

Transversus Abdominis Plane Block Versus Ilioinguinal/Iliohypogastric Nerve Block with Wound Infiltration for Postoperative Analgesia in Inguinal Hernia Surgery: A Prospective Observational Study

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Received: 07-04-2021 / Revised: 09-06-2021 / Accepted: 15-07-2021

Abstract

Background: The major goal in the management of postoperative pain is minimising the dose of medications to lessen side effects while still providing adequate analgesia. Various analgesic modalities have been used for postoperative analgesia in patients undergoing inguinal hernia surgery. **Aim:** To compare the efficacy and duration of analgesia with ultrasound-guided TAP block and IIIH nerve block with wound infiltration in the postoperative period among patients undergoing unilateral open inguinal hernia surgery and to evaluate the need for rescue analgesia, haemodynamic parameters and complications if any. **Methods:** This prospective observational study was conducted at the SMHS Hospital which is one of the associated hospitals of Government Medical College, Srinagar for patients who underwent open inguinal hernia repair over a period of eighteen months. A total sample size of 60 patients was available for study. For statistical purpose only, these patients were assigned to one of the groups as per the methodology adopted. 30 patients in our study received transversus abdominis plane block and they were designated as group T (n=30). 30 patients in our study received ilioinguinal, iliohypogastric nerve block with wound infiltration and they were designated as group I (n=30). The primary outcome measure was the time to rescue analgesia in the first 24 h postoperatively. **Statistical Analysis:** Statistical comparisons were performed using Student's *t*-test and Chi-square test. **Results:** There was a significant difference in postoperative analgesia between two groups at 4, 6, 8 and 12 hours as suggested by the VAS scores at these intervals with a *p*-value < 0.05. Beyond 12th hr there was no significant difference in VAS score. The mean time at which the 1st dose of rescue analgesia was received by the patients in group T was 8.3 + 1.29 hours and that in group I was 6.20 + 0.61 hours and the difference between the two was found to be statistically significant with a *p*-value of < 0.05. Hemodynamics was stable in both the groups. There were no complications attributed to the block. **Conclusion:** Both TAP block and IIIH nerve block with wound infiltration are effective regional blocks for open inguinal hernia procedure in adult patients. Hence, both TAP block as well as IIIH block with wound infiltration can be used as effective modalities to control postoperative pain after open inguinal hernia procedures.

Keywords: TAP block, Inguinal hernia, nerve block, transversus abdominis plane block, ultrasound-guided, visual analog scale, wound infiltration

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Introduction

Open inguinal hernia surgery is one of the commonly performed surgical procedures which is associated with substantial postoperative pain and distress. The reported incidence of pain after inguinal hernia repair varies from 0% to 37%. [1] It is associated with delayed return to normal daily activities and may also be related to persistent postsurgical pain (affecting between 0% and 43% of patients). [2] Hence there is a need of adequate analgesia, whose benefits include attenuation of surgical stress response, decreased perioperative morbidity and improved surgical outcome. In addition to this, effective pain control facilitates rehabilitation and accelerates recovery from surgery. [3,4] The major goal in the management of postoperative pain is minimising the dose of medications to lessen side effects while still providing adequate analgesia. A multimodal approach includes opioids, nonsteroidal anti-inflammatory drugs, paracetamol infusion and regional anaesthetic

techniques such as caudal block, local infiltration or nerve blocks. [5] However, these treatments may yield suboptimal pain control or may be limited by the significant risk of side effects. Of the commonly used oral analgesics, acetaminophen has only mild analgesic properties and has a prolonged time to onset [6,7] and opioid medications are associated with somnolence, nausea, vomiting, pruritis and respiratory depression. Further the potential risks of caudal blocks include subcutaneous infiltration, blood vessel puncture and dural penetration. [8,9] As opposed to these, the use of local anaesthetics for blocks/infiltration are associated with minimal side effects, shorter intra-hospital recovery, lesser morbidity and overall costs [10] and hence proven to be preferred methods for effective pain control. Pain and discomfort are important components which are expected after abdominal wall incision. [11] Peripheral nerve blocks such as transversus abdominis plane (TAP) block, abdominal field blocks and ilioinguinal/ iliohypogastric (IIIH) nerve blocks have been described in the literature as means to alleviate pain due to abdominal wall incision. [10] Both techniques produce the same block of the ilioinguinal and iliohypogastric nerves; with the only difference being that TAP is a compartment block, while ILI+IHG is a truncal block. [12]

Methods

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The present study was conducted as a prospective observational study in the Postgraduate Department of Anaesthesiology and Critical Care SMHS Hospital, an Associated Hospital of Government Medical College Srinagar. After obtaining approval from the institutional ethical committee and informed consent of the patients for participation in the study, patients scheduled to undergo open inguinal hernia surgery were observed in this study over a period of eighteen months. Inclusion and exclusion criteria were according to the hospital protocol. After detailed preanaesthetic evaluation male patients in the age group between 18 to 65 years belonging to the American Society of Anaesthesiologists (ASA) Class I or II, posted for unilateral open inguinal hernia surgery were included for study. Each patient underwent a routine preoperative evaluation, done 24 hrs prior to surgery as a part of our routine protocol. A thorough history including history of any comorbid disease, previous history of anaesthetic exposure, medication intake and allergy to any drug was also elicited. General physical examination was done which include vitals, height, weight of the patient, systemic examination of respiratory system, cardiovascular system and central nervous system. Airway assessment was done to predict the airway status of the patient. The baseline investigations CBC (complete blood count), KFT (kidney function test), LFT (liver function test), blood sugar, chest x-ray, electrolytes, electrocardiogram and serology was done preoperatively. All the study patients were instructed about the use of the VAS [visual analogue scale] score before surgery (VAS score 0 - no pain, VAS score 10 - worst possible pain) as shown in the figure below. It is a printed horizontal card of 10 cm in length, with two verbal descriptors as 'no pain' at one end and 'worst possible pain' at other end. The patients were asked to mark on the line the point at which they feel, represents their perception of their current pain state. The patients were advised to remain fasting for a period of 8 hours and were explained about the study design and associated risks and benefits and informed written consent was obtained. In the OT room patients were connected to monitors such as electrocardiogram (ECG), non-invasive blood pressure (NIBP), and pulse oximeter to record heart rate, NIBP, ECG and oxygen saturation (SpO₂). An intravenous line was secured by inserting a 18-gauge/20-gauge cannula and patient was preloaded with 15-20ml/kg crystalloid.

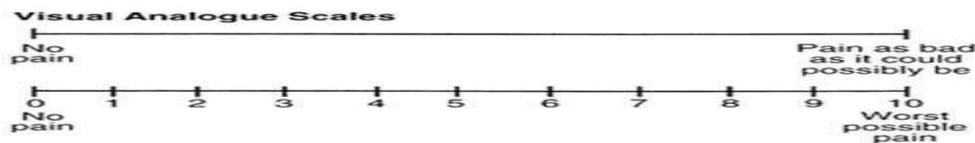


Figure showing visual analogue scale

Statistical Methods

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 21. (SPSS Inc., Chicago, Illinois, USA). Statistical data was analyzed using statistical package for social science (SPSS) version 21. The baseline characteristics and outcome variables were described using mean and standard deviation and dichotomous and categorical variables were expressed as percentages. For continuous variables, independent Student's t-test was applied and $P < 0.05$ was considered statistically significant. For comparing proportions between two

Under all aseptic precautions subarachnoid block was performed by the anaesthetist in all patients in sitting position in L3-L4 space using quincke's spinal needle 25-26 gauge with 3ml of 0.5% hyperbaric bupivacaine. After that patient underwent inguinal hernia repair and standard ASA monitoring was done throughout the procedure. At the end of surgery patients received either TAP or IIIH block. All the blocks were performed by anaesthesiologist experienced in ultrasound guided blocks using portable ultrasound machine. Ultrasound guided transverses abdominis plane block [TAP Block] After surgery, transversus abdominis plane (TAP) block was performed using a 22 gauge short-bevel needle under ultrasound guidance using ultrasound machine with 5-10 MHz linear probe. The transducer was placed in a transverse plane, above the iliac crest, in the region of the anterior axillary line and after visualization of the muscles and intervening plane, 20 ml of 0.2% ropivacaine was injected into the transverses abdominis plane. Ultrasound guided ilioinguinal/iliohypogastric block with Wound infiltration. Surgical wound infiltration was done with 10 ml of 0.2% ropivacaine by the surgeon at the end of surgery. Then IIIH nerve block was performed using a 22 G short bevel needle under ultrasound guidance with ultrasound machine. A 5-10 MHz linear probe was placed in the axial plane at the level of the anterior superior iliac spine and after identifying the ilioinguinal/ iliohypogastric nerves in the transverses abdominis plane, 10 ml of 0.2% ropivacaine was given close to the nerves. After completion of the block, the patients were shifted to post-anaesthesia care unit (PACU) and were kept there under observation for 24 hrs. Several parameters were assessed for 24 hrs from the time of administration of block at 0, 2, 4, 6, 8, 12, 18, 24 hrs. These parameters included HR, SPO₂, BP, pain evaluation using visual analogue scale (VAS 0-10; 0 = no pain, 10 = max pain), the time to first rescue analgesia (given when VAS > 5) and any adverse effects such as nausea, vomiting, urinary retention, pruritis and motor weakness were noted. Intravenous Fentanyl 25 mcg (iv) was given as rescue analgesic along with 75 mg of injection Diclofenac intramuscular (im). Patients were monitored for the need of any subsequent analgesia for 24 hours.

Visual Analogue Scale

groups, Chi-square test was used and $P < 0.05$ was considered statistically significant.

Results

In our observational study, number of patients was not fixed and we observed the patients who underwent open inguinal hernia repair over a period of eighteen months. A total of 66 patients were included in the study out of which 6 patients were excluded on the basis of study design and exclusion criteria. A total sample size of 60 patients was available for study. No significant difference was found between the groups in terms of demographic profile of patients (Table 1).

Table 1: Demographic profile of the study population

Parameters	Group P n=19	Group D n=17	P value
Age (yrs)	52.16±10.7	49.16±10.2	0.27*
Height (cm)	174.60±4.90	175.87±4.35	0.29*
Weight	77.43±6.61	77.07±5.14	0.81*
ASA I/II	26/4	27/3	0.688*
BMI	25.35±1.42	24.93±1.29	0.24*

(Mean, SD= standard deviation, * = level of significance)

By conventional criteria the association between the treatment groups, the mean post-operative vas score at 0, 2, 4,6,8,12,18 and 24 hrs (TAP vs IIIH) are 0.77 + 0.50 Vs 0.97 + 0.41, 1.10 + 0.30 Vs 1.13 + 0.34; 2.33 + 0.88 Vs 3.43 + 0.67; 3.86 + 0.81 Vs 6.66 + 0.84; 6.26 + 0.78 Vs 3.43 + 1.33; 3.20 + 1.37 Vs 3.80 + 0.80; 3.67 + 1.09

Vs 3.50 + 1.13 and 2.33 + 0.47 Vs 2.46 + 1.04, respectively. There was a significant difference in postoperative analgesia between two groups at 4, 6, 8 and 12 hours as suggested by the VAS scores at these intervals with a p- value < 0.05. Beyond 12th hr there was no significant difference in VAS score (Table 2).

Table 2: VAS score of patients at different intervals in the two groups

Time	Group TAP	Group IIIH	P Value
0 hr	0.77±0.50	0.97±0.09	0.09*
2 hr	1.10±0.30	1.13±0.7	0.7*
4 hr	2.33±0.88	3.43±0.67	<0.0001**
6 hr	3.86±0.81	6.66±0.84	<0.0001**
8 hr	6.26±0.78	3.43±1.33	<0.0001**
12 hr	3.20±1.37	3.80±0.80	0.04*
16 hr	3.67±1.09	3.50±1.13	0.56*
24 hr	2.33±0.47	2.46±1.04	0.53*

(Mean, SD= standard deviation,* = level of significance)

The mean time at which the 1st dose of rescue analgesia was received by the patients in group T was 8.3 + 1.29 hours and that in group I

was 6.20 + 0.61 hours and the difference between the two was found to be statistically significant with a p- value of <0.05 (Fig 1).

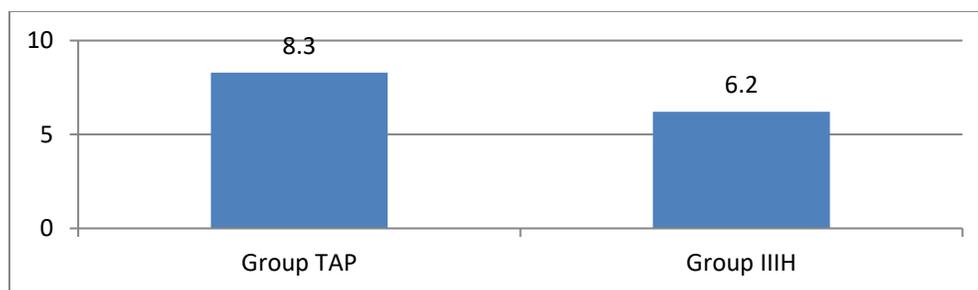


Fig 1: showing the mean time at which 1st dose of rescue analgesia was received in the two groups

The mean of total analgesic consumption in 24 hours was found to be 0.96 + 0.18 doses in group T and 1 + 0.00 doses in group I, while the

difference between the two groups was found to be statistically insignificant, with a p value of > 0.05 (Fig 2).

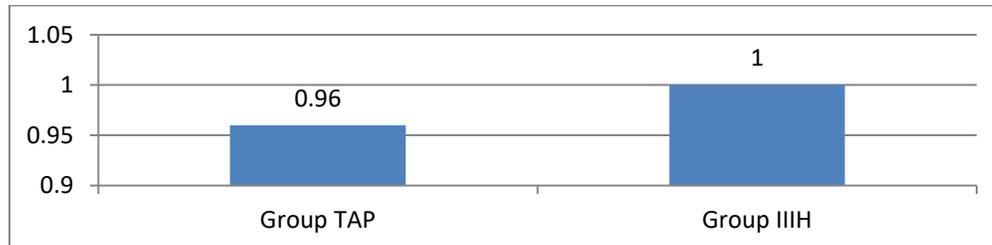


Fig 2: showing total analgesia consumption in 24 hours in the two groups

The side effects in both the groups were found to be postoperative nausea and vomiting with a percentage of 6.67 per cent and 10 percent in groups T and I respectively. By conventional criteria the

association between the groups T and I, the side effects is considered to be not statistically significant since p > 0.05 (Table 3).

Side effects	Group TAP	%	Group IIIH	%
PONV	2	6.67	3	10.00
Pruritis	0	0.00	0	0.00
Lower limb weakness	0	0.00	0	0.00
Urinary retention	0	0.00	0	0.00
Nil	28	93.33	27	90.00
Total	30	100	30	100

Discussion:

Acute postoperative pain following open inguinal hernia repair is maximum during the first 24 h period.[13] Postoperative pain remains grossly undertreated with up to 70% of patients reporting moderate to severe pain following surgery.[14] Pain control is essential for improvement of the quality of patient care.[15,16] Various modalities have been adopted to reduce this pain which includes parenteral opioids, nonsteroidal anti-inflammatory drugs,

central neuraxial analgesia, TAP block, IIIH nerve blocks and wound infiltration with varying results. Among all these techniques, TAP and IIIH blocks are effective and easy to perform with least complications.[17-21] Regional nerve block techniques offer a great degree of postoperative pain relief, thus facilitating early ambulation and discharge. Greater success can be achieved using ultrasound by more accurate placement of reduced volumes of local anaesthetic agents closer to the targeted nerves.[15,16] The analgesic efficacy of

TAP block in the intraoperative and immediate post-operative period in lower abdominal or pelvic surgeries has been documented by many studies.[22-25] But these studies compared TAP block with a control group receiving systemic analgesia.

Hernia repair induces parietal pain depending on Ilioinguinal/Iliohypogastric nerve distribution. The IIIH nerve blocks usually performed blindly, have been documented to provide effective postoperative analgesia.[26,27] There are very few studies available that compared TAP block with other regional blocks such as Ilioinguinal, Iliohypogastric nerve blocks. C.Aveline et al[28] compared ultrasound guided transversusabdominis plane block with conventional ilioinguinal/iliohypogastric nerve blocks in open inguinal hernia repair. The ilioinguinal and iliohypogastric nerves show frequent variation in their course and division at iliac crest. So the failure rate is as high as 10-30%.[12] The blind technique also carries a risk of possible transient femoral nerve palsy,[29,30] which could be explained by faulty deposition of local anaesthetic deep to the transversusabdominis muscle i.e between transversusabdominis and fascia transversalis. These disadvantages of blind technique can be overcome by using guided approach. Hence we use ultrasound for IIIH block.

Moreover Sasaoka et al and Asad et al indicated that the addition of a genitor femoral block to IIIH nerve block provided better pain relief compared with IIIH block alone.[31,32] However, it is quite difficult to block genital branch under ultrasound guidance. Hence, we decided to add wound infiltration along with IIIH nerve block in one group and to compare it with TAP block alone in another group. Taking all this in consideration we conducted a study at SMHS hospital where we compared ultrasound guided TAP block with ultrasound guided IIIH nerve blocks with wound infiltration in patients undergoing open inguinal hernia repair. In this prospective observational study, ultrasound guided TAP block and ultrasound guided IIIH nerve blocks with wound infiltration were observed in patients for elective surgery of open inguinal hernia repair.

In our study the demographic profiles are comparable between two groups with respect to age, height, weight, BMI and ASA suggesting that there is no difference between the groups. Since p value was more than 0.05. In other words the groups contain subjects with the same basic demographic characteristics. Haemodynamic parameters postoperative systolic blood pressure, diastolic blood pressures, heart rate and oxygen saturation between both groups were not considered statistically significant since p value was more than 0.05. This suggest that there was no adverse effect of TAP block and IIIH nerve on postoperative systolic blood pressure, diastolic blood pressures, heart rate and oxygen saturation.

In our prospective observational study we compared pain intensity using VAS pain score and 24 h analgesic consumption. We found that the time for VAS to reach >5 (first breakthrough analgesia-fentanyl 25 mcg/IV and Diclofenac 75 mg/IM) was longer in TAP group (8.30 ± 1.29) as compared to IIIH group (6.2 ± 0.61). We also found that TAP block patients expressed less pain at rest on VAS scores at 4, 6 and 12 hours. These findings were similar to the study done by Aveline et al[28] who compared ultrasound guided transversusabdominis plane block and IIIH nerve blocks for day care inguinal hernia repair and reported that the TAP block patients expressed significantly less pain at rest on VAS scores at 4, 12, and 24 h. Similarly, a meta-analysis was conducted by Yu et al[33] including all relevant randomized controlled trials in the published literature, to compare the efficacy of TAP block with local anaesthesia infiltration for postoperative analgesia. These researchers concluded that the TAP block was comparable to local anaesthesia infiltration for short-term analgesia; but, they found that TAP block could also provide better long-lasting analgesia, especially at 24 hours after surgery.

In our study, we used IIIH block + wound infiltration with a local anaesthetic which resulted an equal amount of rescue analgesia in both the groups. The mean dose of fentanyl iv was $24 + 4.5$ mcg in

group T and $25 + 0.0$ mcg in group I, while that of Diclofenac was $72 + 13.5$ mg and $75 + 0.0$ mg, respectively. This difference was not found to be statistically significant suggesting that the total analgesia consumption in 24 hours was equal in both the groups. These findings are similar to the study done by Petersen et al[34] who studied the post-operative analgesic effect of TAP block and ilioinguinal block in ninety patients undergoing inguinal hernia repair. The TAP block was evaluated versus placebo and versus ilioinguinalblock and wound infiltration. They found no significant differences in morphine or ketobemidone consumption in the first 24 hours between the groups that received TAP block and ilioinguinal block for post-operative analgesia. But these observations are contrasting to those of Aveline et al[28] who conducted a study in 273 patients undergoing inguinal hernia repair surgery, which were randomly allocated to receive either ultrasound-guided TAP block or blind IHN block with levobupivacaine 0.5% before surgery. They found that the post-operative morphine requirements were lower in the TAP group in the first 24 hours. The TAP block was performed under ultrasound guidance. However, neither of them used ultrasound guidance for IHN block which could be a cause of reduced efficacy of block. The findings of our study are again contrasting to the study done by Frassanito et al[35] who reported that the patients of IIIH group required increased amount of analgesic consumption for the first 24 hours compared to the patients of TAP group. But in our study, the incidence of consumption of rescue analgesia was lesser even in the IIIH group which can be explained by the fact that we used wound infiltration along with IIIH block while they used IIIH block alone.

Conclusion

Both TAP block and IIIH nerve block with wound infiltration are effective regional blocks for open inguinal hernia procedure in adult patients. The time for first rescue analgesia was prolonged in TAP group compared to IIIH group, but total analgesic requirement within the first 24 h remained the same in both the groups with minimal side effects. Hence, both TAP block as well as IIIH block with wound infiltration can be used as effective modalities to control postoperative pain after open inguinal hernia procedures.

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Conflict of Interest: Nil

Source of support:Nil