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Original contribution

Transversus abdominis plane block for laparoscopic inguinal hernia repair: a randomized trial☆,☆☆,★

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Abstract

Background: Pain after laparoscopic inguinal hernia surgery can be moderate to severe, interfering with return to normal activity. The study aimed to assess the efficacy of bilateral ultrasound-guided (USG) transversus abdominis plane (TAP) block for relieving acute pain after laparoscopic hernia repair as T10-L1 nerve endings are anesthetized with this block.

Methods: Seventy-one American Society of Anesthesiologists I to II patients, aged 18 to 65 years, undergoing unilateral/bilateral laparoscopic hernia repair were randomized to port site infiltration (control, 36) and TAP block groups (35). All patients received general anesthesia (fentanyl 2 μg/kg intravenously at induction, 0.5 μg/kg on 20% increase in heart rate or mean blood pressure) and paracetamol 6 hourly. Postintubation, TAP group received bilateral USG TAP block (15-20 mL 0.5% ropivacaine, maximum 3 mg/kg) with 18-G Tuohy needle. Control group had 20 to 30 mL 0.5% ropivacaine infiltrated preincision, at port sites from skin to peritoneum. Postoperative patient-controlled analgesia fentanyl was provided for 6 hours; pain was assessed using 0- to 100-mm visual analog scale (VAS) at 0, 1, 2, 4, 6, and 24 hours and telephonically at 1 week and 3 months.

Results: Demographic profile of the 2 groups was comparable. Significantly more number of patients required intraoperative fentanyl in the control group (24/36) than in the TAP group (13/35); VAS at rest was lower in TAP than control patients in postanesthesia care unit at 0, 2, 6, and 24 hours (median VAS TAP group: 0, 0, 0, and 0; control: 10, 20, 10, and 10; $P = .002$, $P = .001$, $P = .001$, and $P = .006$, respectively); $P < .01$ was considered statistically significant. TAP group had significantly lower VAS on deep breathing at 6 hours and on knee bending and walking at 24 hours and lesser patient-controlled analgesia fentanyl requirement. No significant difference in pain scores was observed at 1 week and 3 months.

Conclusion: TAP block reduced postoperative pain up to 24 hours after laparoscopic hernia repair.

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★ Registered with Clinical Trial Registry of India: number CTRI/2014/07/004748.

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1. Introduction

Laparoscopic inguinal hernia repair is associated with lesser pain and faster patient mobilization than open hernia repair [1–3]. The 2 techniques of laparoscopic hernia repair are total extraperitoneal (TEP) and transabdominal preperitoneal (TAPP) laparoscopic repair. TEP involves placing a mesh in the preperitoneal space without entering the peritoneal cavity, whereas TAPP accesses the same space after peritoneal incision and pneumoperitoneum [2,3]. Pain after laparoscopic hernia surgery, although less, can be considerable and interfere with return to daily activity [2,4]. This has led to the use of techniques such as preperitoneal instillation of local anesthetic or port site to decrease pain after laparoscopic hernia repair [3,5].

In a qualitative systematic review, pain after both TAPP and TEP repair was found to be of a similar character, that is, lower abdominal groin pain of moderate to severe intensity, more on the first day that increased on coughing and mobilization. Shoulder tip pain due to pneumoperitoneum or somatic pain was not prominent after either type of repair [2].

Transversus abdominis plane (TAP) block is a regional anesthetic technique that involves depositing local anesthetic in the muscle plane between transversus abdominis and the internal oblique muscles, anesthetizing the T10 to L1 intercostal nerves, thereby having the potential to provide perioperative analgesia after hernia repair [6]. TAP block has been used to provide effective analgesia for a number of lower abdominal procedures such as lower segment cesarean section, total abdominal hysterectomy, open appendicectomy, open hernia surgery, and in renal transplant recipients [7–12]. However, there is inconclusive literature regarding the efficacy of TAP block for providing perioperative analgesia for laparoscopic hernia repair. Stebelski et al used landmark-based bilateral TAP block for TEP repair, Kim et al used bilateral ultrasound-guided (USG) TAP block for unilateral and bilateral TEP; Beyls et al administered ipsilateral USG TAP blocks for unilateral laparoscopic hernia surgeries [13–15]. All studies reported a significant decrease in 24-hour postoperative analgesic consumption in the TAP group but did not show a significant decrease in the pain scores. A series by Meyer et al [16] showed that TAP block facilitated TEP repair under general anesthesia without the need for curarization. No study has evaluated the pain scores on knee bending or walking with TAP block after laparoscopic hernia repair under general anesthesia.

This study was designed to evaluate if bilateral USG TAP block would decrease pain at rest and on movement and perioperative opioid requirement as compared to port site infiltration with local anesthetic in the first 24 hours after laparoscopic hernia (TEP and TAPP) repair surgery.

2. Methods

The study was approved by the Institutional Ethics Committee of the All India Institute of Medical Sciences, New Delhi (ref. no. T-232/03.06.2011 approved from November 14, 2011) and registered with the Clinical Trial Registry of India (CTRI/2014/07/004748) retrospectively. The primary end point was to compare pain scores (using a 0- to 100-mm visual analog scale [VAS]) at rest at 24 hours in patients undergoing laparoscopic hernia repair under general anesthesia with or without TAP block. The other primary objectives were comparison between the TAP and the port site infiltration (control) groups of VAS on movement (knee bending, deep breathing, and walking at 24 hours) and intraoperative and postoperative fentanyl requirement (up to 6 hours postoperatively as longer duration patient-controlled analgesia [PCA] device would require patients to be anchored to the bed). The secondary objectives were comparison of incidence of postoperative nausea and vomiting, quality of recovery score on the evening of the first postoperative day, and the incidence of chronic pain at 3 months after surgery between the groups.

The sample size was calculated using a previous study [13]. With a sample size of 15 in each group, the VAS score at 24 hours in the block group was found to be 8 ± 7, whereas that in the control group was 16 ± 15. Setting the power of the study at 80% and significance at 5%, we calculated the sample size to be 31 in each group. Taking a loss to follow-up of 10%, we estimated the sample size of 36 in each group.

Patients aged 18 to 65 years, American Society of Anesthesiologists grade I or II, scheduled for uncomplicated unilateral or bilateral hernia repair were enrolled between November 2011 and December 2013. Exclusion criteria were refusal to participate, infection at site of block, coagulation abnormalities, history of hypersensitivity to local anesthetics, inability to use the PCA device, obesity (body mass index, >30 kg/m^2), or weight less than 50 kg (as it would decrease the maximum allowable volume of 0.5% ropivacaine to <15 mL for each side). Once eligibility was established, an informed written consent was obtained.

All patients were premedicated with oral diazepam 0.1 mg/kg on the night prior and morning of surgery and transferred to the anesthesia room 30 to 45 minutes before surgery. Intravenous access was established, routine monitoring (heart rate, electrocardiography, oxygen saturation, and noninvasive mean blood pressure) was started, and baseline parameters were noted. Entropy electrodes were applied to monitor the depth of anesthesia. General anesthesia was induced with fentanyl 2 μg/kg and propofol 2 to 3 mg/kg intravenously (IV). Once the entropy values were between 45 and 65, vecuronium was administered, and the trachea was intubated. Anesthesia was maintained with oxygen, air (50%:50%), and desflurane, keeping entropy values between 45 and 65 and controlled ventilation to maintain normocapnia (end-tidal CO_2, 35-40 mm Hg). Dexamethasone (8 mg) was given at the beginning, and paracetamol (1 g) and ondansetron (4 mg) IV were administered 30 and 15 minutes before the end of the surgery, respectively.

After induction of general anesthesia, patients were randomly allocated to either the control group (port site infiltration) or the TAP group (TAP block) after opaque, sealed envelopes containing computer-generated random numbers

were opened by an anesthesiologist not participating in the study.

2.1. TAP block technique

Using a 7- to 10-MHz linear array transducer and SITE-RITE 5 Ultrasound device (Bard Access System, Inc, Salt Lake City, UT), the 3 muscle layers in the region of the anterior axillary line midway between the iliac crest and the costal margin were identified. After piercing the external oblique and internal oblique aponeurosis with an 18-G Tuohy needle using the in-plane technique, advanced from medial to lateral, 1 to 2 mL of saline was injected to confirm ballooning of a hypoechoic bleb in the TAP plane. Thereafter, 15- to 20-mL 0.5% ropivacaine was administered. The procedure was repeated on the other side taking care not to exceed a total dose of 3 mg/kg body weight of ropivacaine.

2.2. Port site infiltration

In the control group, the same concentration of 20 to 30 mL of 0.5% ropivacaine was infiltrated in the skin, muscle layer, and peritoneum at the port sites by the surgeon before incision using a spinal needle. Both TEP and TAPP required one 10-mm port and two 5-mm ports as described below.

2.3. Surgical procedure

The surgeries (TAPP or TEP repair) were carried out by either of the 2 surgeons (MCM and VKB) according to the standard protocol at our institute [17].

2.4. TAPP

A 10-mm port was inserted at the umbilicus for the 30° telescope; and two 5-mm ports, 5 to 6 cm from umbilicus at the lateral borders of the rectus abdominis muscle. Pneumoperitoneum of 12 to 14 mm Hg was created. The hernia sac was reduced. The peritoneal flap was raised laterally from anterior superior iliac spine up to the medial umbilical ligament. Polypropylene mesh was introduced from the 10-mm port, and the entire myopectineal orifice was covered by it. It was then fixed in place while lowering the intraabdominal pressure to 8 mm Hg.

2.5. TEP

For TEP repairs, the ports were put just below the umbilicus (10 mm) for the 30° telescope, just above the pubic symphysis (5 mm), and in between the 2 in the midline (5 mm). After expansion of the preperitoneal space by dissection and insufflating carbon dioxide, the peritoneal flap was raised; mesh was introduced through the 10-mm port and spread over defect but not fixed in place.

In all patients in case of an intraoperative increase in the heart rate or mean arterial pressure of greater than 20% above baseline, 0.5 μg/kg fentanyl IV boluses were administered.

After port closure, the anesthetic agents were discontinued, neuromuscular paralysis was reversed, and trachea was extubated when patient was fully awake.

Postoperatively, a blinded observer unaware of the preoperative intervention assessed pain scores. Pain was assessed once the patient was fully awake in the operating room (OR), then at 0, 1, 2, 4, 6 hours in the post anaesthesia care unit (PACU), and at 24 hours (ward) using a 0- to 100-mm VAS. Pain on movement (by asking the patient to take a deep breath and bend the leg on the operated side) was assessed at 4, 6, and 24 hours postoperatively. Pain on walking was assessed at 24 hours postoperatively.

For initial pain relief, 0.5 μg/kg fentanyl IV was administered every 5 to 10 minutes until VAS decreased to less than 30. After this, all patients were started on a PCA device (Medima s-PCA, Warszawa, Poland) programmed to administer bolus 25-μg fentanyl, lockout interval 5 minutes, 4-hour maximum dose 400 μg for 6 hours postoperatively.

If the patient continued to have pain (VAS $\geq$ 30 for 1 hour) despite optimal use of PCA fentanyl, rescue with 100 μg/kg IV morphine was administered. After the initial 6 hours, patients received oral analgesics (paracetamol 1 g 8 hourly alternating with 75 mg diclofenac 12 hourly).

Time to first analgesic requirement was the time after extubation to time of first analgesic demand (VAS scores $\geq$ 30) by the patient. *Duration of block* was defined as time from giving the block/port site infiltration to the time of first analgesic demand (VAS $\geq$ 30).

Quality of recovery (QoR) score was assessed on the evening of first postoperative day using the scoring system by Myles et al [18]. The score assesses patients' general well-being; pain relief; and ability to understand instructions, to take care of personal needs, to breathe easily, and to remain nausea free postoperatively on a scale of 0 to 18. A higher score denotes a better quality of recovery.

All the patients were telephonically contacted at 1 week and 3 months and asked about pain. Those who complained of persistent pains at 3 months were administered the DN4 questionnaire [19]. The DN4 questionnaire helps to differentiate neuropathic from nonneuropathic pain based on clinical features. It includes 2 sets of questions to be able to ascertain the characteristics of the pain (burning, painful cold, and electric shocks) and if it associated with tingling, numbness, pins and needles sensation, or itching in the area of pain. In addition, a bedside examination is done to evaluate hypoesthesia to touch, prick, or increase in pain by brushing in the area that is painful. Each point is given a value of 1 if positive (0 if negative), maximum score is 10, and a score of 4/10 is the cutoff for diagnosing neuropathic pain.

3. Statistical analysis

Analysis was done using Stata 9.0 (College Station, TX). Data were presented as number (percentages) or mean ± SD/median (min-max). Continuous baseline parameters were

Table 1 Demographic characteristics

	Control group (n = 36)	TAP group (n = 35)	*P*
Age (y), mean (SD)	41 (13.3)	39.7 (14.9)	.684
Sex			
Male (n)	35 (97%)	35 (100%)	.321
Female (n)	1 (2%)	0 (0%)	
Weight (kg), mean (SD)	64.3 (4.44)	64.34 (7.26)	.948
ASA status			
1	33 (92%)	31 (89%)	.662
2	3 (8%)	4 (11%)	

compared using the Student *t* test; categorical variables were compared using χ^2 test. The primary outcome, VAS score at rest at 24 hours, was compared using Wilcoxon rank sum test because the data were not following normal distribution (as assessed by Shapiro-Wilk test).

The duration of the block between the control and block groups was compared using the Student *t* test. The difference in intraoperative and postoperative fentanyl requirement and time to first analgesia was compared using Wilcoxon rank sum test. The median difference in VAS at movement, walking, between the groups was compared using Wilcoxon rank sum test. The VAS at rest and movement were compared between the 2 groups over a period, and issue of multiple comparisons was adjusted using Bonferroni correction. The QoR score compared using the Student *t* test. $P < .05$ was considered statistically significant.

4. Results

A total of 75 patients were screened. Of these, 1 refused consent; 2 weighed less than 50 kg and were excluded. Thus, 72 patients met the inclusion criteria. One of these patients received a scrotal incision and, hence, was excluded from the study. Hence, a total of 71 patients were included in the analysis (36 in the control group and 35 in the block group). The patient demographics and surgical data were comparable between the TAP and control groups except that duration of anesthesia was significantly longer in the TAP group (Tables 1 and 2). The median (range) duration of anesthesia was 100 (55-180) minutes in the TAP group as compared to 70 (40-180) minutes the control group ($P = .000$) (Table 2).

The median intraoperative as well as postoperative fentanyl requirement was significantly lower in the TAP group as compared to the control group. The need for rescue analgesia with morphine was comparable between the groups (Table 3).

Median time to first analgesic requirement was found to be significantly longer in the TAP (65 [5-270] minutes) as compared to the control group (32.5 [0-125] minutes) ($P = .039$). The mean duration of analgesia was also found to be significantly longer in the TAP (181 ± 81 minutes) as compared to the control group (118 ± 53 minutes) ($P = .002$).

VAS at rest was significantly lower in the TAP as compared to the control group at all the time points except immediately postoperatively in the OR, at 1 and 4 hours postoperatively (Fig. 1). On deep breathing, VAS was significantly lower in the TAP group at 6 hours, whereas on knee bending, VAS was significantly lower in the TAP group at 24 hours (Fig. 2).

VAS on walking at 24 hours was significantly lower in the TAP (median [range], 0 [0-50]) as compared to the control group (10 [0-75]; $P = .039$) (Fig. 2). The QoR score (mean ± SD) was significantly better in the block group (16 ± 1.4) as compared to the control group (15.4 ± 1.4) ($P = .029$). There was no difference in postoperative nausea and vomiting between the groups.

At 1 week, 26 patients (72%) of the control group and 19 patients (54%) in TAP group complained of dull and dragging pain at the operative site ($P = .117$). None of the patients who were pain free at 1 week complained of pain at 3 months. Of the 26 control group patients who had pain at 1 week, 7 (27%) complained of pain at 3 months. In the TAP group, 3 (16%) of 19 who complained of pain at 1 week had pain ($P = .374$) at 3 months. All these patients were requested to come to the hospital for further evaluation, but only 5 (4 control group and 1 TAP group patient) turned up. These patients were

Table 2 Surgical data

	Control group (n = 36)	TAP group (n = 35)	*P*
Duration of surgery (min), median (range)	45 (25-135)	45 (20-120)	.38
Duration of anesthesia (min), median (range)	70 (40-180)	100 (55-180)	.000 *
TAPP (n)	16 (44%)	11 (31%)	.26
UL/BL (n)	8/8	10/1	
TEP (n)	20 (56%)	24 (69%)	
UL/BL (n)	12/8	13/11	
Total			.38
Unilateral (n)	20 (56%)	23 (66%)	
Bilateral (n)	16 (44%)	12 (34%)	

UL = unilateral repair; BL = bilateral repair.
* $P < .05$ statistically significant.

Table 3 Intraoperative and postoperative fentanyl requirement

	Control group (n = 36)	TAP group (n = 35)	*P*
Intraoperative fentanyl requirement (μg/kg)	2.5 (2-3.5)	2 (2-3)	.01 *
No. of patients requiring intraoperative fentanyl (n)	24 (66.7%)	13 (37%)	.013 *
Postoperative fentanyl requirement (μg)	150 (0-1050)	25 (0-475)	.049 *
No. of patients requiring postoperative morphine (n)	4 (11%)	1 (3%)	.164

Values are expressed as median (range).
* *P*< .05 statistically significant.

administered the DN4 questionnaire. None of them were found to have neuropathic pain.

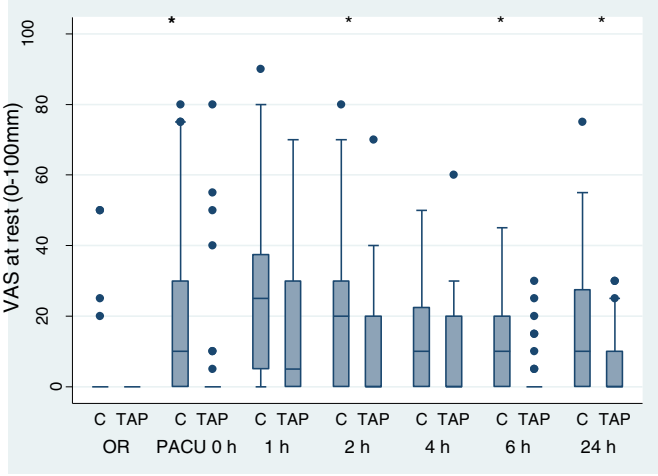
5. Discussion

Our study demonstrated that TAP block significantly decreased the VAS at rest for up to 24 hours postoperatively as compared to port site infiltration with local anesthetic in patients undergoing laparoscopic hernia repair. VAS on deep breathing was significantly lower at 6 hours; VAS on knee bending as well as on walking was significantly lower at 24 hours. Different studies have reported different results with TAP block for laparoscopic hernia repair, and this is probably due to the different techniques and adjuvants used. Beyls et al [15] administered ipsilateral USG TAP blocks for unilateral laparoscopic hernia surgery (TAPP or TEP not specified). They observed no decrease in pain scores in the TAP as compared to control group patients who received standard analgesia alone (VAS at 24 hours was 14.58 ± 12.66 in the TAP group vs 18.9 ± 14.5 in the control group) [15]. They, however, observed a significant decrease in number of patients requiring postoperative analgesic before discharge in the TAP group (2/50) as compared to the control group (9/50) [15].

Even in patients undergoing unilateral hernia repair, ports are inserted on either side and in the midline in TAPP repair, and multiple ports are inserted in the midline in TEP repair. Therefore, a bilateral TAP block would be needed to provide effective analgesia even in those undergoing unilateral laparoscopic TAPP or TEP repair [17]. Stebelski et al [13] performed bilateral landmark-guided TAP block for TEP repair (unilateral or bilateral not specified) and found no statistically significant decrease in VAS between the groups. The VAS was 38 ± 23, 24 ± 22, 28 ± 31, 18 ± 21, 16 ± 15, and 17 ± 24 in the control and 31 ± 20, 15 ± 18, 12 ± 11, 12 ± 11, 8 ± 7, and 8 ± 11 in the TAP group in a 0 to 100 VAS scale at 1, 2, 3, 4, 24, and 48 hours postoperatively [13].

The use of clonidine and adrenaline as adjuvants in the study (0.25% levobupivacaine) and control groups (saline) could have contributed to decreasing difference in VAS between the groups. The authors, however, attributed this to the small sample size (15 patients each group) and variability in observed pain scores [13].

Kim et al [14] used bilateral USG TAP block for patients undergoing unilateral and bilateral TEP repair and found no significant difference in pain (numeric rating scale from 0 to 10) except in the immediate postoperative period (numeric rating scale, 4.33 ± 1.83 in TAP and 5.73 ± 2.04 in control groups) [14]. Similar to Beyls et al, they found a significant



VAS (0-100mm) in median (range), OR: Operating Room, PACU 0h: Post anesthesia care unit on transfer, *p < 0.01 statistically significant after Bonferonnicorrection. C: Control group, TAP: TAP group

Fig. 1 Visual analog scale (0-100 mm) at rest.

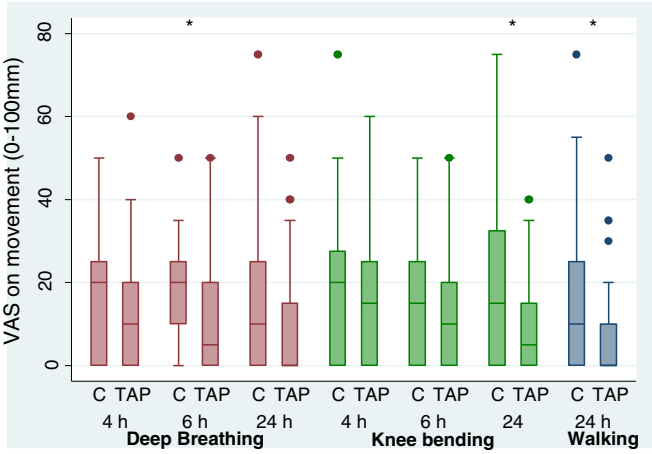


Fig. 2 Visual analog scale (0-100 mm) on movement.

decrease in the total amounts of fentanyl (74.3 ± 49.5 μg in control and 39.4 ± 46.4 μg TAP groups) and ketorolac (12.2 ± 19.3 mg in control and 3.6 ± 12.5 in TAP groups) used in the first 24 hours between the groups [14,15].

We found a significant reduction in the pain scores (rest and movement) in the TAP group at all time points studied except immediately postoperatively in the OR, at 1 and 4 hours postoperatively. At this time, although VAS was lower in the TAP group, the difference was not statistically significant. This could be because patients of both the groups were on PCA device until 6 hours postoperatively and the significantly increased fentanyl consumption in the control group (150 [0-1050] μg) as compared to the TAP group (25 [0-475] μg) may have masked the difference in pain scores between the groups.

In the study by Meyer et al [16], USG TAP facilitated unilateral and bilateral TEP repair under general anesthesia without need for curarization. Similar to our study, the authors reported that the block provided effective analgesia for 24 hours and decreased need for postoperative opioid consumption. Of the 50 patients in this study, 7 had an inadvertent peritoneal rent, and 1 needed conversion to TAPP [16].

There is a perception that pain after TAPP and TEP repair may be different. The need to create a pneumoperitoneum for TAPP repair would suggest that patients might develop shoulder tip pain. However, in a qualitative systematic review including 71 studies that assessed pain after laparoscopic hernia repair, Tolver et al [2] found that there was no difference in pain characteristics, intensity, and duration on comparison of TEP and TAPP repairs. Pain after both TAPP and TEP repairs was deep, abdominal groin pain due to the hernia repair, and this dominated over the somatic or incisional pain which again was more pronounced than the shoulder pain due to pneumoperitoneum [2]. The authors surmised that this could be because surgery was performed far away from the diaphragm, irritation of which is responsible for the referred shoulder pain [2]. The authors found that median VAS after both types of laparoscopic hernia repair was 13 to 58 on a 0- to 100-mm VAS scale with moderate to severe pain reported in half the patients. Pain was highest on the first postoperative day and decreased by day 3. Coughing and movement aggravated the pain. Pain intensity was not higher after a bilateral as compared to unilateral repair with both TAPP and TEP repairs. Young age and increased preoperative heat response to pain were predictive of postoperative pain rather than the hernia size, type, and whether it was a primary or recurrent hernia [2].

Therefore, as pain after both procedures is similar, we included both TEP and TAPP repairs in our study. In addition, many times in case of difficulty in performing a TEP repair or if inadvertent peritoneal tear occurs, intraoperative conversion to TAPP surgery may be needed [16]. In addition, sometimes, a defect is observed on the contralateral side after introduction of the telescope, and a decision taken to convert a unilateral to bilateral hernia repair intraoperatively. Therefore, both unilateral and bilateral hernia repairs were included in the present study. In addition to reducing VAS at rest for 24 hours postoperatively, a decrease in VAS on movement especially on walking at 24 hours was also observed in our study. This is especially important as these surgeries may be performed as day care procedures.

The time to first postoperative analgesic requirement in the present study was also significantly longer in the TAP group as compared to control group. Similar results have been observed by Stebelski et al [13] (11 ± 13 hours TAP group vs 7 ± 12 hours control group). The longer duration of analgesia observed in this study could be because of addition of clonidine as adjuvant and that the proximal landmark-guided TAP block in the triangle of Petit could lead to paravertebral spread of the local anesthetic leading to a more proximal blockade of somatic and sympathetic afferents [19]. In our study, the TAP block was performed more anteriorly, where all 3 abdominal muscle layers and the TAP plane are well delineated using an ultrasound; hence, the question of inadvertent paravertebral spread is unlikely [19].

Studies on patients undergoing lower segment cesarean section have also shown longer times to first postoperative analgesic requirement ranging from 220 to 240 minutes. The reason for the prolonged time to first analgesia in these studies could be due to the fact that the TAP block was performed postoperatively after surgery under spinal anesthesia [8,20]. In our study, the block was performed preincision, as the onset of this sensory block is slow and may take up to 60 minutes to reach maximal effect [21]. However, the total duration of the block in our study, that is, time from administration of the block to the first demand for analgesia (181 ± 81 minutes), is comparable to these studies [8,20].

The TAP block was administered after induction of anesthesia leading to an increase in the total duration of anesthesia in the TAP as compared to the control group in our study. A similar increase in anesthetic time was observed by Kim et al [14], duration of anesthesia in the TAP group 87.9 ± 17.1 minutes as compared to 75.5 ± 17.5 minutes control group because the block was performed after anesthetic induction. Performing the block under sedation before induction may minimize the anesthesia time but can increase patient discomfort. We found no study that has calculated the cost of anesthesia in patients undergoing laparoscopic hernia repair with or without the TAP block. Kokulu et al [22] found that cost-effectiveness was more in patients undergoing laparoscopic cholecystectomy with TAP block as compared to standard general anesthesia because of decreased desflurane use in this group. Further studies are needed to ascertain this outcome in patients undergoing laparoscopic hernia repair.

A limitation of our study was that patients could be followed up for only 3 months for assessing persistent pain. None of our patients in either group were found to have neuropathic pain at 3 months. This was unlike the study by Aveline et al [11] where 13.6% patients of the TAP group and 15.7% patients of the control group were diagnosed to have neuropathic chronic pain at 6 months (P= .64). The low incidence of pain at 3 months in our study could be attributed to the smaller sample size studied as compared to Aveline et al (n = 275) [11].

In conclusion, a preincision USG bilateral TAP block with a maximum of 3 mg/kg of 0.5% ropivacaine (volume of 15-20 mL each side) decreased total perioperative fentanyl requirement, increased time to first analgesic requirement, decreased pain scores on rest and movement for up to 24 hours, and decreased pain on walking at 24 hours in patients undergoing unilateral or bilateral uncomplicated laparoscopic hernia repair surgery under general anesthesia.

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