Original Research Article

Comparison between oblique subcostal transversus abdominis plane block and rectus sheath block for midline incision abdominal surgeries

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ABSTRACT

Background: Epidural analgesia remains the gold standard for pain control for abdominal surgical procedures, yet have many potential side effects, risks and limitations. The idea of oblique subcostal transversus abdominis plane block (OSTAPB) and rectus sheath block (RSB) is to anesthetize part of or the entire abdominal wall instead of using intrathecal or epidural techniques, especially in the presence of sepsis and coagulopathy.

Materials and methods: 60 patients scheduled for midline incision abdominal surgeries were randomly assigned to receive ultrasound-guided RSB and OSTAPB blocks with 20ml 0.25% bupivacaine and 40ml 0.25% bupivacaine respectively on each side after induction with general anaesthesia and before start of surgery. Preoperative and intraoperative parameters, plus intraoperative and postoperative cumulative analgesic consumption were recorded. Both groups received intravenous paracetamol 15mg/kg 8 hourly. Postoperative pain severity was assessed using 10cm VAS score and time to request for rescue analgesia, total analgesic consumption in 24 h were recorded.

Results: Patients in the OSTAPB group had more stable hemodynamics and consumed statistically significant less opioid in comparison to RSB group either intraoperatively or postoperatively. Mean VAS scores were statistically significant less in OSTAPB group than in the RSB group at 0, 2, 6, 12, and 24 h postoperatively. More patients' satisfaction was reported in the OSTAPB Group.

Conclusion: Ultrasound-guided RSB and OSTAPB block is effective pain management technique for midline laparotomies in scenarios where epidural is contraindicated, has failed or in case of unexpected change in surgical plan and in patients with compromised physiology.
Keywords: Bupivacaine; Oblique Subcostal TAP Block; Post‑ operative analgesia; Rectus Sheath Block; Ultasound Guided

Introduction:

Abdominal surgeries comprise of a significant proportion of surgical procedures performed these days. The gold standard for pain control during abdominal surgical procedures is epidural analgesia. However, epidural analgesia complications include hypotension, bradycardia, dural puncture, spinal infection, immobilization due to motor block, urine retention and rarely neurological damage. Due to these risks, alternative approaches to traditional anaesthetic techniques should also be assessed. Recently facial plane blocks like oblique subcostal transversus abdominis plane block (OSTAPB) and rectus sheath block (RSB) are gaining attention to anaesthetize part of or the entire abdominal wall instead of using intrathecal or epidural techniques.[1]

Schleich in 1899 first described the rectus sheath block as a method of facilitating surgery involving the anterior abdominal wall in adults.[2] The ventral branches of the T7–T11 spinal nerve roots innervate the anterior abdominal wall's central portion. These ventral branches run between the rectus abdominis muscle and the posterior rectus sheath, and enter the rectus muscle near the midline.[3] The tendinous intersections of the rectus muscle are not fused to the posterior rectus sheath, hence, local anaesthetic from a single injection site is able to spread cephalocaudally within this compartment.[4] It was the sole anaesthetic used for elective umbilical surgery in high-risk patients with inadequate cardiovascular and physiological reserves[5-6].

Transversus abdominis plane block has described as the deposition of local anaesthetic drug in the neurovascular plane sited between transversus abdominis muscle and internal oblique muscle in correspondence of lumbar triangle of Petit, the anatomical space formed by the latissimus dorsi margin posteriorly, the external oblique margin anteriorly and the iliac crest inferiorly. In the anterolateral abdominal wall, the transversus abdominis plane (TAP) lies superficial to the transversus abdominis muscle. Transversus abdominis plane contains the thoracolumbar nerves (T6-L1), which can be blocked with a local anaesthetic for postoperative analgesia. TAP blockade using ultrasound (US) has recently been described.[5] The posterior TAP block is used for surgery below the umbilicus and entails injecting local anaesthetic into the TAP in the lateral abdominal wall between the costal edge and the iliac crest.[6,7] The subcostal TAP block is used for abdominal surgery in the periumbilical region and involves injecting local anaesthetic into the TAP lateral to the linea semilunaris immediately inferior and parallel to the costal edge.

Modification can be made to the subcostal TAP block by introducing the needle into the TAP near the costal margin but medial to the linea semilunaris with subsequent needle

progression and hydro dissection taking place along a line from the xyphoid to the anterior part of the iliac crest.[8,9] This line is referred as the oblique subcostal line and its accompanying block as the oblique subcostal TAP block (OSTAPB). The purpose of this approach was to provide a wider analgesic blockade that could be used for surgery both above and below the umbilicus. Hebbard *et al.*[10] described the US-guided continuous oblique subcostal TAP block. With a single oblique subcostal TAP block (OSTAPB) injection, the sensory block extends to the thoracolumbar nerves (T6-L1) making the block beneficial for midline abdominal incisions also. Rectus sheath block and oblique subcostal transversus abdominis plane block are efficient in a wide spectrum of surgical procedures. However; there is paucity of literature in relation to studies comparing the efficacy of Ultrasound guided rectus sheath block and oblique subcostal transversus abdominis plane block.

Hence; under the light of above-mentioned data, the present study was undertaken for comparing the efficacy of ultrasound guided rectus sheath block and oblique subcostal transversus abdominis plane block for perioperative analgesia in midline incision abdominal surgery.

Materials and Methods:

This double blind prospective, randomized comparative study was conducted at tertiary care teaching centre, Jaipur after Institutional Ethical Committee Clearance (No. MGMCH/IEC/JPR/2020/88). Thereafter, the study was registered with the Clinical Trials Registry - India (www.ctri.nic.in) (reference/registration identity: CTRI/2021/07/034703). Recruitment of the patients for the study was started after obtaining the registration with CTRI. Written and informed consent was taken from all the patients. The period of study was January 2021 to December 2021. Patient fulfilling criteria of American Society of Anaesthesiology (ASA) of Classes I/ II, aged 18-65 years**,** undergoing midline incision abdominal surgeries under general anaesthesia and giving consent willingly were included in the study. Patients with ASA CLASS III, IV & V, allergic to study medications or with infection at the site of proposed block, unable to comprehend or participate in pain scoring system were excluded from study. Total 60 patients scheduled for elective midline incision abdominal surgery who fulfilled inclusion criteria were included in this study.

A detailed pre anaesthetic assessment was done a day before surgery. On the day of surgery, on arrival to operating room, patients were connected to the monitors e.g.,Non-invasive Blood pressure (NIBP), Electrocardiogram (ECG), oxygen saturation (SpO2) etc. All the baseline hemodynamic parameters were noted.18-gauge intravenous (IV) line was secured and intravenous fluid started.

All patients in the study received a general anaesthetic as follows: Inj. Fentanyl 2mcg/kg intravenously (IV); Inj. Propofol 2-2.5 mg/kg IV; Inj. Vecuronium 0.1 mg/kg IV. All patients were intubated under direct laryngoscopy using cuffed endotracheal tube of appropriate size. Anaesthesia was maintained with Isoflurane, initially at 1 MAC (minimum alveolar

concentration) then titrated to clinical end points with oxygen and nitrous oxide (N2O) at 40:60 ratio.

After the induction of general anaesthesia, patients were given USG guided blocks according to their respective allocated groups as follows:

- Group RSB [n=30] received single shot rectus sheath block with 20ml of 0.25% bupivacaine on each side
- Group OSTAPB [n=30] received single shot oblique subcostal transversus abdominis plane block with 40ml of 0.25% bupivacaine on each side

Intraoperative hemodynamics such as Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Mean arterial pressure (MAP), Heart rate (HR), Oxygen saturation (SpO2) were monitored continuously and noted at different time intervals till the end of surgery. Supplemental analgesia was given in both groups with inj. fentanyl 0.5 mcg/kg IV if heart rate (HR) and/or blood pressure (BP) exceeded 20% of baseline values and total supplemental analgesic given intraoperatively was noted. Any episode of intraoperative hypotension was treated with inj. mephentermine. Inj. ondansetron 0.1 mg/kg and inj. paracetamol (PCM) 15 mg/kg IV were given before completion of surgery. At the end of the surgery, all patients were reversed from muscle relaxation with IV neostigmine (0.05mg/kg) and glycopyrrolate (0.02mg/kg) and tracheal extubation was done.

Postoperatively, in both groups IV paracetamol 15 mg/kg was administered 8 hourly. An investigator blinded to group allocation assessed the presence and severity of pain, nausea, vomiting, and the need for rescue analgesia at 0, 2, 6, 12, and 24 hours after surgery. The severity of pain was assessed using a 10 cm Visual Analog Scale (VAS) at rest and movement like on deep breathing or coughing (0 - no pain and 10 - worst imaginable pain). Rescue analgesia was given for visual analogue scale (≥4) with IV tramadol 2 mg/kg. The time to request for rescue analgesia, total analgesic consumption in 24 h was recorded. When patients complained of nausea or vomiting, they were given ondansetron (4 mg) IV as a rescue antiemetic. A 10-point scale was used to assess patient satisfaction with the anaesthetic approach 24 hours after surgery (0- not satisfied,10- fully satisfied).

Statistical analysis: All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software. The level of significance was determined using the Chi-square test and the student t test. p- value < 0.05 was considered significant.

Results and discussion:

In the present study, the age of the patients in both the groups varied from 18 to 65 years. The mean age in group RSB was 44.1 years and in group OSTAPB was 43.9years. The difference in the mean age in between both the study groups was statistically non-significant (p value > 0.05), hence the two groups were comparable with respect to age distribution. Similarly both the groups were comparable with respect to ASA grading, gender and body weight (Table 1).

Table 1: Demographic and clinical characteristics of patients

Characteristics	Group RSB	Group OSTAPB	p- value
Age (yr)(Mean±SD)	44.17 ± 12.9	43.9 ± 14.1	0.12 (NS)
Sex (Male/Female)	8/22	11/19	0.71 (NS)
Weight(kg)(Mean±SD)	68.3 ± 7.2	69.7 ± 6.8	0.88 (NS)
ASA grade (I/II)	22/8	19/11	0.67 (NS)
Duration of surgery(min) (Mean±SD)	169.93 ± 15.6	171.76 ± 15.56	0.65 (NS)

ASA: American Society of Anaestheiologist; NS: Non Significant; SD: Standard Deviation; RSB: Rectus Sheath Block; OSTAPB: Oblique Subcostal Transversus Abdominis Plane Block

The mean preoperative heart rate was 78.42 ± 6.61 per minute in group RSB and 76.56 ± 7.07 per minute in group OSTAPB and was statistically non-significant (p value > 0.05). There was no statistical difference in change in SpO2 at different time intervals in the two groups (p value > 0.05) in intraoperative periods. There was no statistical difference in change in MAP at different time intervals in the two groups (p value > 0.05) in intraoperative periods. Our results are similar to the earlier studies by Guo JG *et al.*[11] and Toker MK *et al.*[12]

Mean intraoperative supplemental analgesic requirement of fentanyl among patients of the RSB group and OSTAPB group was 28.08 mcg and 20.61 mcg respectively (Table 2). Significant results were obtained by comparing the mean intraoperative supplemental analgesic requirement among the patients of the two study groups (p value = 0.0001). Our results are in agreement to those observed by Guo JG *et al.*[11] and Mohamed Ibrahim *et al.*[13] Mohamed Ibrahim *et al.* in their study observed that OSTAPB group required less intraoperative rescue fentanyl compared to the control group.[13] In a study conducted by Guo JG *et al.*, mean intraoperative supplemental analgesic requirement among the patients of the OSTAPB group was also significantly less (p value = 0.001).[11]

Table 2: Intraoperative supplemental analgesic requirement (mcg)

Intraoperative supplemental analgesic requirement (mcg)	Group RSB	Group OSTAPB	p- value
Mean ± SD	28.08±5.29	20.61±7.86	0.0001(S)

S: Significant; SD: Standard Deviation; RSB: Rectus Sheath Block; OSTAPB: Oblique Subcostal Transversus Abdominis Plane Block

While analysing statistically, it was observed that mean VAS at rest at 6 hours and 12 hours was significantly lower among the patients of the OSTAPB group in comparison to the RSB group (Figure 1). Similar results were found by other researchers too. Yoshida *et al.*[14], in a previous study, on the patients undergoing subcostal transversus abdominis plane block, reported that median pain score at rest at 1 hour and 24 hour after TAP was 0 and 1 respectively.

The mean VAS at movement 6 hours and 12 hours was also significantly lower among the patients of the OSTAPB group in comparison to the RSB group (Figure 2). Our results were in concordance with a previous study conducted by Yoshida *et al.*,[14] on the patients undergoing subcostal transversus abdominis plane block, reported that median pain score at movement at 1 hour and 24 hour after TAP was 2 and 3 respectively. Mohamed Ibrahim *et al.*[13] in their study observed that VAS at movement was lower in the OSTAPB group at 4 and 6 h than the local group.

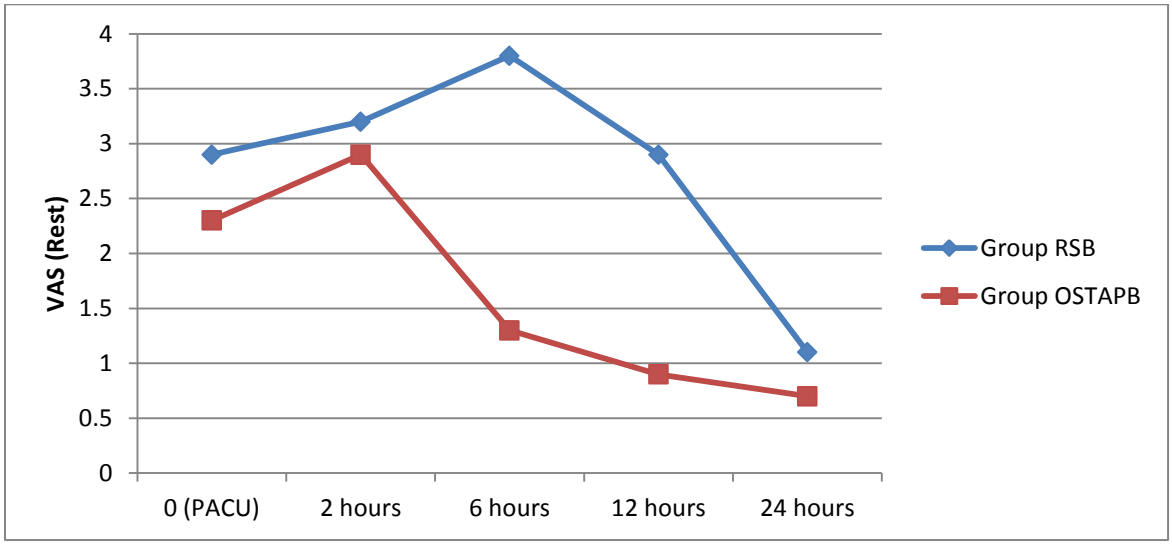

Figure 1: Mean VAS score at rest

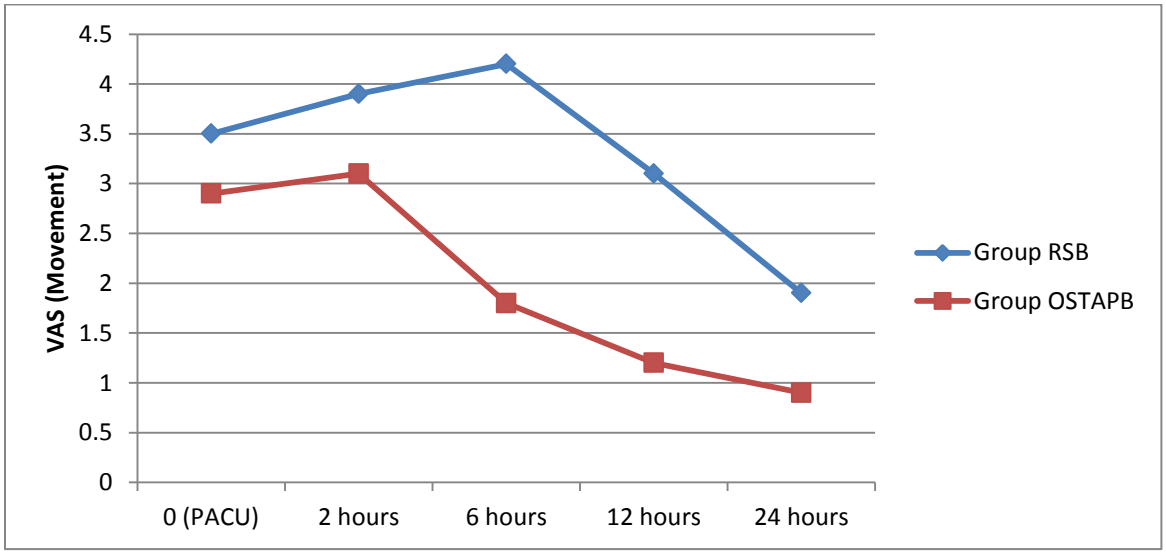

Figure 2: Mean VAS score at movement

While comparing between Group RSB and Group OSTAPB, it was found that mean time to first analgesic requirement among Group OSTAPB (243.6 minutes) was significantly higher in comparison to Group RSB (56.3 minutes) (p- value = 0.012). Similarly it was found that Total

rescue analgesia consumed among Group OSTAPB (49.2 mg) was significantly lower in comparison to Group RSB (83.3 mg) (p- value =0.038) (Table 3). Our results were consistent with previous findings where TAP blocks have been described to last from 6 h to 24 h (Støving K *et al.*, McDonnell JG *et al.*).[15,16] In another study conducted by Ibrahim M *et al.*,[13] mean opioid (morphine) consumptions in PACU and mean 24 hr morphine consumption showed statistically significant difference (p less than 0.02 and less than 0.001 respectively) between OSTAPB group, local infiltration group and control group.

Table 3: Total rescue analgesia requirement (mg)

Total rescue analgesia consumed (mg)	Group RSB	Group OSTAPB	p- value
Mean ± SD	83.3 ± 39.4	49.2 ± 23.8	0.038 (S)

S: Significant; SD: Standard Deviation; RSB: Rectus Sheath Block; OSTAPB: Oblique Subcostal Transversus Abdominis Plane Block

An explanation for our above findings (VAS at rest and movement, analgesic requirement) can possibly be due to a widespread cutaneous sensory blockade with a consistent dermatomal distribution from T6-L1 dermatomes with OSTAP block in comparison to RSB which provides T7-T11 blockade only.

Nausea was seen in 2 patients each of Group RSB and Group OSTAPB. Vomiting was seen in 3patients of Group RSB and 2 patients of Group OSTAPB. All the readings were comparable and the difference was found to be non – significant in the two groups (p value > 0.05). This can be explained due to opioid sparing effect of both the blocks. [17] In another study conducted by Guo JG *et al.*,[11] authors also reported lower incidence of postoperative nausea and vomiting in OSTAPB group compared to the control group.

The patient satisfaction score was significantly better among patients of group OSTAPB (8.6) in comparison to patients of group RSB (6.2). On comparing statistically, the results were found to be significant.

Conclusion:

On the basis of our study, we infer that ultrasound guided OSTAP block is safe, and provides better analgesia with significant opioid sparing effect in comparison to ultrasound guided RSB during the postoperative 24 hours in patients undergoing midline incision abdominal surgery. The better sensory coverage of OSTAP block raises the prospect of using this block as intraoperative as well as postoperative analgesia for abdominal surgery. As the current tendency of anaesthesia practice is shifting towards safer ultrasound-guided regional anaesthesia and away from the undesirable effects of systemic opioids and the potentially devastating effect of neuraxial blockade, intraoperative oblique subcostal TAP blockade is a promising alternative in the daily practice of anaesthesia.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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