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Efficacy of landmark based blind transverse abdominis plane block for post-operative pain relief in inguinal hernia

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ABSTRACT

Background: Pain after open hernia surgery can be moderate-to-severe and is known to be associated with prolonged hospital stay and delayed return to normal daily activities. **Aims and Objectives:** We aimed to investigate the effect of a blind landmark-based approach of transversus abdominis plane (TAP) block on patients undergoing elective inguinal hernia repair surgery under spinal anesthesia. **Materials and Methods:** This was a prospective, randomized, controlled, and clinical trial consisting of 60 patients scheduled for inguinal hernia repair under spinal anesthesia. Patients in Group-1 received TAP block by landmark based blind technique, whereas those in Group-2 did not receive TAP block. Pain assessments were scored for all patients at rest and movement at 2, 4, 6, 12, and 24 h after surgery using visual analog scale. **Results:** The pain scores in the post-operative period, during rest and movement, were significantly lower in patients that received TAP block. Significant number of cases reported nausea and vomiting or headache in Group-2 due to increase requirement of analgesics for pain relief during first the 24 h of post-operative period. **Conclusion:** Landmark-based blind TAP block may be an effective way of providing analgesia in patients undergoing elective open inguinal hernia repair under spinal anesthesia.

Key words: Transversus abdominis plane block; Inguinal hernia; Post-operative analgesia

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INTRODUCTION

Open inguinal hernia surgery is one of the commonly performed surgical procedures which is associated with substantial post-operative pain and distress. Pain after open hernia surgery can be moderate-to-severe and is known to be associated with prolonged hospital stay and delayed return to normal daily activities. In addition, inadequately treated post-operative pain may be a risk factor for persistent pain after hernia surgery.[1] The incidence reported to be 11–200/10,000 populations in the age group of 16–24 years and over 75 years, respectively.[2,3] Pain after hernia repair is either due to neuropathic etiology, resulting from nerve injury or compression and may be due to non-neuropathic cause resulting from scar tissue, mechanical pressure, or meshomas.[4]

Various treatment modalities have been advocated in post-operative hernia repair pain management. Most of them have been proved inconsistent. Opioids and NSAIDs provide good analgesia but are associated with several undesirable side effects.[5]

In the last decade, peripheral nerve blocks have gained considerable popularity for the management of acute post-operative pain after major surgery in adults and children, especially as a part of multimodal approach for postsurgical pain management. The transversus abdominis plane (TAP) block is a relatively new promising regional anesthesia technique that provides analgesia to the parietal peritoneum, skin, and muscles of the anterior abdominal wall.[6]

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The TAP block was first introduced by Rafi[7] in 2001 as a landmark-guided technique through the triangle of petit to achieve a field block. It involves the injection of a local anesthetic solution into a plane between the internal oblique muscle and transversus abdominis muscle. Since the thoracolumbar nerves originating from the T6 to L1 spinal roots run into this plane and supply sensory nerves to the anterolateral abdominal wall,[8] the local anesthetic spread in this plane can block the neural afferents and provide analgesia to the anterolateral abdominal wall. It has been shown to be effective in several clinical settings, such as abdominoplasty, cesarian delivery, prostatectomy, and colorectal surgery.[9-12]

Abdominal field blocks have been around for a long time and have been extensively used as they are mostly technically unchallenging. They, however, provide limited analgesic fields; hence, multiple injections are usually required. Conventionally, these blocks have blind end points (pops) making their success unpredictable.

The description of the landmark technique for performing TAP block advocated a single-entry point, the triangle of Petit, to access a number of abdominal wall nerves hence providing more widespread analgesia. More recently, ultrasound-guided TAP block has been described with promises of better localization and deposition of the local anesthetic with improved accuracy.

In this study, we aimed to investigate the effect of a blind landmark-based approach of TAP block on post-operative visual analog scale (VAS) scores and total analgesic consumption in the 24-h post-operative period on patients undergoing elective inguinal hernia repair surgery under spinal anesthesia.

Aims and objectives

In this study, we aimed to investigate the effect of a blind landmark-based approach of TAP block on postoperative visual analog scale (VAS) scores and total analgesic consumption in the 24-hour postoperative period on patients undergoing elective inguinal hernia repair surgery under spinal anaesthesia.

MATERIALS AND METHODS

This was a prospective, randomized, controlled, and clinical trial conducted between January 2019 and January 2020. After the hospital ethics committee approval and written informed patient consent, 60 American Society of Anesthesiologists (ASA) physical status I–II patients aged 20–60 years scheduled for elective primary unilateral open inguinal hernia repair under subarachnoid block (Spinal Anesthesia) were included in this study. Only the patients with indirect hernias, fully reducible according to the Nyhus classification,[13] were included in the study. Exclusion criteria were refusal of the patient, age younger than 20 years, emergency surgery, patients' physical status class >3 according to the ASA classification, unconscious patient, scrotal hernias, recurrent hernias, contraindication to spinal anesthesia, failure in spinal anesthesia, body mass index (BMI) 35 kg/m^2, known allergy or contraindication to study drugs, chronic hepatic or renal failure, and pre-operative opioid or nonsteroidal anti-inflammatory drug treatment for chronic pain.

Patients were divided randomly (simple randomization using a computer based random number generator) into two equal groups consisting of 30 patients each.

The patients, their anesthesiologists, investigators providing post-operative care, and the surgeon were blinded to group assignment. All patients were pre-medicated with midazolam at a dose of 0.02 mg/kg intravenous (IV) before surgery. Heart rate, non-invasive blood pressure, and peripheric O_2 saturation were monitored during surgery in 15-min intervals. Supplemental oxygen was administered to all patients through a nasal cannula. Patients were placed in the lateral decubitus position. Spinal anesthesia was applied to all patients with 3.5 mL of heavy bupivacaine in the L3–L4 subarachnoid space. The surgery was begun after checking the level of block with the pin-prick test every 2 min, until the block remained at the same level 3 consecutive times. Patients in Group-1 received TAP Block, whereas those in Group-2 did not receive TAP Block. All the patients were operated by the same surgeon by using Prolene mesh and standard technique.

The point of entry for the blind TAP block is the lumbar triangle of Petit. This is situated between the lower costal margin and iliac crest. It is bound anteriorly by the external oblique muscle and posteriorly by the latissmis dorsi. This technique relies on feeling double pops as the needle traverses the external oblique and internal oblique muscles. A blunt needle will make the loss of resistance more appreciable.

Technique

At the end of the surgery, the iliac crest was palpated to check the insertion point of the needle; then the skin, which was marked before surgery by the anesthesiologist, was pierced with a blunt regional anesthesia needle (Quincke needle, No.23) at the level of the Petit triangle near the midaxillary line. The needle was advanced at right angles to the skin in a coronal plane, until resistance was encountered. This showed that the needle tip was at an external oblique muscle. The needle was gently advanced and the tip of the

needle was gently controlled in the open surgical plane by the surgeon until it entered the plane between the internal and external oblique muscles.[14] After passing through the internal oblique muscle and further advancement into the transversus abdominis fascial plane, the needle was carefully aspirated to exclude vascular puncture. 20 mL of 0.25% bupivacaine (in Group-1) or the same volume of saline (in Group-2) was injected in incremental doses through needle. All the blocks were performed by the same surgeon at the end of the surgery.

Duration of surgery, systolic arterial pressure, and diastolic and mean arterial pressures were recorded in 15-min intervals during operation. Pain assessments were scored for all patients at rest and movement at 2, 4, 6, 12, and 24 h after surgery by an anesthesiologist (independent observer) who did not know the group assignment. VAS (0: no pain to 10: worst imaginable pain) was used for pain assessment, for which all patients received instructions before surgery. Patients were given IV paracetamol if VAS 3, maximally 4 times a day at 6-h intervals. If pain relief was inadequate, tramadol IV at a dose of 1 mg/kg was used. Total analgesic consumption in the 24-h post-operative period were also recorded. Any complications related to interventions were also noted.

Data analysis was performed using Statistical Package for the Social Sciences version 17.0 software (IBM Corporation, Armonk, NY). Data were expressed as mean±standard deviation. Kolmogorov–Smirnov test was used to identify the distribution of variables. Non-parametric statistical methods were used for the heterogeneous variables. The Mann–Whitney U-test was used for nonparametric variables. $P<0.05$ was considered statistically significant.

RESULTS

There was no statistically significant difference in the demographic's characteristics of patients between the two groups with respect to age, height, weight, BMI, or ASA physical status. Furthermore, there were no statistically significant differences in mean blood pressure, heart rate, and oxygen saturation between both group the groups (Table 1).

There was no statistically significant difference in the length of surgical incision between the two groups. Post-operative pain was measured using VAS scale (0–10) during rest and movement. The pain scores in the post-operative period, during rest and movement, were significantly lower in patients that received TAP block. Similarly, post-operative VAS pain scores at movement were significantly lower in patients who received TAP block group as compared with Group II at 0, 3, 6, 12, and 24 h after surgery. The number of patients with overall pain scores at rest and at movement below 4 at 24 h after surgery was significantly higher in Group-1 (Tables 2 and 3).

Table 1: Demographics

Parameters	Group-1	Group-2
Age	41.8 years	42.6 years
Height	160.2 cm	161.5 cm
Weight	68.4 kg	67.8 kg
BMI	24 kg/m^2	24 kg/m^2
ASA-1	12	11
ASA-2	13	12
ASA-3	5	6
Heart rate	80/min	78/min
Blood pressure	112/78 mm Hg	118/82 mm Hg

BMI: Body mass index

Table 2: Visual analog score at rest

Duration	Group-1	Group-2
0	0	0
3 h	0	3
6 h	0	4
12 h	0	3
24 h	0	2

Table 3: Visual analog score at activity

Duration	Group-1	Group-2
0	0	0
3 h	0	4
6 h	0	6
12 h	2	5
24 h	1	4

At the same time, our study results showed that patients undergoing TAP block had a reduced analgesic requirement during the first 24 h after surgery compared to patients from Group-2. Time to rescue analgesia was noted and mean time was recorded in both groups which was higher in the TAP group (5.5±0.9 h) compared to non-TAP group (2.5±1.2 h) (Figure 1).

Significant number of cases reported nausea and vomiting or headache in Group-2 due to increase requirement of analgesics for pain relief during first the 24 h of post-operative period. No patient in both groups reported pruritus. No complications were reported in relation to the administration of the TAP block based on landmark technique.

DISCUSSION

We observed that the landmark-based blind approach of TAP block provided effective post-operative analgesia after elective inguinal hernia repair under spinal anesthesia

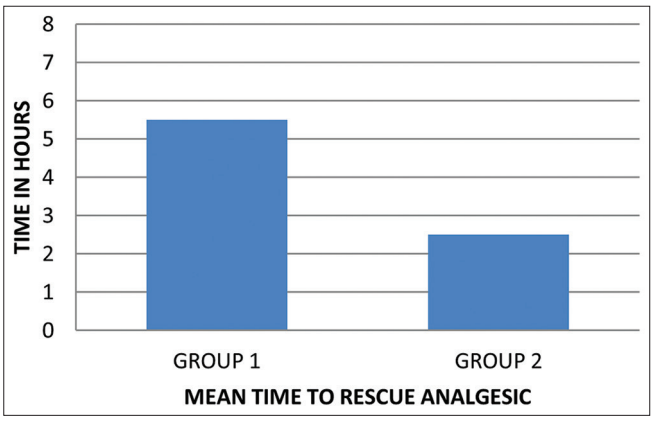

Figure 1: Time to rescue analgesia

and reduced total analgesic requirement in the 24-h post-operative period.

Despite a variety of available pain medications and analgesic methods available, effective post-operative pain relief remains a challenge for anesthesiologists. At the same time, the World Health Organization and International Association for the Study of Pain have recognized pain relief as a fundamental human right.[17] Uncontrolled post-operative pain may lead to complications and prolonged hospital stay and rehabilitation.[16] Thus, effective post-operative analgesia is a key element in reducing post-operative morbidity, accelerating recovery, and avoiding chronic post-operative pain.[18-20]

Historically, several techniques of regional analgesia have been proven to be effective in providing postoperative analgesia in patients undergoing open inguinal hernia repair. They include wound infiltration with LA, ilioinguinal/iliohypogastric nerve block, and TAP block. TAP block is anatomically advantageous because it provides a method to block the sensory supply to the whole anterior lower abdominal wall as confirmed by cadaveric studies as well as in volunteers.[17]

Various studies have demonstrated that TAP block provides effective analgesia and decreases post-operative morphine requirement after caesarian delivery, abdominal hysterectomy, retro-pubic prostatectomy, colorectal surgery, inguinal hernia repair, and abdominal surgery.[11,21-24] Aveline et al., recently showed that ultrasound-guided TAP block provided better pain relief and reduced the opioid requirement when compared with conventional iliohypogastric nerve blocks.[24]

Several approaches have been described for performing TAP block – the classic posterior blind approach and ultrasound-guided approaches. The blind technique was initially described by Rafi.[7] It involves injection of local anesthetic solution into the TAP using the double pop of piercing the fascial planes through the iliolumbar triangle of Petit.

The main complication of the blind TAP block is peritoneal injection of the LA agent.[25] The introduction of ultrasound guidance allows the anesthesiologist to avoid this complication. Using the ultrasound, the three layers of the abdominal wall are identified with ease, and the needle can be followed throughout its course through the layers. The needle can then be placed accurately in the TAP and the spread of LA agent in the plane directly visualized. However, we did not observe any complications in our patients, since we used the landmark based technique. This might be caused by the fact that TAP block was performed by advancing the needle carefully, with the tip of the advancing needle controlled by the finger of the surgeon in the open surgical plane.

We performed TAP block in this study at the level of the Petit triangle near the midaxillary line, marking the insertion point of the needle before the surgery and controlling the position of the needle and spread of the local anesthetic in the open surgical plane in our landmark based blind approach of TAP block with good results. Similar results were observed in the study by Salman et al., who used a semi-blind technique for TAP block.[14]

Limitations of the study

The main limitation of the study was that ultrasound guided blocks were not used in our study and only semi blind landmark-based approach was used for TAP block.

CONCLUSION

Our study shows that the landmark based blind TAP block may be an effective way of providing analgesia in patients undergoing elective open inguinal hernia repair under spinal anesthesia.

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SP- Concept and design of the study, prepared first draft of manuscript, and revision of the manuscript; **CK**- Interpreted the results, reviewed the literature, and manuscript preparation; and **SH**- Concept, coordination, statistical analysis and interpretation, and preparation of manuscript.

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