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Comparison between Lateral and Posterior Approach of Transversus Abdominis Plane Block after Lower Uterine Segment Cesarean Section

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ABSTRACT

Introduction: *Ultrasound guided Transversus Abdominis Plane (TAP) block is a new anesthetic technique which is used for post-operative pain management in abdominal surgery. Ultrasound-guided lateral and posterior approaches of TAP block is useful in the management of post-operative pain after lower uterine cesarean section (LUCS) operation. Aim of this study is to compare the usefulness of lateral and posterior approaches of ultrasound-guided TAP block after LUCS in post-operative pain management, presence of complications and patient satisfaction level.* ***Methods:*** *This randomized clinical trial was carried out in Khwaja Yunus Ali Medical College and Hospital during the period of July, 2020 to June, 2021. A total of 90 patients were scheduled for elective LUCS and assigned into two equal groups, group A and group B received ultrasound guided TAP block in lateral and in posterior approach respectively. Then patients were observed for pain intensity from side to side movement by visual analogue scale (VAS), postoperative complications after 1 hour, 2 hours, 4 hours, 6 hours, 12 hours and 24 hours of TAP block, patient's overall satisfaction regarding postoperative analgesia. Statistical analyses of the results were obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-22).* ***Results:*** *The mean pain intensity in visual analogue scale (VAS) was statistically significant ($p<0.05$) at 4, 6, 12 and 24 hours after TAP block between lateral and posterior approach. Post-operative complications like sedation, nausea and vomiting were less in patients receiving TAP in posterior approach than lateral approach. Most of the patients were satisfied (24, 53.3%) regarding post-operative analgesia in TAP with posterior approach.* ***Conclusion:*** *TAP block in posterior approach provided considerably good post-operative analgesia, patient satisfaction and less complication in post-operative first 24 hours than lateral approach after LUCS.*

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INTRODUCTION

Lower uterine cesarean section (LUCS) with pfannenstiel incision in the lower abdomen causes severe pain, especially in the first two days after operation.[1] Poor pain control after LUCS can be associated with postoperative hemodynamic changes and other complications.[2,3] Ultimately that causes prolonged hospital stay and it also has an impact on psychological changes, quality of life, and patient satisfaction.[4] Moreover, good post-operative analgesia can prevent the development of chronic pain after LUCS.[4] There are several methods available to treat postoperative pain such as opioids injections, and regional analgesia like epidural analgesia and peripheral blocks. Among them, opioids are popular after LUCS. But opioids have many side effects like sedation, nausea and vomiting, itching etc.[5,6] Transversus Abdominis Plane (TAP) block is a peripheral nerve block technique that blocks the anterior division of T_6 to the L_1 spinal nerve, supplying the anterolateral abdominal wall, which carries pain sensation after abdominal incisions.[7] These nerves runs into the fascial plane between the internal oblique and transversus abdominis muscles.[8] TAP block can provide postoperative analgesia after lower abdominal surgery. In this technique, local anesthetic is administered into the neurovascular plane between the internal oblique and transversus abdominis muscles by ultrasound guidance. Out of several techniques, lateral TAP and posterior TAP block are popular. When local anesthetic injection is administered along mid axillary line is called lateral TAP block and if in lumbar triangle of petit called posterior TAP block.[4] Since the first description of the TAP block in 2007,[4] many studies have reported that TAP block is a useful strategy to manage postoperative pain for patients undergoing lower abdominal surgery.[9,10] It can reduce post-operative pain and other complications after LUCS.[4] It also can effectively use as a part of multimodal analgesia in patients undergoing total abdominal hysterectomy. Earlier, TAP block is performed prior to surgical incision, and they found that the TAP block with ropivacaine reduced postoperative Visual Analogue Scale (VAS) scores at 6, 36, and 48 hours and total morphine requirements in the first 48 postoperative hours were also reduced and it delivers a superior analgesic effect with less post-operative complications with good quality of recovery.[7]

After the LUCS, a well-planned analgesia is needed for early mobilization, shorten post-anesthetic care, hospital stay, and to ensure adequate patient comfort. Considering the facts, this study was aimed to compare the lateral and posterior approaches of ultrasound-guided TAP block after LUCS.

METHODS

This randomized clinical trial (RCT) was done in 90 patients who underwent elective lower uterine cesarean section (LUCS) under subarachnoid block in 600 bedded Khwaja Yunus Ali medical College and Hospital, Sirajganj, Bangladesh during the period of July, 2020 to June, 2021. Patients scheduled for LUCS with subarachnoid block, LUCS done by pfannenstiel incision, aged between 20-40 years and American Society of Anesthesiologists (ASA) physical status I and II were enrolled for this study. Infection on the site of block, psychological disorder, requiring general anaesthesia, coagulopathy, neuropathic pain, addiction to any substance, patient under treatment with anti-depressants and allergic to local anesthetic agent were excluded from this study. Informed written consent was taken from every study subject.

Patients were randomly assigned into two equal groups (45 for each group) by randomly selecting their sealed opaque envelopes. The patients were fasting for 6-8 hours before surgery. Immediately after operation, the Group-A received ultrasound guided TAP (Figure 1) in lateral approach (Figure 2). The Group-B in the same period received ultrasound guided TAP in posterior approach (Figure 3). In both the group, the patients were administered injected 20 ml of 0.25% plain bupivacaine in each side.

At the day of surgery, patients were received into operation theatre. The baseline parameters were measured, an IV channel was opened and preloading was done with the Hartman's solution

of about 500ml. The patients were anaesthetized with help of subarachnoid block. In sitting position on the table, lower back of the patients was disinfected with the 10% povidone iodine and the skin and the needle track between L_3-L_4 was anaesthetized with hypodermic needle. Then subarachnoid block was performed with 25G Quincke spinal needle using 0.5% bupivacaine heavy (0.3mg/kg) in both the groups (group-A and group-B). The monitoring of the patient was performed during operation and was continued in the postoperative period. Immediately after completion of surgery, the target site was identified and disinfected with povidone iodine. Then with the guidance of ultrasound with high frequency (6-8MHz) linear ultrasound probe, the three muscle layer of abdominal wall was identified and needle was introduced. After aspiration, TAP block was performed with the help of 21G 100mm needle using 20 ml of 0.25% plain bupivacaine solution bilaterally and the solution was injected with intermittent aspiration test to prevent intravascular injection (first 2ml to test easy flow and hypersensitivity). Thereafter, the needle was withdrawn and sterile dressing was placed. In group- A, block was performed in lateral approach where the patient was in supine position. Here ultrasound scanning was done along mid axillary line and needle was introduced in a point between costal margin and iliac spine in mid axillary line. In group B, block was performed in posterior approach, where the patient was turn to the semi-lateral position. A high frequency (6-8 MHz) linear probe was placed along the posterior axillary line and after finding the posterior part of TAP, 20ml of 0.25% bupivacaine was injected in the posterior junction of the transverses abdominis plane through triangle of petit on both sides.

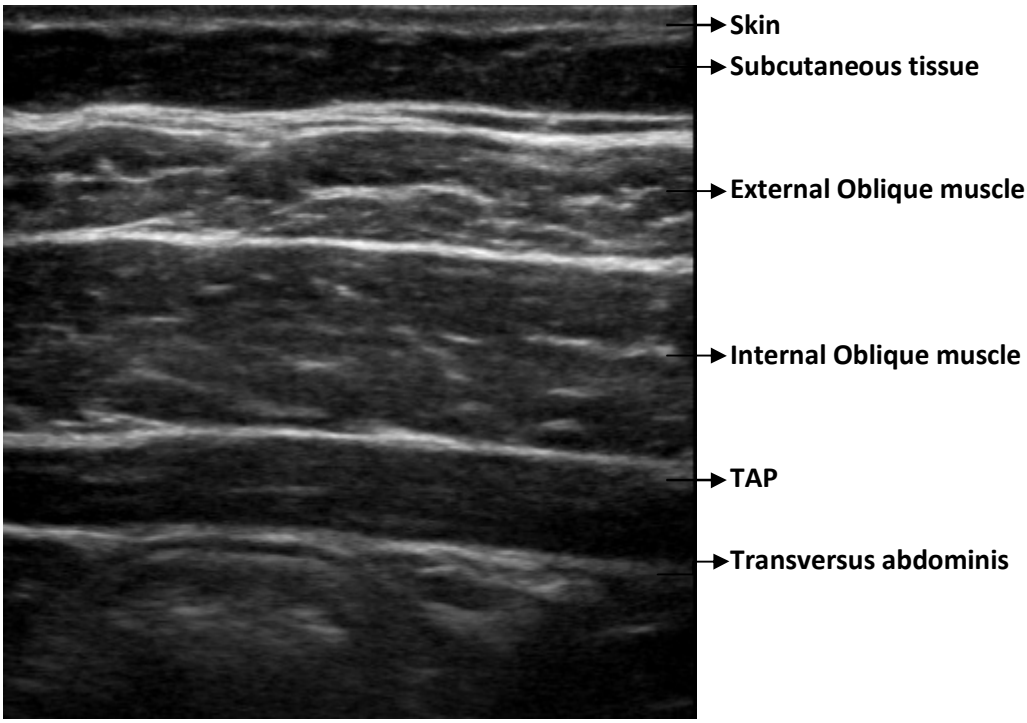

Figure 1: Ultrasound anatomy of TAP block

In the postoperative room, rescue analgesia may or may not be required. If required, it was maintained in both groups with intravenous Injection morphine through patient controlled analgesia (PCA) device. The PCA device was programmed in the following order-Initial loading dose infusion of (60 mcg/kg) and preset dose of 20 mcg/kg per demand with lockout interval of 10 minutes and one hour dose limit 4mg. The PCA device was designed only to reach the endpoint

of consumption during the first 24 hours after surgery. Intravenous ondansetron 4-8 mg was given when required.

All patients was taken into Post Anesthesia Care Unit (PACU) and observed pain intensity by visual analogue scale (VAS, Figure 4) after 1, 2, 4, 6, 12 and 24 postoperative hour. Patient's satisfaction regarding postoperative analgesia was measured likert scale in which there is 5 parameter 'very unsatisfied', 'unsatisfied' 'neutral' 'satisfied', 'very satisfied' .

The study outcomes were recorded 1, 2, 4, 6, 12, 24 hours after TAP block. The patients were also be observed during study period for presence of any complication like bradycardia, tachycardia (Heart rate less than or more than 20% of preoperative level respectively on two consecutive readings), hypotension and hypertension (Mean Blood Pressure less than or more than 20% of preoperative level respectively on two consecutive readings), sedation, nausea, vomiting.

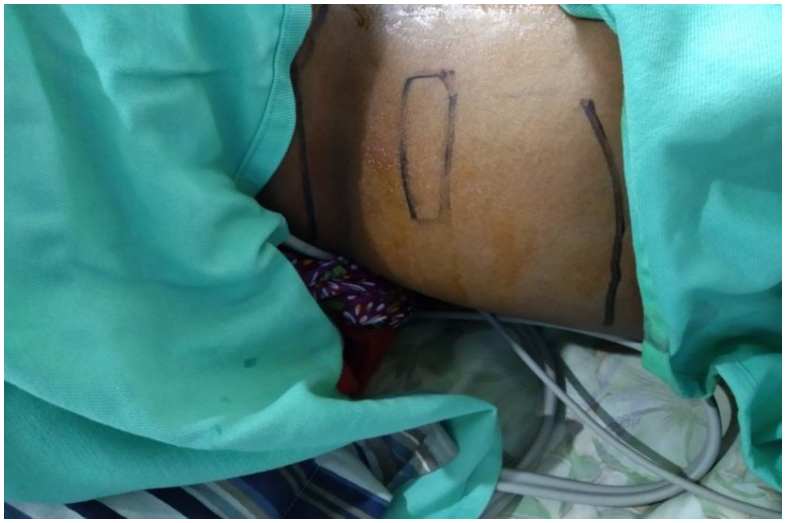

Figure 2: Site of Lateral TAP block along mid axillary line

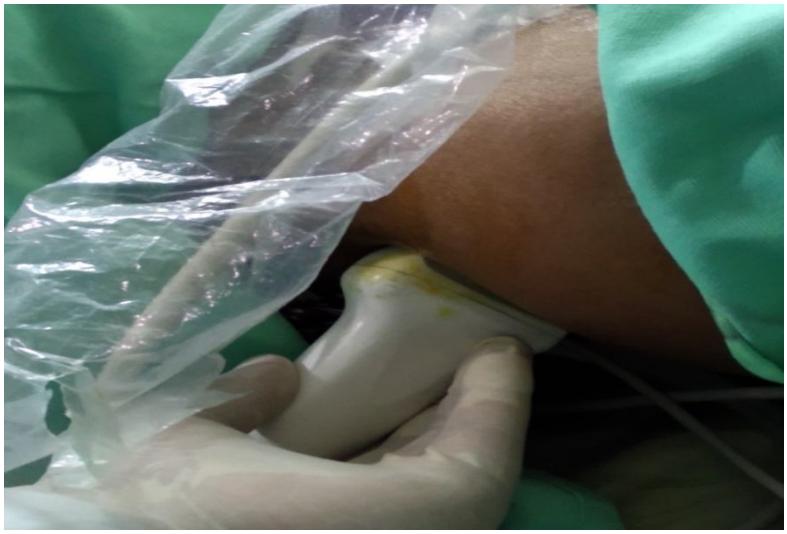

Figure 3: Site of posterior TAP block, triangle of petit

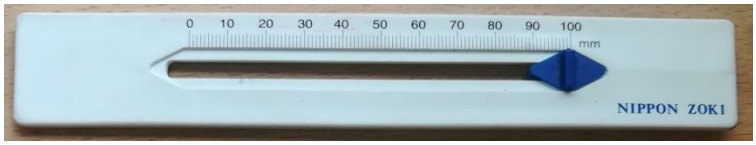

Figure 4: Visual analogue scale (VAS)

Study was approved by the ethical review committee of Khwaja Yunus Ali medical College and Hospital. Statistical analysis was carried out by using the Statistical Package for Social Sciences version 22.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Qualitative variables of this study were expressed as percentage. Quantitative variables were expressed as Mean±Standard deviation (SD). Level of significance was done by student *t* test and Chi-square test. The results were presented in tables, figures, and diagrams etc. A *p*-value <0.05 was considered as statistically significant.

RESULTS

The mean age was found 25.58±3.09 years and 25.24±3.28 years in group A and group B respectively. The mean weight was 60.51±4.63 kg in group A and 59.49±5.57 kg in group B. The mean age and weight were not statistically significant (p>0.05) between two groups.

Table I: Distribution of the study subjects by pain intensity measured by VAS (n-90)

Pain intensity (VAS) at rest (in cm)	Lateral approach Group-A (n-45) Mean±SD	Posterior approach Group-B (n-45) Mean±SD	*p*-value
1 Hours after TAP	0.71±0.72	0.73±0.65	0.890[ns]
Range (Min-max)	0-3	0-2	-
2 Hours after TAP	1.74±0.66	1.16±0.8	0.001[s]
Range (Min-max)	0-3	0-2.2	
4 Hours after TAP	3.48±0.27	3.08±0.44	0.001[s]
Range (Min-max)	2.8-3.9	1.9-3.9	-
6 Hours after TAP	4.22±0.34	3.8±0.17	0.001[s]
Range (Min-max)	4-5	3.5-4	-
12 Hours after TAP	3.87±0.23	3.5±0.16	0.001[s]
Range (Min-max)	3-4.1	3-3.9	-
24 Hours after TAP	3.61±0.21	2.56±0.41	0.001[s]
Range (Min-max)	3-4	2-3	-

s=significant; ns=not significant; *p* value reached from Unpaired *t*-test

Table I shows distribution of study patient by pain intensity measured by VAS at rest. Where after 2, 4, 6, 12 and 24 hours there were statistically significant (p<0.05) between two groups.

Post-operative complications like sedation, nausea and vomiting were less in patients receiving TAP in posterior approach than lateral approach (Table II).

Table II: Postoperative complications within study subjects (n-90)

Post-operative Complications	Lateral approach Group-A (n-45) Frequency (%)	Posterior approach Group-B (n-45) Frequency (%)	*p* value
Hypotension	1(2.2%)	0(0.0%)	0.001[s]
PONV	18(40.0%)	6(13.3%)	
Sedation	25(55.6%)	10(22.2%)	
No complication	01 (2.22%)	29 (64.44%)	

s= significant, postoperative nausea and vomiting (PONV) Statistical analysis was done by Chi-square test.

In this study, most of the patients were satisfied (24, 53.3%) regarding post-operative analgesia in TAP with posterior approach (Table III).

Table III: Distribution of the study patients by patient's satisfaction regarding Analgesia (n-90)

Level of Satisfaction	Lateral approach Group-A (n-45) Frequency (%)	Posterior approach Group-B (n-45) Frequency (%)	*p* value
Unsatisfied	8(17.8%)	3(6.7%)	
Neutral	25(55.6%)	15(33.3%)	0.008[s]
Satisfied	12(26.7%)	24(53.3%)	
Very satisfied	0(0.0%)	3(6.7%)	

s = significant, statistical analysis was done by Chi-square test

DISCUSSION

Postoperative management is necessary to reduce postoperative complications, morbidity and mortality. Several study found transversus abdominis plane (TAP) block is very effective in the management of postoperative pain after Lower uterine cesarean section (LUCS).[4]

In this study, the mean pain intensity measured by visual analogue scale (VAS) in first few hours of TAP block is not statistically significant (p >0.05) between posterior and lateral approach. But after 4, 6, 12 and 24 hours of TAP, VAS at rest was statistically significant (p<0.05) between two groups.

Lower uterine cesarean section was done under subarachnoid block. The effect of subarachnoid block may persist 2-3 hours after operation.[11] So, there was less or no pain in first few hours of TAP block. May be this is the cause why there was no statistical significant differences found in VAS at rest between two groups of TAP block. After 3-4 hours of subarachnoid block, generally there were no persisting effects of nerve block, but the TAP blocks already started to work, and effectiveness of TAP block was evident. VAS score at rest in patients having posterior TAP block was lesser than lateral TAP.

The result of this study was consistent with Faiz et al.[12] They compared analgesic effects of ultrasound-guided posterior and lateral TAP block in patients undergoing LUCS under subarachnoid anesthesia and found VAS score at rest was significantly lower in the posterior block group after 6, 12 and 24 hours operation but the mean values of VAS during coughing was significant only 12 hours after block between two groups.

In case of caesarean section, pregnant patients having high level of estrogen and progesterone, which increases pain threshold level.[13] So that patient could not feel minute pain. This may be the cause that before 6 hours postoperatively they could not found any significant differences between lateral and the posterior approach of TAP block. This may also the cause for not finding difference of VAS scores after 12 hours of postoperative period. Using TAP block for pain reduction after hysterectomy improved the recovery of patients.[7]They emphasized that ultrasound-guided posterior TAP block compared with the lateral TAP block was more effective in pain control after abdominal surgery.

In a meta-analysis done by Abdallah et al.[4] reveals, compared with the control, posterior TAP block technique reduces the rest pain VAS score by 17 mm at 12 hours (p<0.00001), by 13 mm at 24 hours (p-0.005), by18 mm (p<0.00001) at 36 hours. When a TAP block was performed using the lateral technique, rest pain VAS scores were reduced by 5 mm at 12 hours (p<0.0001), but there is no differences in rest pain scores at 24 and 36 hours postoperatively between lateral and control groups. But they could not compare lateral and posterior of TAP blocks directly.

In early post-operative period following LUCS, patient may develop several complications like sedation, nausea, vomiting, hypotension and respiratory depression. Patient satisfaction depends on types and severity of complications. This study showed no incidence of respiratory depression, local anesthetic toxicity, bradycardia, hemorrhage, pruritus within 24 hours of TAP blocks in both groups of patient.

Results of this study also showed, morphine related side effects was evident in both groups of patients, among them sedation and postoperative nausea-vomiting was common. Morphine has side effect like sedation, nausea, vomiting. So the group of patient consumed more

morphine, they had more incidence of morphine related side effect like sedation, nausea, vomiting etc. The patients of posterior TAP blocks had relatively less morphine than the lateral TAP block patients. So, sedation and postoperative nausea-vomiting was more common in lateral TAP than the posterior TAP and the differences were statistically significant (p<0.05) between two groups. Abdallah et al.[4] showed the incidence of postoperative nausea and vomiting is similar between the TAP block and the control group for both the posterior and the lateral techniques at 24 and 48 hours. The incidence of pruritus in the lateral TAP block technique was increased at 24 hours compared with control, but there was no difference at 48 hours. There were no data on the incidence of pruritus for the posterior technique. The incidence of sedation was reduced at 24 hours and at 48 hours compared with the control group when the posterior TAP block technique was performed; but there was no difference from control at 24 hours with the lateral technique. Cause of this may be, both posterior and lateral TAP patient were sensitive to morphine and nausea, vomiting occurs similarly in both type of TAP. But posterior TAP gives prolonged analgesia so in late postoperative period less amount of morphine required. So, there are fewer incidences of sedation and pruritus in posterior TAP patients. In this study there was very less incidence of sedation in late part of postoperative period.

This study showed that, patient's satisfaction regarding post-operative analgesia after 24 hours of TAP was higher in the patients having posterior TAP block. More percentage of patients was satisfied in posterior TAP block group than lateral TAP block. The patients had more analgesia and less nausea, vomiting, got more comfort and they were more satisfied, which is consistent with Faiz et al.[12].They also found patients' satisfaction was significantly ($p<0.05$) higher in the posterior group than patients having lateral TAP block.

This study findings suggested that, TAP block in posterior approach provided effective and longer duration analgesia than lateral TAP block and patient's satisfaction regarding was also better. Several possible explanations may account for these findings. Firstly, injection in posterior area of TAP probably results in the blockade of lateral cutaneous branches of thoracolumbar nerves before branching or anastomosis.[9,10] Secondly, the posterior approach and not the lateral approach spreads the local anesthetic regionally and in a retrograde fashion in the paravertebral space covering from T_4 to L_1 within 4 hours after injection and potentially blocks a few degrees along the thoracolumbar sympathetic system.[14] Evidence suggests that the reason for the posterior approach to achieve faster and longer analgesic effect is the role of sympathetic nervous system in pain management immediately after surgery.

Finally, the posterior TAP block injection may causes the formation of a depot or focus of local anesthetic in the neurofascial TAP plane. This depot of local anesthetic perhaps also justifies the better effect in posterior approach.

CONCLUSION

Transversus abdominis plane (TAP) block in posterior approach provided considerably good patient satisfaction than lateral approach after lower uterine segment cesarean section (LUCS) in terms of good post-operative analgesia and less complications. This study suggested to routine practice of TAP in posterior approach during LUCS.

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Conflicts of interest: None.

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