): Comparison of the mean arterial blood pressures of the various groups.

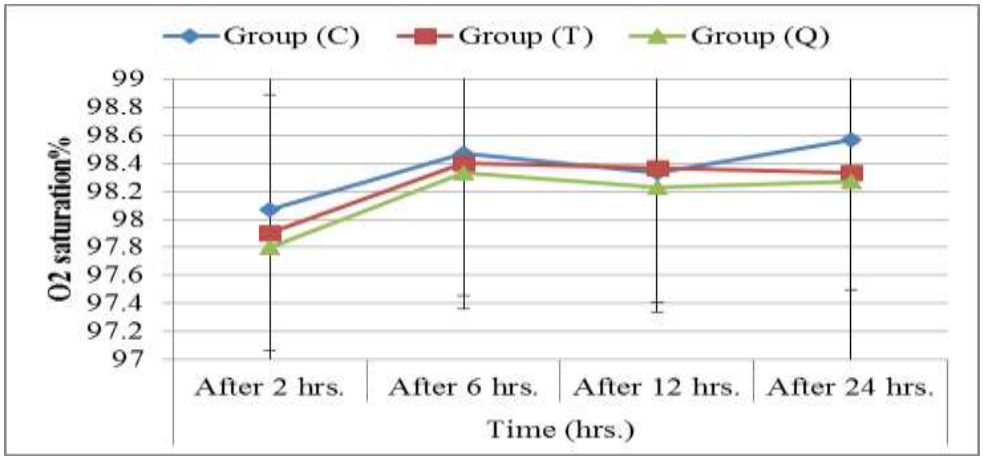

Figure (3): Comparison of the groups based on O2 sat.

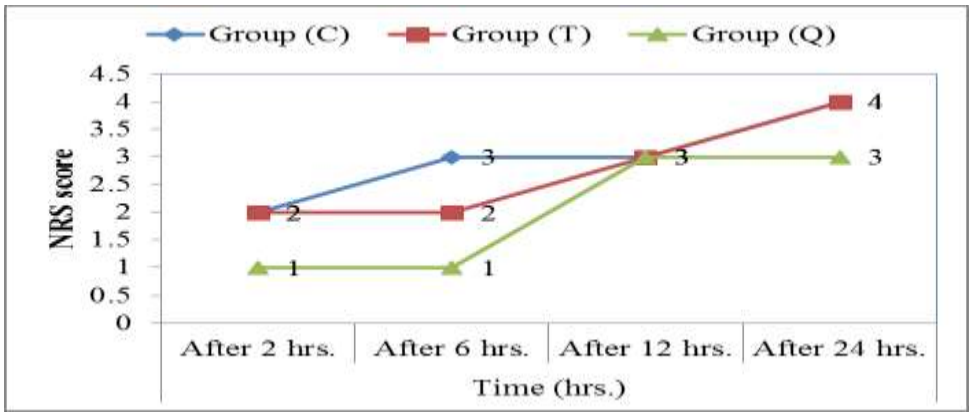

Figure (4): NRS comparison of the groups.

Table (2): Comparison of the groups based on who first requested rescue analgesia.

First request of rescue analgesia (hrs.)	***Group (C) "n=30"***	***Group (T) "n=30"***	***Group (Q) "n=30"***	***F-test***	***p-value***
Mean±SD	6.13±2.66	15.00±4.83	17.48±5.01	56.015	<0.001**
Range	2-12	4-20	5-24		
Multiple Comparison Tukey's test					
Group C vs. Group T		Group C vs. Group Q		Group T vs. Group Q	
<0.001**		<0.001**		0.038*	

*P-value >0.05 is insignificant; *p-value <0.05 is significant; **p-value <0.001 is highly significant*

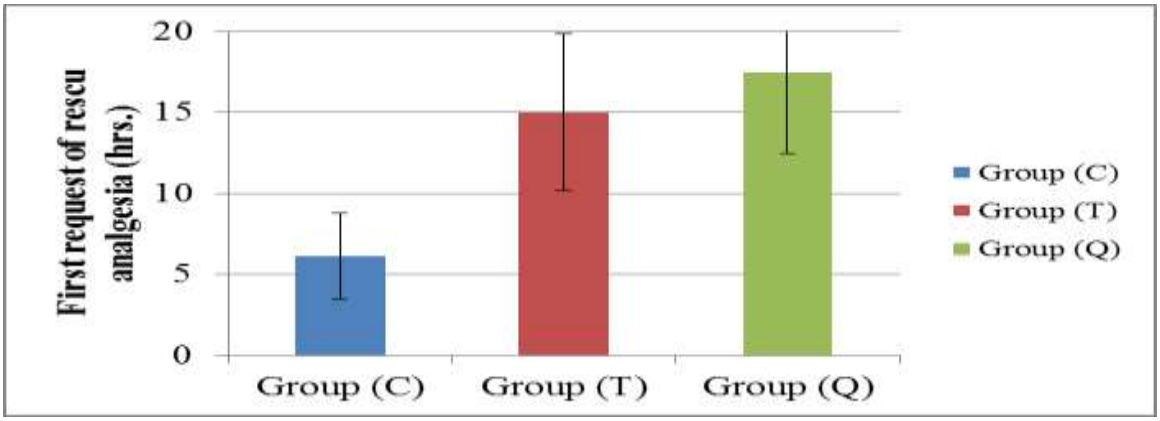

Figure (5): Comparison of the groups based on who first requested rescue analgesia.

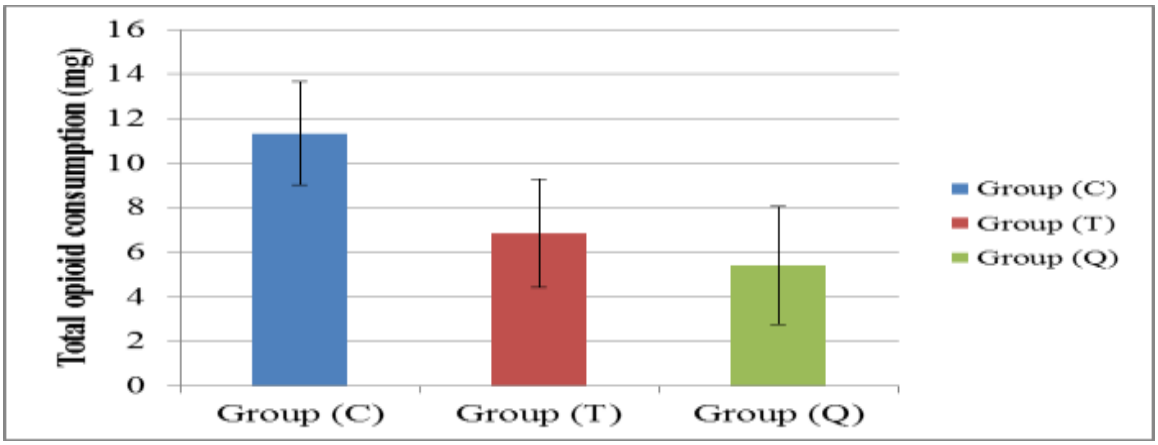

Figure (6): Comparison of total opioid usage between groups.

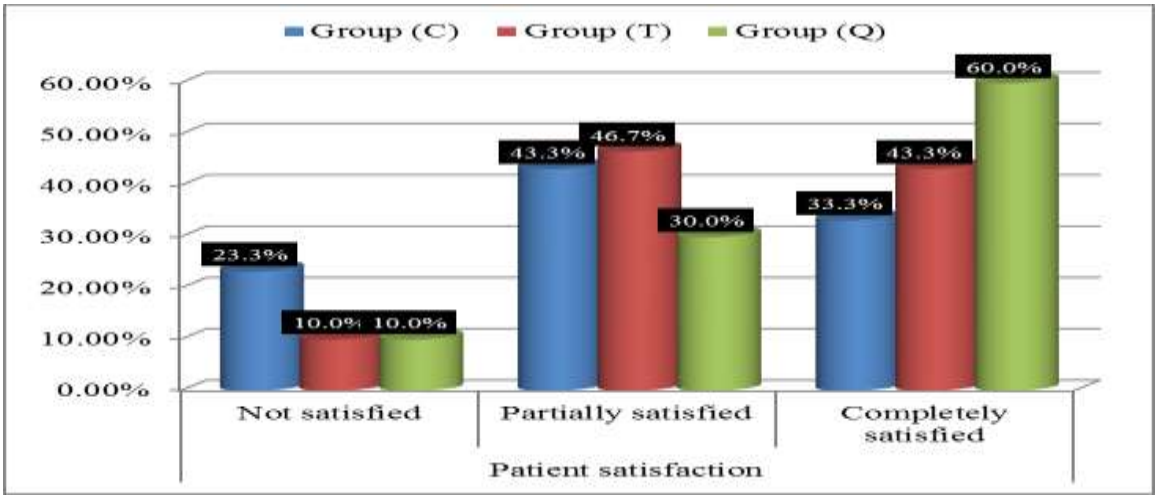

Figure (7): Comparison of the groups based on the level of patient satisfaction.

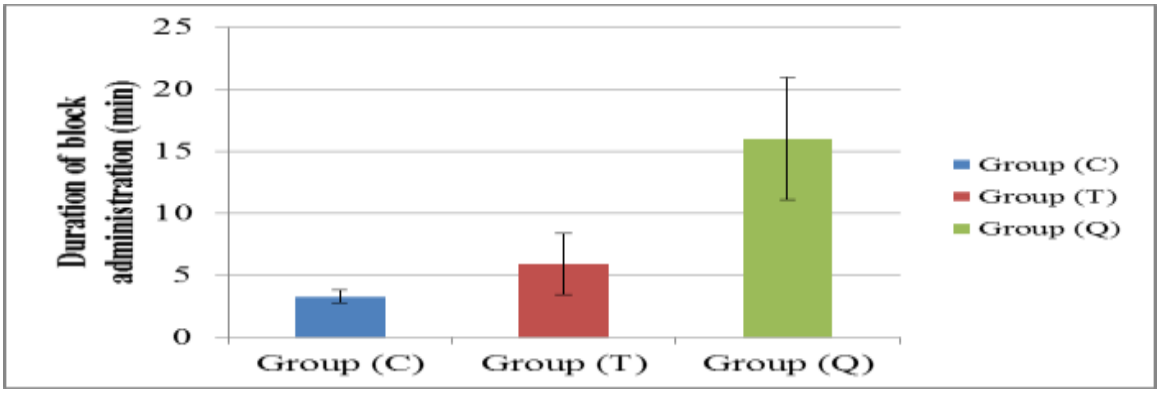

Figure (8): Comparison of the length of the block administration for each group.

DISCUSSION

To optimize the early stages of mother-child contact, post-CS pain must be aggressively treated because it is a significant source of patient dissatisfaction [10]. It has been demonstrated that a US-guided TAP block, which is simple, dependable, and safe, can offer efficient postoperative analgesia for many lower abdominal operations such as CS [11]. US-guided TAPB has continued to develop, as seen by US-guided QLB [1].

Our study found that the QLB was superior for analgesia than TAPB with increased rates of pain in the control group post cesarean section, as was revealed in research by ***Verma K., et al., (2019)*** -, ***Esmail A M A., et al. (2020)***. Also, the Meta-analysis study done by ***Wang Y, et al. (2020)***, showed higher VAS scores in the TAP group than that in the QL group. The systematic review done by ***Chen J., et al. (2020)*** compared QLB and TAPB through a meta-analysis study that collected data from 15 trials which revealed better and long-lasting results of the effectiveness of analgesia in the QL block in comparison to the TAP block. Several mechanisms were suggested to explain these results as follows:

In QLBs, LA can spread along the endo thoracic fascia, which runs continuously from the thoracic wall to the transversalis fascia pla in the abdominal wall. This causes LA to expand cranially between the ribs and the endothoracic membrane, maybe all the way to the thoracic paravertebral region. This means that QLB could serve as a thoracic paravertebral block indirectly. Mechanoreceptors and many sympathetic fibers are in the paravertebral space and thoracolumbar plane. In QLBs as opposed to TAPBs, the introduction of LA to these regions causes widespread and somatic visceral analgesia. Additionally, the thoracolumbar fascia and endo thoracic fascia are loaded with adipose tissue that has limited tissue perfusion, which results in a slower absorption rate of LA into the blood in QLB blocks. This prolongs the sensory block induced by QLB compared to TAPB.

Another point of view was seen in the study done by ***Benedicta R., et al in (2022)*** that NRS scores at (8 hrs.) were considerably greater in the TAP block group compared to the QL block group, even though NRS scores were greater in both groups at (8, 12, and 24 hrs.). This could be explained by the approach of QL block as they used the QL1 approach (lateral approach) which considered to be the lateral continuation of TAPB with minimal spread of local anesthetic when opposed to the technique of the current study where was QL2 or QL3 (posterior or anterior respectively) approaches. Heart rate, mean arterial blood pressure, and oxygen saturation between the three groups in our study did not differ in a way that was statistically significant. Along with our review, the study of ***Verma K, et al. (2019)***. In contrast to our study results, ***Esmail A M A., et al. (2020)*** study which found a significant lowering in the hemodynamics measured in the QLB group rather than in the TAP group and control group because the block was administered in their study after sedation, premedication, and before induction of general anesthesia so the level of sensory blockade was confirmed before induction of anesthesia which excludes the possibility of blockade failure. Also, the dose of local anesthetic used in the blockade was more than the dose used in our work.

In our study, we observed the need for rescue opioid analgesia was slower in the QL group than in the TAP group while the faster group asked for the first rescue opioid analgesic dose in was control group.

Along with our study, the results of the systematic review done by ***Chen J., et al. (2020)***, ***Jadon A. et al. (2022),*** and the study done by ***Verma Ket al. (2019)*** could be caused by the slower rate of local anesthetic blood absorption in the QLB rather than the TAPB, which results in long-lasting analgesia in the QLB. This explanation was almost confirmed in the ***Esmail A M A., et al. (2020)*** study. According to the patient satisfaction evaluation, our analysis revealed that the QL block group had the highest percentage of parturients who were completely satisfied, followed by the TAP block group, and the lowest percentage was in the control group. However, this difference was statistically insignificant .

In parallel to our study the results shown from the systematic review done by ***Chen J. et al., (2020)***, ***Esmail A. M A., et al. (2020),*** and the study done by ***Jadon A., et al. (2022)*** demonstrated that the QL group had considerably higher patient satisfaction ratings.

The results of our study were supported by the systematic review conducted by ***Chen J, et al. (2020),*** the meta-analysis study conducted by ***Wang Y, et al. (2020),*** and the ***Jadon A, et al. (2022)*** study where the results showed a highly significant variation in morphine consumption in the control group, afterward in the TAP block group, and the lowest in the QL block group. **Verma K, et al. (2019)** demonstrated the same outcomes but with tramadol rather than morphine. From another point of view, the study performed by ***Borys, et al. (2021)*** observed no difference in the overall postoperative analgesic usage between the research groups in terms of statistics. Contrarily, more patients in the TAP group rather than in the QLB group required further subcutaneous morphine injections. This difference could also be explained using the linear probe in QLB, performing the blocks with three different operators, and finally the site of local anesthetic injection during QLB performance.

The procedure's simplicity is a crucial issue. The TAP block process is simple, however, the location and deep anatomical terminus of the QL block are thought to be technically challenging. However, because QLB offers long-lasting analgesia and decreases the need for opioids, it ultimately prevails [17].

In our study we used the duration of block administration as an indicator for the ease of the technique, both were done under ultrasound guidance with full filling of all the prerequisites needed for block administration before parturients transfer to the PACU. Our results showed that the time spent administering blocks had a statistically significantly higher mean value in the QL block group in comparison to that of the TAP block group and the lowest mean value of the time consumed was absolutely in the control group according to the statistical analysis of the duration of block administration.

In the study done by ***El-Boghdadly K, et al. 2021*** they said that it is worth thinking about the relative safety and simplicity of TAP block vs. QLB. TAP block is thought to be simpler to execute than QLB and requires a lower level of competence, even though both procedures require ultrasound guidance. Unfortunately, there weren't many papers that commented on the duration of block administration or any other indicator to be taken into consideration for evaluation of the ease of the techniques apart from the judgment of the operating anesthetist.

Conclusion

Our study suggested that the use of the QLB for analgesia after CS is superior to the use of TAP block as it provides a better and long-lasting analgesic effect decreases the need for rescue opioid analgesia, has no side effects, and promotes the satisfaction of parturients

Despite these advantages for expectant mothers, it is important to consider the patient's placement and the technical challenges associated with the deep anatomical endpoint.

Limitations

Our trial findings raise important clinical questions regarding the time needed for block administration. Both the operator-dependent and time-consuming ultrasound-guided TAP block and QL block provide technical challenges, but the positioning of patients and the imaging of structures in the latter were significantly more problematic than in the former, particularly in patients with truncal obesity. This could be a confounding factor. Also, the extension of sensory blocks was not evaluated as the patients were subjected to spinal anesthesia which might provide valuable information about the LA spread.

REFERENCES:

1. Pangthipampai P, Dejarkom S, Poolsuppasit S, Luansritisakul C, and Tangchittam S (2021). Bilateral posterior Quadratus Lumborum block for pain relief after cesarean delivery: a randomized controlled trial. BMC anesthesiology; 21(1), 1-11.
2. Raghvendra K P, Thapa D, Mitra S, Ahuja V, Gombar S, and Huria A. (2016). Postoperative pain relief following hysterectomy: A randomized controlled trial. Journal of Mid-life Health; 7(2), 65-68
3. Chen J, Chen C, Sun G, Guo C, and Yao W. (2020): Quadratus Lumborum Block Versus Transversus Abdominis Plane Block for Postoperative Analgesia in Abdominal Surgery: A Systematic Review and Meta-analysis. :(1)20 53
4. Bhattacharjee S, Ray M, Ghose T, Maitra S, & Layek A (2014). Analgesic efficacy of transversus abdominis plane block in providing effective perioperative analgesia in patients undergoing total abdominal hysterectomy: a randomized controlled trial. Journal of anesthesiology, clinical pharmacology; 30(3), 391-396
5. Srivastava U, Verma S, Singh T K, Gupta A, Saxsena A, Jagar K D, and Gupta M (2015). Efficacy of trans-abdominis plane block for post-cesarean delivery analgesia: A double-blind,

randomized trial. Saudi journal of anesthesia; 9(3), 298-302

6. Blanco R, Ansari T, and Girgis E (2015). Quadratus lumborum block for postoperative pain after cesarean section: a randomized controlled trial. European Journal of Anesthesiology (EJA); 32(11), 812-818.
7. Han B, Wang W, and HE A (2017). Comparison of ultrasound-guided quadratus lumborum block and transversus abdominis plane block combined with patient-controlled intravenous analgesia with sufentanil on post-operation analgesia after appendectomy. The Journal of Clinical Anesthesiology; 33(10) 984-986.
8. Jie Z, Jialing M and Yanping G. (2019). Effect of low back quadratus block and transverse abdominis block on postoperative analgesia in elderly patients undergoing radical gastrectomy. Guizhou Medical Journal; 43(09):1368-1371.
9. Verma K, Malawat A, Jethava D, and Jethava DD. (2019): Comparison of transversus abdominis plane block and quadratus lumborum block for post-caesarean section analgesia: A randomized clinical trial. Indian Journal of Anesthesia, 63(10), 820-826.
10. Azanu W K, Osarfo J, Larsen-Reindorf R E, Agbeno E K, Dassah E, Amanfo A O, Dah A

    Plane block versus local wound infiltration for postoperative analgesia in patients undergoing gynecological surgery under general Anesthesia. Kathmandu Univ Med J; 46(2):93-96.

11. K, and Ampofo G. (2022): Assessment and determinants of acute post-caesarean section pain in a tertiary facility in Ghana. Plos one, 17(5), e0268947.
12. Ranjit S. and Shrestha S.K. (2014): Comparison of ultrasound-guided Transversus Abdominis
13. Wang Y, Wang X, and Zhang K. (2020): Effects of transversus abdominis plane block versus quadratus lumborum block on postoperative analgesia: a meta-analysis of randomized controlled trials. BMC anesthesiology, 20(1), 1-9.
14. Çaparlar C Ö, Altınsoy S, Akelma F K, Özhan M Ö, and Ergil J. (2022). Posterior quadratus lumborum block versus posterior transversus abdominis plane block for unilateral inguinal hernia surgery. Nigerian journal of clinical practice, 25(9), 1457-1465.
15. Esmail A M A, Seleem A E S, Mohammad E S, and El-Sayed M M M. (2020): Comparative Study between Ultrasound Guided Quadratus Lumborum Block versus Ultrasound Guided Transversus Abdominis Plane Block for Postoperative Pain Relief in Patients Undergoing Unilateral Inguinal Surgeries. Al-Azhar Medical Journal, 49(3), 1231-1244.
16. Benedicta R, Jain MK, Dixit N, and Shivappagoudar VM. (2022): The efficacy of ultrasound-guided transversus abdominis plane block versus quadratus lumborum block for postoperative analgesia in lower-

17. segment cesarean section with low-dose bupivacaine: A randomized controlled trial. Anesthesia: Essays and Research, 16(2), 203 - 207.
18. Borys M, Potręć-Studzińska B, Kutnik P, Sysiak-Sławecka J, Rypulak E, Gęca T, Kwa´sniewska A, Czuczwar M, and Piwowarczyk P. (2021). The Effectiveness of Transversus Abdominis Plane and Quadratus Lumborum Blocks in Acute Postoperative Pain Following Cesarean Section—A Randomized, Single-Blind, Controlled Trial. International Journal of Environmental Research and Public Health, 18(13), 7034.
19. Jadon A, Amir M, Sinha N, Chakraborty S, Ahmad A, and Mukherjee S. (2022): Quadratus

    lumborum or transversus abdominis plane block for postoperative analgesia after cesarean: a double-blinded randomized trial. Brazilian Journal of Anesthesiology, 72(4), 472-478.
20. El-Boghdadly K, Desai N, Halpern S, Blake L, Odor PM, Bampoe S, and Sultan P. (2021): Quadratus lumborum block vs. transversus abdominis plane block for cesarean delivery: a systematic review and network meta-analysis. Anesthesia, 76(3), 393-403.
21. Hebbard P. (2008): Subcostal transversus abdominis plane block under ultrasound guidance. Anesthesia & Analgesia, 106(2), 674-675.