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Original Research Article

Ultrasound guided quadratus lumborum block and transversus abdominis plane block for postoperative analgesia after lower segment caesarean section under spinal anesthesia: A prospective observational study

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ABSTRACT

Background: Caesarean section being a major surgical procedure is associated with substantial postoperative discomfort and moderate to severe pain for 48 hours postoperatively. This prospective study was undertaken to observe the ultrasound guided quadratus lumborum block and transversus abdominis plane block for postoperative analgesia after lower segment caesarean section under spinal anesthesia.

Materials and Methods: Hundred patients belonging to ASA class I & II and a normal singleton pregnancy with a gestation of at least 37 weeks posted for elective caesarean delivery under spinal anesthesia were selected. The patients who had received either TAP block or QL block were assigned two groups. The patients who had received TAP block were assigned group A and the patients who had received QL block were assigned group B.

Results: The overall VAS score in group B was lower than in group A. The duration of analgesia in Group A ranged from 6-12 hours with a mean duration of 8.5±1.998 hours. In Group B the duration ranged from 9-24 hours with a mean duration of 16.5±3.096 hours. The difference in duration of analgesia between the two groups was statistically significant. In group A the mean analgesic consumption dose was 1.07±0.264 grams at 12 hours, 2.11±0.317 grams at 24 hours and 2.67±0.673 at 48 hours. In group B it was 0.43±0.501 grams at 12 hours, 1.35±0.567 grams at 24 hours and 1.65±0.604 grams at 48 hours. The difference was statistically significant

Conclusion: It can be concluded that Ultrasound Guided nerve blocks (TAP block and QL block) can be used as a part of multimodal analgesia for better postoperative pain relief in lower abdominal surgeries like LSCS especially when given before the resolution of spinal anaesthesia. Further it was observed that QLB 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.

1. Introduction

Ultrasound has gained popularity among anesthesiologists performing regional anaesthesia.[1,2] In fact, some might say that the ultrasound transducer has become the new stethoscope of the modern anesthesiologist, facilitating performance of regional nerve blocks.[1]

As the use of ultrasound by anesthesiologists is increasing, newer techniques are being pioneered and used worldwide.[1,2] Conventional approaches to TAP block is one of the options that creates satisfactory somatic analgesia with minimal or no visceral blockade.[2] Therefore, a more posterior approach that injects the local anaesthetic adjacent to quadratus lumborum muscle has been sought for to potentially provide the patients with more visceral blockade and thus better analgesia.[3]

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Quadratus lumborum block is a newer abdominal truncal block for controlling somatic pain in both upper and lower abdomen. [3,4]

In our study we have compared the ultrasound guided transversus abdominis plane block with Quadratus Lumborum block for postoperative analgesia after lower segment cesarean section under spinal anesthesia.

2. Aims and Objectives

1. Degree of postoperative pain relief via Visual Analogue Score (VAS) {time frame: 48 hours}.
2. Duration of postoperative analgesia.
3. Time of request for first rescue analgesia and total consumption of rescue analgesia in first 48 hours.
4. To observe Inadvertent side effects if any.

3. Materials and Methods

This prospective observational study was conducted at Lal Ded Hospital, an Associated Hospital of Government Medical College Srinagar.

3.1. Study population

After approval from ethical committee of the Institution, we observed 100 patients over a period of twenty months who had received either TAP block or QL Block.

Written informed consent was obtained in all the patients.

3.2. Inclusion criteria

Hundred patients belonging to ASA class I & II and a normal singleton pregnancy with a gestation of at least 37 weeks posted for elective caesarean delivery under spinal anaesthesia

3.3. Exclusion criteria

1. Patients with coagulopathy.
2. Patients belonging to ASA class > II.
3. Patients with Body Mass Index > 30.
4. Patient with known hypersentivity to local anesthetic.
5. Patients with anatomical abnormality.
6. Patients with multiple pregnancy (twins or triplets).
7. Patients with any surgical complication like postpartum hemorrhage or in whom the surgery is prolonged for more than 1 hour.

3.4. Preanesthetic preparation

The patients enrolled in the study were clinically assessed, evaluated and investigated as per the normal hospital protocol and proforma. The Visual Analogue Scale (VAS) as the method of rating pain was explained to all the patients prior to the surgery.

On arrival to operating room, consent was checked and fasting confirmed. Standard monitoring including ECG, blood pressure and pulse oximetry was instituted. Intravenous access using 18 G i.v. cannula was established.

Patient received inj. Ranitidine 50 mg and inj. Metoclopromide 10mg i.v. as premedication.

In all patients, spinal anaesthesia was performed. With the patient in the sitting position the midline and level of L3-4 and L4-5 intervertebral spaces were identified. Using 26 G Quincke's spinal needle hyperbaric bupivacaine 15 mg was injected intrathecally. Patient was immediately placed in the supine position with left uterine displacement. Spinal Anaesthesia was considered successful when a bilateral block to T6 assesses by loss of cold and touch (blunt pin) discrimination, was established 5 min after the spinal injection.

Anaesthetic and surgical treatments were performed in usual manner.

At the end of the surgery, with the patient in supine position, still fully monitored and after the abdomen was cleaned with 10% betadine solution and under all aseptic precautions, the TAP and QL blocks were performed by an experienced anaesthesiologist

For statistical purposes the patients who had received either TAP block or QL block were assigned two groups. The patients who had received TAP block were assigned group A and the patients who had received QL block were assigned group B.

Group A: This group consisted of the patients who had received ultrasound guided TAP block with 20 ml of 0.2% ropivacaine.

Group B: This group consisted of the patients who had received ultrasound guided QL block with 20 ml of 0.2% ropivacaine.

3.5. Postoperative assessment

Immediately after the performance of block, all the patients were observed for 1 hour to ensure cardio-respiratory stability. Serial measurements of heart rate, blood pressure and respiratory rate were taken at every 5 min for first 30 minutes, and then every 10 min until 1 hour post procedure.

The pressure and severity of pain was assessed systematically using Visual Analog Scale (VAS) at 0 hour, 1 hour 2, 4, 8, 12, 18, 24, 36 and 48 hours. Further at the end of 48 hours, patients were evaluated with respect to time to first rescue analgesia, total analgesia consumption and post-operative nausea/vomiting.

3.6. Statistical methods

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean± SD

and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar diagrams and line diagrams. Student's independent t-test was employed for comparing continuous variables. Chi-square test or Fisher's exact test, whichever appropriate, was applied for comparing categorical variables. A P-value of less than 0.05 was considered statistically significant. All P-values were two tailed.

4. Obsrvations and Results

Table 1 shows age wise distribution of patients in two groups. The age of study subjects ranged from 20 to 35 years with mean age of 27.5±3.28 years in Group A and 26.7±3.67 years in Group B. The difference between two groups was statistically insignificant with p=0.249.

Table 2 shows the weight of patients in two groups. The weight of the study groups ranged from 52 to 70 kgs with the mean weight of 64.8±4.31 kgs in group A and mean weight of 63.1±3.65 kgs in group B. The difference between two groups was statistically insignificant. (p=0.072)

Table 3 shows the duration of surgery in two groups. In group A the mean duration of surgery was 38.1±5.63 minutes and in group B, the duration was 36.9±6.45 minutes. The difference between two groups was statistically insignificant. (p=0.307)

Table 4 shows preoperative vitals in two groups. In group A, mean HR was 91.54±9.13, mean SBP was 124.44±10.63, mean DBP was 77.76±6.52, mean MAP is 93.32±7.23. In group B mean HR was 90.57±9.29, mean SBP was 125.28±10.44, mean DBP was 78.46±6.62, mean MAP was 94.07±7.24. The difference between two groups was statistically insignificant (p = 0.598).

Table 5 shows comparison of postoperative heart rates at different intervals between the two groups. The postoperative heart rate between two groups at different intervals of time postoperatively does not show any statistical difference (p= 0.064).

Table 6 shows comparison of systolic blood pressure between the two groups. The SBP between two groups at different intervals of time postoperatively does not show statistical difference (p=0.611).

Table 7 shows comparison of diastolic blood pressure in two groups. The DBP in two groups at different intervals of time postoperatively does not show statistical difference (p=0.845).

Table 8 shows the comparison of Mean arterial pressure between two groups. The mean arterial pressure between the two groups at different intervals of time postoperatively does not show statistical difference (p=0.540).

Table 9 shows the comparison of postoperative oxygen saturation between two groups. The oxygen saturation between the two groups at different intervals of time postoperatively does not show statistical difference (p=0.207).

Table 10 shows comparison between two groups based on VAS pain score postoperatively at 0,1,3,6,9,18,24.36 and 48 hours. The VAS pain scores between two groups shows significant difference (p<0.001). The overall VAS score in group B was lower than in group A

Table 11 shows Comparison between the duration of analgesia in the two groups. The duration of analgesia in Group A ranged from 6-12 hours with a mean duration of 8.5±1.998 hours. In Group B the duration ranged from 9-24 hours with a mean duration of 16.5±3.096 hours. The difference in duration of analgesia between the two groups was statistically significant (p<0.001).

Table 12 compares the total rescue analgesia consumption between the two groups at 12, 24 and 48 hours. In group A the mean analgesic consumption dose was 1.07±0.264 grams at 12 hours, 2.11±0.317 grams at 24 hours and 2.67±0.673 at 48 hours. In group B it was 0.43±0.501 grams at 12 hours, 1.35±0.567 grams at 24 hours and 1.65±0.604 grams at 48 hours. The difference was statistically significant (p<0.001).

5. Discussion

5.1. Duration of analgesia

In our study the mean duration of analgesia for US guided TAP block was 8.5 hours (6-12 hours) and for QL block it was 16.5 hours (9-24 hours) with p value <0.001 which shows statistically significant difference.

Blanco R et al.,[5] in a randomized controlled trial done in 2016 concluded that QLB produces more prolonged analgesia than TAP block. Similar results have been published in other studies and the major advantage of QL block was considered to be its analgesic action similar to opiod analgesics, yet avoiding the adverse effects such as nausea and vomiting.

5.2. Mechanism of quadratus lumborum block

The prolonged duration of action after QL block is suggested to be due to the spread of local anaesthetic solution along the thoracolumbar Fascia and endothoracic fascia to the paravertebral space.

It is said that QLB is the extension of TAP block toward the dorsal region. According to Hebbard P et al,[6] US guided TAP block has the limitation of requiring two levels of block to cover incision above and below umbilicus. The advantages of single shot QLB is that it covers the dermatome segments from L3 to T4 segments as the drug is expected to travel from the quadratus lumborum to higher paravertebral space. Carney J et al.[7] described that the contrast solution placed posteriorly accumulates near the lateral border of the QL and then spreads in a posterior cranial fashion to the anterior aspect of QL and psoas major to lie at the paravertebral space.

Table 1: Age distribution of study patients in two groups

Age (years)	N	Mean	SD	Range	P-value
Group A	54	27.5	3.28	22-35	0.249
Group B	46	26.7	3.67	20-35	

Table 2: Average weight (kg) of study patients in two groups

Weight (kg)	N	Mean	SD	Range	P-value
Group A	54	64.8	4.31	52-75	0.072
Group B	46	63.1	3.65	55-70	

Table 3: Comparison based on duration of surgery (minutes) in two groups

Duration of Surgery (Minutes)	N	Mean	SD	Range	P-value
Group A	54	38.1	5.63	30-50	0.307
Group B	46	36.9	6.45	25-48	

Table 4: Comparison based on preoperative vitals in two groups

Preop Vitals	Group A		Group B		P-value
	Mean	SD	Mean	SD	
HR	91.54	9.13	90.57	9.29	0.601
SBP	124.44	10.63	125.28	10.44	0.693
DBP	77.76	6.52	78.46	6.62	0.598
MAP	93.32	7.23	94.07	7.24	0.610
Spo2	96.04	1.18	95.67	1.30	0.147

Table 5: Comparison of postoperative HR (beats/min) in two groups at various intervals of time

Time Interval	Group A		Group B		P-value
	Mean	SD	Mean	SD	
0 Hour	86.37	6.03	84.57	5.16	0.114
1 Hour	85.54	5.06	84.17	4.24	0.152
3 Hour	84.76	5.83	82.59	5.13	0.073
6 Hour	82.61	5.28	81.04	4.27	0.110
9 Hour	85.06	5.20	82.93	5.27	0.064
12 Hour	83.74	5.98	81.39	5.18	0.061
18 Hour	81.19	6.46	79.15	4.68	0.079
24 Hour	83.35	5.58	81.07	5.12	0.058
36 Hour	79.57	6.52	77.39	5.12	0.069
48 Hour	77.87	6.85	76.09	5.25	0.153

Table 6: Comparison of postoperative SBP (mmHg) in two groups at various intervals of time

Time Interval	Group A		Group B		P-value
	Mean	SD	Mean	SD	
0 Hour	130.39	6.00	128.52	6.67	0.144
1 Hour	128.91	6.27	127.13	6.93	0.182
3 Hour	127.96	4.59	126.43	5.34	0.127
6 Hour	124.83	5.46	123.52	5.14	0.222
9 Hour	126.67	4.59	126.00	5.16	0.496
12 Hour	125.61	5.11	124.22	5.08	0.176
18 Hour	128.43	5.54	127.85	5.78	0.611
24 Hour	130.59	4.87	128.80	5.52	0.088
36 Hour	125.11	5.05	124.22	5.20	0.386
48 Hour	123.72	5.04	123.09	5.21	0.538

Table 7: Comparison of postoperative DBP (mmHg) in two groups at various intervals of time

Time Interval	Group A		Group B		P-value
	Mean	SD	Mean	SD	
0 Hour	83.15	7.84	82.24	7.37	0.554
1 Hour	82.89	8.88	81.91	7.53	0.559
3 Hour	81.91	9.63	80.65	8.25	0.490
6 Hour	81.06	9.55	80.39	8.49	0.716
9 Hour	80.67	8.46	79.85	9.20	0.644
12 Hour	78.87	9.24	78.37	8.79	0.783
18 Hour	82.24	7.89	81.91	8.82	0.845
24 Hour	82.19	8.54	81.54	8.51	0.708
36 Hour	79.96	8.46	79.91	8.05	0.976
48 Hour	79.63	8.56	78.76	8.23	0.608

Table 8: Comparison of postoperative MAP (mmHg) in two groups at various intervals of time

Time Interval	Group A		Group B		P-value
	Mean	SD	Mean	SD	
0 Hour	98.90	6.32	97.67	6.04	0.320
1 Hour	98.23	7.08	96.99	6.23	0.359
3 Hour	97.26	7.52	95.91	6.65	0.348
6 Hour	95.65	7.23	94.77	6.26	0.523
9 Hour	96.00	6.31	95.23	6.87	0.562
12 Hour	94.45	6.69	93.65	6.28	0.540
18 Hour	97.64	6.25	97.22	6.80	0.752
24 Hour	98.32	6.06	97.30	6.42	0.415
36 Hour	95.01	6.14	94.68	6.13	0.787
48 Hour	94.33	6.25	93.54	6.24	0.526

Table 9: Comparison of postoperative oxygen saturation (%) in two groups at various intervals of time

Time Interval	Group A		Group B		P-value
	Mean	SD	Mean	SD	
0 Hour	98.54	0.503	98.70	0.465	0.107
1 Hour	98.70	0.461	98.89	0.315	0.082
3 Hour	98.93	0.328	98.91	0.285	0.836
6 Hour	98.57	0.499	98.43	0.544	0.185
9 Hour	98.81	0.392	98.72	0.455	0.253
12 Hour	98.93	0.264	98.91	0.285	0.815
18 Hour	98.93	0.264	98.93	0.250	0.864
24 Hour	98.48	0.504	98.61	0.493	0.207
36 Hour	98.70	0.571	99.49	0.382	0.152
48 Hour	98.78	0.451	98.63	0.505	0.196

Table 10: Comparison based on VAS in two groups at various intervals of time

Time Interval	Group A		Group B		P-value
	Mean	SD	Mean	SD	
0 Hour	0.52	0.540	0.39	0.493	0.225
1 Hour	1.13	0.646	0.63	0.488	<0.001*
3 Hour	2.13	0.646	0.91	0.590	<0.001*
6 Hour	3.26	1.102	1.43	0.583	<0.001*
9 Hour	4.02	1.677	2.30	0.726	<0.001*
12 Hour	2.46	1.463	3.39	1.064	0.002*
18 Hour	3.02	1.205	3.17	1.981	0.514
24 Hour	3.91	1.457	2.52	1.786	<0.001*
36 Hour	2.76	1.822	1.72	1.905	0.006*
48 Hour	1.15	1.053	0.78	0.664	0.045*

Table 11: Comparison based on duration of analgesia (hours) in two groups

Duration of analgesia (hours)	N	Mean	SD	Range	P-value
Group A	54	8.5	1.998	6-12 hours	<0.001*
Group B	46	16.5	3.096	9-24 hours	

Table 12: Comparison based on analgesic consumption (gm) in two groups at various intervals of time

Time Interval	Group A		Group B		P-value
	Mean	SD	Mean	SD	
12 hours	1.07	0.264	0.43	0.501	<0.001*
24 hours	2.11	0.317	1.35	0.567	<0.001*
48 hours	2.67	0.673	1.65	0.604	<0.001*

Murouchi T et al[8] 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 tissue and the local tissue perfusion of the adipose tissue is low which results in low absorption speed of a local anesthetic into the blood.

5.3. Quality of analgesia

In our study pain was assessed using Visual Analog Scale. The VAS scores were significantly better at every observation time in the QLB group than in the TAPB group. Baidya DK et al.[9] performed single injection QL transmuscular block between the QL and psoas major in lateral position on five children undergoing pyeloplasty, and they reported that it was associated with good postoperative analgesia. Oksuz G et al.[10] who compared TAP block and QLB in pediatric patients undergoing lower abdominal surgery and reported that TAP block group showed significantly higher postoperative FLACC scores than QLB group ($P < 0.05$); furthermore, the number of patients who received rescue analgesia in the first 24 h postoperatively was significantly higher in TAP block group than in QLB group ($P < 0.05$). Parent's satisfaction scores were lower in TAP block group than in QLB group.

5.4. Hemodynamic parameters

In both the groups Heart rate, Mean Arterial Pressures and Oxygen saturation were monitored postoperatively. There was no significant difference in the hemodynamic parameters in both the groups.

5.5. Rescue analgesia consumption

Rescue analgesia was provided if the VAS score was equal to or more than 4. Injection Paracetamol 1 gm intravenous infusion was used as rescue analgesia. In our study the time to request for first rescue analgesia and the total consumption of rescue analgesia in 48 hours was observed.

Patients who received QL block had significantly less cumulative rescue analgesia doses than patients who received the TAP block ($p<0.001$) at 12 hours (mean – 0.43±0.50 gms vs 1.07±0.26 gms; $p<0.001$), 24 hours mean- 1.35±0.56 gms vs 2.11±0.31 gms; $p<0.001$) and 48 hours (mean - 1.65±0.060 gms vs 2.67±0.67 gms; $p<0.001$. Yousef NK[11] conducted a study in 2018 in which he compared TAP and QL blocks in women who underwent total abdominal hysterectomy. Fentanyl and morphine requirement was less in the QL block group. A meta-analysis published in 2016 compared eight trials studying the lateral technique of TAP block (the widely recognized TAP block in between internal oblique and transverses abdominis muscles) versus four trials studying the posterior technique for a TAP block (which is similar to QLB type 1) and reported that patients who had the posterior TAP block had less postoperative morphine consumption during 12–24h and 24–48h intervals.

5.6. Complications

In our study none of the patients developed any complication in both the study groups. Kumar GD et al[12] compared TAP block versus QL block for postoperative analgesia following lower abdominal surgeries and concluded that the adverse events associated with escalating doses of morphine, such as pruritus, nausea, somnolence, and respiratory depression can also be avoided by lower doses required with QL block.

The topographically broader field of action (T6 to L1) and longer duration of pain relief make it superior to TAP block in providing postoperative pain relief. Although the duration of action differs with each study, there is a significant difference between TAP and QL blocks.

6. Conclusion

After reviewing the available literature and conducting the present study it can be concluded that Ultrasound Guided

nerve blocks (TAP block and QL block) can be used as a part of multimodal analgesia for better post-operative pain relief in lower abdominal surgeries like LSCS especially when given before the resolution of spinal anaesthesia. Further it was observed that QLB 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. As QLB provides good quality analgesia for longer duration without side effects but proper understanding of the sono-anatomy and technical aspects of quadratus lumborum block are essential for its effective and safe use.

7. Source of Funding

None.

8. Conflict of Interest

The authors declare that there is no conflict of interest.

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