

Ultrasound-guided Transversus Abdominis Plane Block for Post-operative Analgesia in Inguinal Hernia Repair

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Abstract

Context: Postoperative pain for inguinal hernia repair has been traditionally managed with infiltration of the wound with a local anesthetic. However, ultrasound-guided transversus abdominis plane (TAP) block has recently been used with precision to achieve effective control of postoperative pain. **Aims:** To evaluate the efficacy of ultrasound-guided TAP block for postoperative analgesia in patients undergoing inguinal hernia repair. **Settings and Design:** This was institutional-based randomized prospective clinical study. **Materials and Methods:** Adult patients were randomly allocated into those who received TAP block with bupivacaine (group T) and control group C was managed with rescue analgesia. Postoperative visual analogue score, time to first rescue analgesia, visual analogue score at first rescue dose, and total rescue doses consumed were assessed for both the groups. **Statistical Analysis Used:** Independent *t*-test, Fisher's exact test, and Chi-square test were used to analysis the data. $P < 0.05$ was considered statistically significant. **Results:** There was no statistical difference for the demographic profile among the groups. On comparing the two groups, time to first rescue analgesia dose was longer in group T compared to group C ($P = 0.01$). Postoperative VAS scores and total rescue analgesia consumption was lower for the T group compared to group C up to 12 hours. **Conclusions:** TAP block is an effective tool in postoperative pain control. It is safe and easy to accomplish this block with the real-time ultrasonography.

Keywords: External oblique, internal oblique, transversus abdominus, ultrasound-guided transversus abdominis plane block

INTRODUCTION

Inguinal hernia repair is a universally performed operative procedure. It is usually performed as a day-care procedure. Inguinal hernia repair can be performed by variety of anesthetic techniques viz. general anesthesia and regional anesthesia such as spinal, epidural, and paravertebral block.^[1] The choice of anesthesia and advantage of one technique over another have been a subject of debate.

Recently, the use of ultrasonography has gained popularity due to the ease with which it can perform transversus abdominis plane (TAP) block. TAP block is an effective technique to reduce postoperative pain intensity and opioid consumption after lower abdominal surgery.^[2] This has been achieved due to real-time visualization of fascial plane between internal oblique and the transversus abdominis muscles of abdominal wall where local anesthesia drug can be easily be injected to achieve effective pain control.

Therefore, we designed a prospective randomized study to investigate the efficacy of ultrasound guided TAP block on

postoperative pain and the demand for rescue analgesia when performed after inguinal hernia repair under general anesthesia.

PATIENTS AND METHODS

This was a prospective randomized trial initiated after institutional ethical committee approval and obtaining written informed patient consent. A total of 40 adult male patients belonging to ASA class I and II scheduled for elective unilateral inguinal hernia repair under general anesthesia were enrolled in this study.

Exclusion criteria for the study were: BMI ≥ 30 kg/m², skin infection at the puncture site, known hypersensitivity to local anesthetic or tramadol, chronic obstructive pulmonary disease, chronic hepatic or renal failure, and preoperative chronic use of other analgesia (opioids or nonsteroidal

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anti-inflammatory drugs). Those who were included in the study were randomly separated into two groups of 20 patients each.

Group C: No TAP block. Only postoperative rescue analgesia was administered.

Group T; 20 ml local anesthetic was injected in ultrasound-guided TAP.

All patients were educated about the use of VAS score on a 10-point scale with 0 being no pain at one end and 10 being the worst possible pain.

In an operation theatre, an intravenous catheter was secured and ringer lactate was started. Patients were connected to monitor and assessed at regular interval for electrocardiogram (ECG), noninvasive blood pressure, and SpO₂.

Patients in both the groups were induced with intravenous propofol 2.0 mg/kg and fentanyl 2.0 µg/kg. Airway control was achieved with appropriate size proseal laryngeal mask airway, breathing spontaneously and maintained with oxygen:air mixture and sevoflurane at 1.5–2.0 MAC.

After the surgery, group T received ultrasound-guided TAP block (20.0 ml preservative free 0.25% bupivacaine) with 5.0 cm long echogenic needle, whereas group C received only rescue analgesia. Ultrasound-guided TAP block was performed with portable ultrasound machine (sonosite micromax) with HFL38/13-6 MHz broadband linear array (nerve) transducer placed between anterior superior iliac spine and subcostal margin [Figure 1], and transducer was tilted to obtain a clear sonoanatomy of the abdominal wall muscles with the study drug injected between internal iliac and transversus abdominis muscle [Figures 2 and 3].

After performing the TAP block, sevoflurane was terminated, laryngeal mask removed, and patients were shifted to PACU and monitored for pain by VAS score

at hourly interval for 6 hours and subsequently at 2-hour intervals up to 12 hours postoperative period. Rescue analgesia intravenous tramadol 50 mg was administered on patients' demand. Time to first rescue dose, total rescue consumption, number of patients who demanded analgesia, and average VAS score at first dose were recorded as primary end points. Any complications observed were also noted. An observer who did not witness the study drugs recorded the postoperative VAS.

Statistical analysis

Statistical analysis was performed using statistical package of social sciences (SPSS) version 19.0 (IBM). Data are expressed as mean ± standard deviation for continuous variables and number for categorical variables. Continuous variables were compared using independent two-sample *t*-test. Fisher's exact test and Chi-square analysis was used for comparing categorical data. *P* < 0.05 were considered statistically significant.

RESULTS

The demographic profile was found to be comparable with no statistically significant difference between the two groups [Table 1].

The VAS score trends for the two groups are depicted in Figure 4. Throughout the postoperative period, the average VAS scores were higher values for group C whereas group T had lower scores which was statistically significant at various postoperative time intervals.

The various postoperative parameters recorded are shown in Table 2. More doses were required to control pain in group C. Average time to first rescue analgesia was prolonged for the group T which was statistically significant (*P* < 0.001). Similarly, average VAS score was lower for group T.



Figure 1: Transducer position during ultrasound guided TAP block

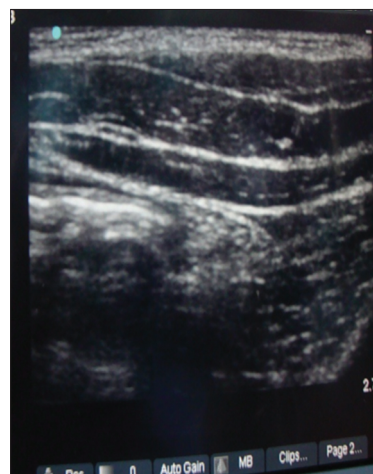


Figure 2: The three abdominal muscles (external oblique, internal oblique and transversus abdominis) with slit between IO and TA

DISCUSSION

TAP block is a relatively new regional anesthetic technique used as multimodal approach to provide postoperative analgesia of the anterolateral abdominal wall. The technique for achieving TAP blocks has evolved from crude landmark to more sophisticated ultrasound-guided technique.

This study has demonstrated that ultrasound-guided TAP block is effective in many ways during the postoperative period for inguinal hernia repair. It curtailed the number of analgesic doses required to control the postoperative pain and prolonged the time when the patient first demanded rescue analgesic dose. Overall, lower postoperative VAS scores were maintained throughout the postoperative period which indicated that TAP block is a very effective tool in the postoperative pain management strategy.

Initially, this block was performed in 2001 by Rafi^[3] as per the surface landmark “triangle of Petit” formed by latissimus dorsi, iliac crest, and external oblique muscle but can be a difficult preposition in obese patients where landmarks are not easily discernable. The use of ultrasound has revolutionized the block by giving clear anatomical demarcation between the three abdominal wall muscles: external oblique, internal oblique, and transversus abdominis muscle. Innervation of the anterolateral abdominal wall arises from the anterior rami of spinal nerves T7 to L1.^[4] These include the intercostal nerves (T7-T11), the subcostal nerve (T12), and iliohypogastric and ilioinguinal nerves (L1).^[5] Consistently, these nerves lie between internal oblique and transversus abdominis where they can be identified by ultrasound as a slit and block can be successfully achieved.^[6]

Various clinical trials have established the efficacy of TAP block as an element of multimodal pain management strategy. It confers advantages in specific procedures with mild to moderate surgical trauma such as cesarean section,^[7] hysterectomy,^[8] appendectomy,^[9] laparoscopic procedures,^[10,11] bowel,^[12] and even renal surgeries.^[13]



Figure 3: Widening of slit by LA injected between internal oblique and transversus abdominis

Carney used TAP block in abdominal hysterectomy and found that it significantly decreases postoperative pain scores up to 48 hours period, as reflected in morphine consumption.^[14] A similar study by Belavy showed that postoperative morphine consumption was reduced by approximately 40% in cesarean section where TAP block was performed with ropivacaine.^[15] These studies revealed similar results as ours.

Aveline *et al.* compared ultrasound-guided TAP block with conventional ilio-inguinal/hypogastric nerve block. They concluded that ultrasound-guided TAP block provided better pain control than “blind” IHN block after inguinal hernia repair but did not prevent the occurrence of chronic pain.^[16] During this study those who received a TAP block expressed significantly less pain at rest on VAS scores at 4, 12, and 24 h, and during stay in the PACU, intravenous morphine titration doses were low and comparable in the two groups [median 0 (0–3) mg and 0 (0–0) mg in the IHN and TAP groups, respectively, $P=0.15$]. However, patients in the TAP group required less oral morphine tablets during 2 postoperative days. Our study has also been consistent with this study as far as immediate postoperative period is concerned. The only difference is that we did not include pain assessment at 3 and 6 months after surgery.

Milone *et al.* determined the utility of TAP block on the efficacy of conventional local anesthesia for hernia repair for adequate anesthesia and evaluated its postoperative analgesic effectiveness.^[17] They found that adequate anesthesia was achieved in 8% and 36% of subjects for group with and without TAP block, respectively ($P = 0.001$). At 6 and 12 h postoperative evaluations, patients enrolled in the case group reported significantly less pain (evaluated by VAS score) both at rest and on movement ($P = 0.001$). Moreover, the need of rescue analgesia significantly higher in group where no TAP block was performed (14 vs. 32%, $P = 0.01$). These results are similar to that of ours. In our study, VAS scores continued to rise until 5 hours postoperatively for group C, and then there was a decline in the VAS scores in the control group which was due to majority receiving rescue analgesia whereas the group with TAP block had a very gradual rise in the VAS scores citing the effectiveness of TAP block. Rescue analgesia consumption was very late and only few patients (3/20) demanded it. One patient had mild pain in the control group and did not seek rescue analgesia.

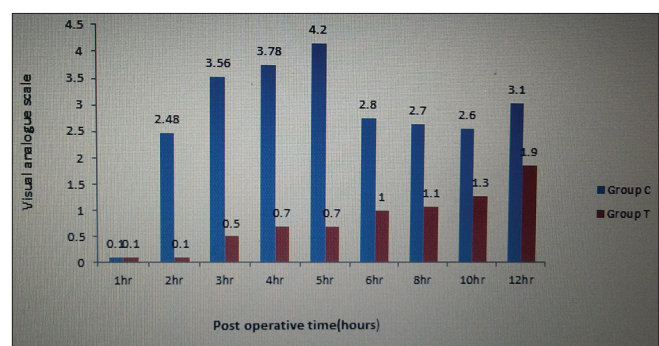


Figure 4: Postoperative VAS score in the two groups

Table 1: Demographic parameters of the two groups

	Group C	Group T	P
Age (years)	57.5+11.7	53.2+13.4	0.54
BMI	28.4+4.3	28.9+5.2	0.71
ASA I/II	8/12	7/13	0.80
Operative time (mins)	58.3+13.2	61.2+14.1	0.41
Mean+SD			

Table 2: Postoperative rescue analgesia

Parameters	Group C	Group T	P
Total rescue dose received	19	3	<0.001
Time to first rescue dose (hrs)	4.35+1.1	10.4+1.5	<0.001
Total tramadol consumption (mg)	47.5+5.2	7.5+2.6	<0.001
Mean+SD			

There are few limitations of our study. We did not use patient control analgesia which could provide better assessment of postoperative pain control. Moreover, we did not check the extent and the intensity of block by pain assessment on movement or cough.

CONCLUSION

In conclusion, ultrasound-guided TAP block has revolutionized the postoperative pain control method and has started to establish a place in multimodal pain management protocol. Its use would go a long way as its utility in other sites are being explored.

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Conflicts of interest

There are no conflicts of interest.

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