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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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☆☆ Institutional review board contact information: Ethics Committee of the All India Institute of Medical Sciences, New Delhi, 110029.

★ 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