ORIGINAL ARTICLE

Ultrasound guided quadratus lumborum and transversus abdominis plane block for postoperative analgesia in patients undergoing caesarean section under subarachnoid block: A comparative study

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Abstract

Background: Effective postoperative pain management after caesarean section is very vital; because it helps early ambulation, facilitates breastfeeding and creates early mother-baby bonding. To reduce this significant postoperative pain various modalities are in current use. All truncal blocks can reduce postoperative pain and reduce opioid consumption after caesarean section significantly. This study aims to compare the effectiveness of USG guided Quadratus lumborum block and Transversus abdominis plane block in postoperative pain management in patients undergoing caesarean section.

Methods: This randomized controlled trial study was conducted in 60 patients, who were underwent elective caesarean section under sub arachnoid block in obstetric operation theatre, Bangabandhu Sheikh Mujib Medical University. The study populations were divided equally into two groups having same numbers of parturient in each. QL block group parturient received ultrasound guided quadratus lumborum block (0.20% bupivacaine) and TAP block group received transversus abdominis plane block (0.20% bupivacaine) after caesarean section. Total volume of the drugs (0.20% bupivacaine) is 20 ml on each side. Then collected data was recorded and compared between two groups: duration of analgesia, time of first analgesic requirement, total dose of opioid consumption in first 24 hours, postoperative pain by VAS score, sedation scale by Ramsay scale and satisfaction level by Likert scale between the groups.

Results: Socio-demographic profile were similar among the both groups ($p>0.05$). The mean VAS score was significantly low in QL block group as compared to the TAP block at 10th, 16th and 20th hours interval ($p<0.05$). Patients with QLB block had significantly late demand of 1st analgesic (14.35±2.55 vs 8.25±2.25) hours ($p<0.05$) and significantly less total opioid consumption (95.5±10.7 vs191.6±14.8) mg ($p<0.05$) compared to patients with TAP block. Post-operative complication was noted significantly higher among patients with TAP block compared to QL block. The level of satisfaction was much higher in QL block group then TAP block group.

Conclusion: This study shows that quadratus lumborum block produce longer duration of analgesia which provides optimum post-operative pain control and reduce the opioid consumption among the patients than transversus abdominis plane block in case of caesarean section under subarachnoid block.

Keywords: Quadratus Lumborum block, transversus abdominis plane block, sub arachnoid block, caesarean section, local anaesthetic, postoperative analgesia

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Introduction

It is very important to provide adequate postoperative analgesia following caesarean section (CS), as it affects the surgical recovery requirements of the parturient.[1] Postoperative pain after caesarean section negatively affects maternal ambulation, breastfeeding and maternal bonding to newborn.[2]

Quadratus lumborum block is a block of the posterior abdominal wall, inter-fascial plane block, which is performed exclusively under ultrasound guidance. The ultrasound-guided quadratus lumborum block (QLB), was first introduced by Blanco R. in 2007, which has been recognized as an effective abdominal wall block approach, in which local anaesthetic injected from the posterior abdomen will spread around the quadratus lumborum muscle and block the intermuscular nerves.[3]

The transversus abdominis plane (TAP) block is used for post-operative pain relief in caesarean section as part of the multimodal analgesic approach.[4,5] It creates satisfactory somatic analgesia with insignificant or no visceral blockad.[6] TAP block targets the somatic nerves on the anterior abdominal wall, most commonly using a subcostal or lateral approach. The subcostal approach targets the anterior cutaneous branches of T6-T10, although more reliably T7-T9. The lateral TAP block provides cutaneous analgesia for lower abdominal incisions (T10-T12)[3].

The deposition of local anaesthetic adjacent to quadratus lumborum muscle not only treats the somatic pain associated with a Pfannenstiel incision but also spreads proximally to the paravertebral space and may have some effect in providing relief to the visceral component of post-caesarean pain.[1]
However, transversus abdominis plane block did not decrease cumulative morphine consumption following caesarean section and were associated with more pronounced sedation. This leads to the suggestion that blocking somatic fibres alone is not sufficient, and a block including the visceral fibres may be more likely to provide adequate analgesia.[7]

However, there is no reports on effectiveness of Ultrasound guided quadratus lumborum block compared to transversus abdominis plane block in our country. Aiming at that direction, we proposed this study to compare the effectiveness of Ultrasound guided quadratus lumborum block and transverse abdominis block in postoperative pain management after caesarean section under Subarachnoid block in terms of reducing opioid consumption, duration of postoperative analgesia, pain assessment by VAS scale & satisfaction level by four-point Likert Scale after caesarean section operation in a tertiary level specialized hospital of the country.

Methods

This randomized control trial was conducted in the Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from December 2019 to September 2021. Patients with ASA class II & III and scheduled for Elective Caesarean section under Sub arachnoid block were included in this study. The exclusion criteria were as follows: patient refusal, allergy to local anaesthetics, infection in the site of block, BMI >40 kg/m2, psychiatric disorder, pregnancy associated complications (eclampsia, pre-eclampsia, antepartum hemorrhage) and any block failure. Then, they were randomized into two groups with 30 patients in each group QL and group TAP.

QL Block Group

At the end of the caesarean section, after proper aseptic preparation, patients were received USG guided bilateral QLBs in supine position with lateral tilt to perform the block, and the transducer was placed at the level of the anterior superior iliac spine and moved cranially until the three abdominal wall muscles are clearly identified. The external oblique muscle was followed postero-laterally until its posterior border was visualized (hook sign), leaving underneath the internal oblique muscle, like a roof over the QL muscle. The probe was tilted down to identify a bright hyperechoic line that represent the middle layer of the thoracolumbar fascia. The needle was inserted in plane from anterolateral to posteromedial. The needle tip was placed between the thoracolumbar fascia and the QL muscle, and after negative aspiration, 20 mL of 0.2% bupivacaine was injected. The same procedure was performed on the other side.

TAP block group

At the end of the caesarean section, after proper aseptic preparation, patients were received USG guided TAP block, the probe was located between the iliac crest and the lower costal margin in the anterior axillary line at the level of umbilicus, and the layers of abdominal wall was identified (external oblique, internal oblique, and transverse abdominis muscles). In plane technique was used and the tip of the needle was inserted between the internal oblique and transverse abdominis muscles. After negative aspiration (to exclude intravascular injection), 20 mL of 0.2% bupivacaine was injected. The same procedure was performed on the other side.

The following variables were measured and documented: heart rate, respiratory rate, oxygen saturation and noninvasive blood pressure in 1st hour, 2nd hour, 4th hour, 8th hour, 10th, 12th hour, 16th hour. Pain was assessed with a visual analogue score (VAS) (0, no pain; 10, worst pain imaginable) pressure in 1st hour, 2nd hour, 4th hour, 8th hour, 10th, 12th hour, 14th, 16th, 20th hour and 24th hour. The time when first dose of pethidine was given by the patient's request in post-operative period it was called first analgesic requirement dose or if VAS was >4. It was recorded in hours. Intramuscular pethidine hydrochloride 1.5 mg/kg was given, if VAS was >4 or whenever patient complained moderate to severe pain. The total amount of pethidine hydrochloride in first 24 was recorded in mg.

After 24 hour the level of satisfaction was assessed by four point Likert scale (Very Satisfied, Satisfied, Dissatisfied and Very Dissatisfied) an anaestheiologist in PACU without influencing the patients.

Sedation scores (Ramsay scale), itching (0, none; 1, mild; 2, moderate; 3, severe), nausea (0–3 scale: 0, none; 1, mild; 2, moderate; 3, severe or vomiting) and other complications were documented. Data collection was continued on the ward for 24 h. Every patient's data were collected and recorded on a separate data sheet. All data were collected from anaesthetic records, demographic information was collected from the patients or her guardian.

Statistical analysis

Following the collection of all necessary data, all of them were entered into SPSS 25.0 (IBM SPSS, Chicago, IL, USA). Statistical analysis was performed by using t-test or chi –square for mean ±SD of onset time of block, the total duration of analgesia after the block, mean VAS, mean opioid requirement. After analyses of all data $P < 0.05$ was considered statistically significant.

Results

In this study, sixty patients were included according to the inclusion and exclusion criteria. They were divided into two groups, QL block group and TAP block group with 30 patients in each group. The patients were also compared with each other with respect to age, ASA class, BMI, perioperative hemodynamic parameters, total opioids requirement in the first 24 during the postoperative period and post-operative side effects in two groups.

On basis of demographic characteristics of the patients, the mean age of the patient was 25.4±3.8 years in QL block and 27.6±3.4 years in TAP block. Maximum patient had ASA Class I (66.7% vs73.3%) in both groups. On consideration of parity, most of the patients had multiparity (57.7% vs63.3%) in both groups. The duration of Surgery was not significant in between the groups, as it is almost same in both group. There is 10% block failure in QL block group and 3% in TAP block group. There had no statistically significant difference in any characteristics of patients between the two groups ($p>0.05$). **(Table 1)**

Table I: Demographic characteristics of the patients and duration of surgery.

Characteristics		QL block group (n=30)	TAP block group (n=30)	P value
Age(years)		25.4±3.8	27.6±3.4	0.76
BMI(kg/m2)		28.5±2.6	30.2±2.9	0.87
ASA	Class II	20(66.7%)	22(73.3%)	0.68
	Class III	10(33.3%)	8(27.7%)	0.69
Parity	Nully	13(43.3%)	11(36.7%)	0.78
	Multi	17(57.7%)	19(63.3%)	0.72
Duration of Surgery (min)		39.8±9.6	41.4±8.9	0.83
Block failure		3(10%)	1(3%)	0.64

Values are expressed as Mean±SD except for ASA status and parity (expressed as percentage). P value was determined by chi-squared Test (2) and student t-test.

There had been a significant difference in mean HR between the two groups as $p<0.05$ at the end of the 10th hrs and 16th hrs during the post-operative period. This might be due to the patient started to feel

pain. Then mean HR became stable and there had been no significant difference was found. Differences in heart rate were shown in **Table II**.

Table II: Postoperative Heart rate of the patients.

Heart rate (beat/min)	QL block group (n=27)	TAP block group (n=29)	P value
1st Hr	85.8±5.6	84.2±6.8	0.737
2nd Hrs	83.9±5.3	82.9±5.5	0.718
4th Hrs	82.6±5.1	84.5±6.1	0.754
6th Hrs	82.3±5.8	83.8±5.6	0.633
8th Hrs	83.2±5.5	85.4±8.3	0.341
10th Hrs	84.3±6.2	89.5±6.9	0.032
12th Hrs	86.3±5.8	85.7±5.2	0.624
16th hrs	88.5±6.3	83.1±5.9	0.029

Values are expressed as Mean±SD. ** Student t-test was performed to compare the mean heart rate of both groups

There had been no significant difference in mean arterial pressure (MAP) between two groups as p>0.05 during the postoperative period. MAP was maintained within the normal range in most of the patients. Which indicates none of them cause haemodynamic instability after the block. p value is determined by student t- test. Figure 1 showed the mean arterial pressure (MAP) during postoperative period between two groups.

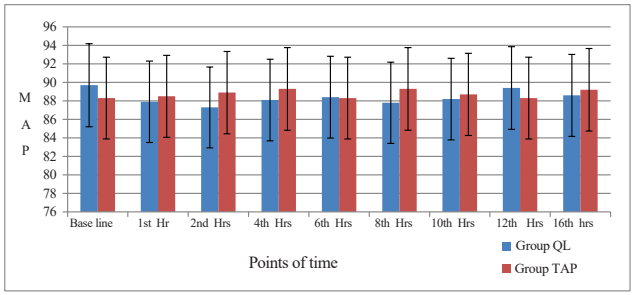

Fig I: Mean arterial pressure (MAP) during postoperative period between two groups.

The VAS were significantly lower in QL block group at all-time intervals except at the 16th hour. VAS score was higher among TAP block at 10th, 16th hrs and 20th hrs. The scores were higher at these time points where the patients feel pain and this difference was statistically significant (as p<0.05). At the end of 24 hours, there was no significant difference in VAS score between the two groups. **(Table III)**

Table III: Comparison of VAS score of the patients between two groups.

VAS score	QL block (n=27)	TAP block (n=29)	P value
Hour1	0.48±0.18	0.57±0.24	0.174
Hour2	0.65±0.27	0.77±0.38	0.173
Hour4	0.74±0.32	0.92±0.40	0.163
Hour6	0.90±0.67	1.78±1.38	0.138
Hour8	1.82±0.95	2.88±1.88	0.172
Hour10	1.14±0.78	4.12±1.84	0.003
Hour12	2.12±1.45	1.88±1.88	0.161
Hour14	2.52±1.62	2.18±1.55	0.128
Hour16	4.08±1.86	1.82±1.34	0.006
Hour20	1.68±1.25	3.14±1.20	0.023
Hour24	2.44±1.57	2.31±1.25	0.187

Values are expressed as Mean±SD. Student t-test was performed to compare the mean VAS score of both groups.

Ramsay sedation score (RSS) score was not significant between the two groups at an all-time interval except 10th, 16th and 20th. (Figure 2) The mean value of RSS was varied low that was patients were agitated or restless at 10th, 16th and 20th hrs in TAP block, this might because of pain as the VAS also high (≥4) at the same time. In QL block group, the same thing has happened at end of the 16th hrs.

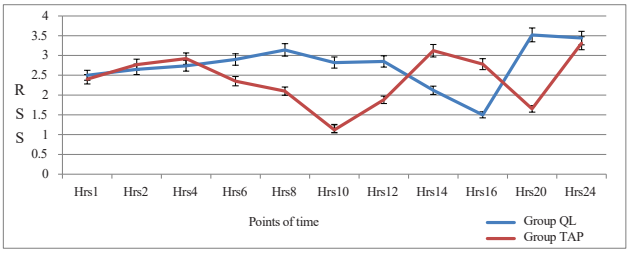

Fig II: Ramsay sedation score (RSS) of patients during postoperative period.

The mean time of 1st analgesic requirement was prolonged (14.35±2.55 vs8.25±2.25) hrs in QL block group than TAP block. Patients in QL block had significantly lower opioid requirements compared to TAP block (95.5±10.7 vs191.6±14.8) mg in the first 24 hour both were statistically significant as p-value was <0.05. Table-4 showed time of 1st analgesic requirement and total opioid consumption of the patients.

Table IV: Assessment of Time of 1st analgesic requirement and total opioid consumption of the patients.

Variable	QL block (n=27)	TAP block (n=29)	P value
Time of 1st analgesic requirement (hour)	14.35±2.55	8.25±2.25	0.007
Total opioid consumption (mg)	95.5±10.7	191.6±14.8	0.008

Values are expressed as Mean±SD and within parenthesis percentage (%) over column in total. Pearson chi-squared Test (2) was performed. Student t-test was performed.

Patients of TAP block had developed significantly high incidence post-operative complication like nausea (23%), vomiting (10%), itching (16.67%) and dizziness (26.67%) compared to QL block. In QL block nausea (10%), vomiting (3.34%), itching (6.67%) and dizziness (10%). Significant statistical difference was found in adverse effects between two groups and adverse effects were higher among the patients in TAP block group (table 5).

Table V: Adverse effects during postoperative period in two groups.

Adverse effects	QL block (n=27)	TAP block (n=29)
Nausea	3(11.11%)	7(24.14%)
Vomiting	1 (3.34%)	3 (10.35%)
Itching	2 (7.4%)	5 (17.41%)
Dizziness	3 (11.11%)	8 (27.6%)

Values are expressed within parenthesis percentage (%) over column in total.

The level of satisfaction was much higher in QL block group. In QL block group 70.3% of patients were satisfied with the therapy that they had given and 22.23% of the patients very satisfied with the same procedure. But in TAP block 65.6% of patients were satisfied with the therapy that they had given and 24.1% of the patients were dissatisfied & 3.4% of the patients were very dissatisfied with the same procedure. Table 6 presented the level of satisfaction among the patients between the two groups.

Table VI: Comparison of the level of satisfaction among the patients between two groups

Level of satisfaction	QL block (n=27)	TAP block (n=29)
Very Satisfied	6(22.23%)	2(6.9%)
Satisfied	19(70.3%)	19(65.6%)
Dissatisfied	2(7.4%)	7(24.1%)
Very Dissatisfied	0	1(3.4%)

Values are expressed in absolute number, within parenthesis percentage (%) over the column in total.

Discussion

Post operative analgesia is important after surgery not only to avoid respiratory, cardiac complications, and prolonged hospital stay but also for humanitarian background.[8] Very frequent surgeries like caesarean sections demand additional attention, considering that they rank among the most common surgeries among women of fertile age. In addition, this procedure takes place at a time of considerable hormonal and emotional changes related to the pregnancy and arrival of the baby, which can negatively influence the postoperative pain, in view of the multidimensional nature of this experience.[9]

The transversus abdominis plane (TAP) is the fascial plane between the internal oblique and transversus abdominis muscle containing the thoracolumbar nerves T10 to L1. The introduction of local anaesthetic in this plane Blocks these nerves (T10 to L1). The ultrasound-guided quadratus lumborum Block (QL block) has been recognized as an effective abdominal wall block approach around the quadratus lumborum muscle and block the intermuscular nerves.

When observed the demographic characteristics of the patients, the mean age of the patient was 25.4±3.8 years in QL block and 27.6±3.4 years in TAP Block. Maximum patients had ASA Class II (66.7% vs73.3%) in both groups. On consideration of parity, most of the patients had multiparity (57.7% vs63.3%) in both groups.

There had been a significant difference in mean HR between two groups as $p<0.05$ at the end of the 10th hrs (84.3±6.2 vs 89.5±6.9) b/min,p-value <0.032 and 16th hrs (88.5±6.3vs 83.1±5.9) b/min, p-value <0.029 during the post-operative period. This might be due to the patient started to feel pain. Then mean HR became

stable and there had been no significant difference was found. There had been no significant difference in systolic blood pressure (SBP) and mean arterial pressure (MAP) between the two groups as p>0.05 during the postoperative period.

The VAS was significantly lower in QL block at all-time intervals except at the 16th hour. VAS score was higher among TAP Block at 10th hrs, 16th and 20th hrs. At the end of 24 hours, there was no significant difference in VAS score between the two groups. Ramsay sedation score (RSS) score was not significant between the two groups at an all-time interval except 10th, 16th, and 20th. The mean value of RSS was very low that was patients were agitated or restless at 10th and 20th hrs in TAP Block. The mean time of 1st analgesic requirement was prolonged (16.35±2.55 vs10.25±2.25)hrs in QL block than TAP Block. Patients in QL block had significantly lower opioid requirements compared to TAP Block (95.5±10.7 vs191.6±14.8)mg in the first 24 hr. both were statistically significant as p-value was <0.05.

Patients of TAP Block had developed a significantly high incidence of postoperative complications like nausea (23%), vomiting (10%), itching (16.67%), and dizziness (26.67%) compared to QL block. In QL block 73.34% of patients were satisfied with the therapy that they had given and 20% of the patients were highly satisfied with the same therapy. But in TAP Block 66.65% of patients were satisfied with the therapy that they had given and 23.34% of the patients were dissatisfied & 3.34% of the patients were very dissatisfied with the same therapy.

Mankikar MG, et al observed that TAP Block with ropivacaine compared with normal saline reduced post operative VAS at 24 h (P = 0.004918). Time for rescue analgesia in the study group was prolonged from 4.1 to 9.53 h (P = 0.01631). The mean requirement of tramadol in the first 24 h was reduced in the study group.[10]

Kang W, et al., had reported that the analgesic effect of QL block is highly dependent on the injection position of the local anesthetic. Besides, the ultrasound-guided QL block type 2+3 can provide a superior analgesic effect following caesarean section to that of QL block type 2 or 3 Blocks. However, it remains to be further validated whether the combination of QL block type 2 and 3 is the best approach.[11]

Kumar GD, et al. had compared the efficacy of transversus abdominal plane (TAP) Block versus QL Block in providing postoperative analgesia for lower abdominal surgeries. they resulted that the time for the first analgesic requirement was 243.00 ± 97.36 min and 447.00 ± 62.52 min and the total analgesic consumption (morphine in mg) was 5.65 ± 1.55 and 3.25 ± 0.78 in the TAP block and QL block group, respectively, both of which were statistically significant (P < 0.01). There was a significant difference in postoperative pain scores (NPIS scale 0-10) at rest, between the two groups, up to 16 hrs.[12]

Deng W, et al. observed the contrast between the quadratus lumborum Block (QL block) and transversus abdominis plane Block (TAP block) for postoperative pain management in patients undergoing laparoscopic colorectal surgery. They also conclude that the QL block is a more effective postoperative analgesia as it reduces opioid consumption compared to TAP block in patients undergoing laparoscopic colorectal surgery.[13]

Yousef NK. Had compared ultrasound-guided bilateral transverse abdominis plane (TAP) Block versus bilateral QL Block in patients undergoing total abdominal hysterectomy. This author finds that bilateral QL Block provided better intraoperative and postoperative analgesia with less opioids consumption compared with bilateral TAP Block, in patients undergoing total abdominal hysterectomy.[14]

A meta-analysis of randomized controlled trials was conducted by Liu X, et al. had concluded that QL Block provides better pain management with less opioid consumption than TAP Block after abdominal surgery. In addition, there are no differences between the TAP Block and the QL Block with respect to PONV.[15]

Verma K, et al. compared QL block and TAP block with 0.2% ropivacaine for postoperative analgesia after caesarean section (CS). They evaluated that time for rescue analgesia requirement was higher in the QL group than in the TAP group (mean ± SD: 68.77 ± 1.74 h vs. 13.3 ± 1.21 h) (P < 0.001). The QL group had significantly less analgesic demand (P <

0.001) at 2, 4, 6, 12, 24, 36, 48 and 72 h post CS. The VAS at rest and movement was significantly reduced in the QL block group at all times.[16]

Parihar A, et al. concluded that Ultrasound-Guided nerve blocks (TAP block and QL block) could be used as a part of multimodal analgesia for better postoperative pain relief in lower abdominal surgeries like caesarean section especially when given before the resolution of spinal anaesthesia. Further, it was observed that QL block was superior to TAP block in terms of better pain control (duration and quality) as shown by lower VAS score, demand for the first rescue analgesia which was delayed and total consumption of rescue analgesia was less in the first 48 hours.[17]

These findings from our study depict that QL block performed in patients scheduled for caesarean section under subarachnoid block results in better pain control and less postoperative opioid consumption in the first 24 hours. Hence it is a superior Block than TAP in patients scheduled for caesarean section.

Conclusion

Under the consideration of present state it can be concluded that quadratus lumborum block has longer duration of analgesia than that of transversus abdominis plane block and also reduced opioid consumption in the first 24 hours after caesarean section under subarachnoid block.

Declaration

Ethics approval

Institutional Review Board (IRB) of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh.

Author contributions

Conception and development of the idea *SS, AKMA*
Data collection *SS, MMH, MMK*
Data analysis *SKB, SS, MBH, DKB*
Writing - Original draft preparation *SS*
Review & editing *SS, AKMA*

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Conflict of interests None

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