

Comparative Study of Ultrasound-Guided Transversus Abdominis Plane with Conventional Ilioinguinal/Iliohypogastric Nerve Blocks for Analgesia in Open Inguinal Hernia Repair

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Abstract

Background: Transversus abdominis plane (TAP) block has been reported to provide effective analgesia after lower abdominal surgery, but there are few data comparing ilioinguinal/iliohypogastric nerve (IHN) block with ultrasound-guided TAP block in patients undergoing inguinal hernia repair.

Material and methods: Eighty two patients undergoing open inguinal hernia repair were randomly allocated to receive either ultrasound-guided TAP block or blind IHN/ILN block with bupivacaine 0.25% 20 ml after surgery. In IHN/ILN block two injections of 10 ml 0.25% bupivacaine each were given at two conventional sites. Both group patients were given general anesthesia. Patients were monitored for visual analogue scale (VAS) scores at rest and on coughing in the recovery room and ward at 0, 2, 4, 6 and 8 hours and number of rescue analgesia required respectively.

Research: Total fifteen patients in blind IHN block required post-operative rescue analgesia whereas in TAP group only two required rescues. Ten out of fifteen required 1 rescue and four required 2 rescues remaining one required 3 rescues in IHN group. VAS scores were lower at 0, 2, 4, 6 and 8 hours in TAP group. No complications were observed in both the groups.

Conclusion: Ultrasound-guided TAP block provided better post-operative analgesia with better VAS scores and reduction in rescue analgesia than 'blind' IHN block in inguinal hernia repair with no complications observed in both groups.

Keywords: USG guided; TAP block; Hernia; Rescue Analgesia; IHN block

Introduction

Inguinal hernia repair is one of the most common surgical procedures [1]. The abdominal wall incision is responsible for the significant part of pain after hernia surgery [2]. Postoperative pain management is complicated in cases that undergo abdominal surgery. Despite of the effective pain management methods, the frequency of moderate or severe pain is found to be 30%-75% [3]. Various medications and procedure methods are used for postoperative pain management. Peripheral nerve blocks with local anesthetic agents (LA) are a method that can be used in inguinal hernia surgeries for both pain management and surgery. Iliohypogastric (IH) and ilioinguinal (II) nerve blocks are generally used for this, in inguinal hernia repair surgery [4]. LA infiltration helps in pain management in acute postoperative period, it also decreases postoperative visual analogue scale (VAS) scores, opioid demand, and time to first rescue analgesic administration [5,6]. Injection of LA solution in blind technique is usually given after perception of a loss of resistance, between the external and internal oblique muscles fascia or between the internal oblique muscle and the transversus abdominis muscle [7,8].

In recent times, the transversus abdominis plane (TAP) block has been considered as an effective technique to reduce postoperative pain

intensity and consumption of opioid analgesic after lower abdominal surgery [9,10]. Ultrasound guidance makes it easy to give the TAP block [11]. Distribution of the LA solution to the nerves lying under the fascia of the transversus abdominis muscle, including IHN is guaranteed by the real-time assessment of the LA injection between the muscle planes. Skin, muscles, parietal peritoneum constitutes the anterior abdominal wall. The lower 6 thoracic nerves (T7 to T12) and the first lumbar nerve (L1) innervate the anterior abdominal wall. Plane between the internal oblique and transversus abdominis muscles harbors the course of the terminal branches of the somatic nerves. This inter muscular plane is called the transversus abdominis plane (TAP). Hence injecting local anesthetic within the TAP can provide unilateral analgesia to the skin, muscles, and parietal peritoneum of the anterior abdominal wall from T7 to L1. Our study is comparative study between ultrasound guided transversus abdominis plane block versus conventional ilioinguinal/iliohypogastric nerve blocks for analgesia in open inguinal hernia repair.

Methodology

Our study was prospective randomized controlled study was conducted in our institute under the Department of Anesthesia over a period of 1 year. Eighty two ASA I-III patients of age between 18 to 80 years who presented for inguinal hernia repair were included in the study. Patients with BMI>40, inability to consent to the study, skin

infection at the puncture site age<18, contra-indication to paracetamol or LA agents, chronic hepatic or renal failure, Severe hypovolemia and neurological disorders were excluded from the study. Sample size was calculated using power and sample size program p.s. version 3.0.43 with power of -0.8 alpha error -0.05 with difference of mean -5 mm on VAS and SD of 8 mm on VAS gave a sample size of 41 in each group. Randomization of the patients was done by the allocation concealment method. Patients was randomized into two groups either into usg guided tap block group or conventional ilioinguinal/iliohypogastric block group by making them pick up the chits.

After approval from Departmental review board (DRB) and research Ethics Committee and written informed consent from the subject, 82 ASA I-III patients who presented for inguinal hernia was enrolled for this study. After the patient arrived in the operating theatre, routine monitoring (ECG, heart rate, non-invasive arterial pressure, and pulseoximetry) and IV access was established and they were positioned supine. Pre operatively pain scores were noted on 10 cm visual analogue scale (VAS). Patients were given general anesthesia (GA) in which patient were induced with propofol 2.5 mg/kg and fentanyl 3 mcg/kg or pentazocin 0.3 mg/kg and vecuronium 0.1 mg/kg and patients airway was maintained using laryngeal mask or cuffed endotracheal tube. Anesthesia was maintained with sevoflurane 0.4 to 0.8 mac and 50% mixture of oxygen in air. Once surgery was over and before reversing and extubating, patient was given either USG guided TAP block or conventional iliohypogastric/ilioinguinal nerve blocks for post-operative analgesia respectively.

Ultrasound-guided Transverse abdominis plane block (USG TAP group)

Patients who were already positioned in the supine position were given USG TAP block after surgery. A linear array transducer probe (6-13 MHz) in the multi beam mode which was connected to a portable ultrasound unit was used to scan the anterior abdominal wall after proper skin disinfection. In the initial steps the ultrasound probe was positioned on the anterior abdominal wall where the medial head of the probe was kept at the level of umbilicus and was adjusted until rectus abdominis muscle was observed. Further, the probe was moved on the lateral side towards the anterolateral part of the anterior abdominal wall between the iliac crest and the subcostal margin, the probe was then held perpendicular to a line joining the anterior superior iliac spine and the inferior so that a transverse view of the abdominal layers can be obtained (Figure 1a).

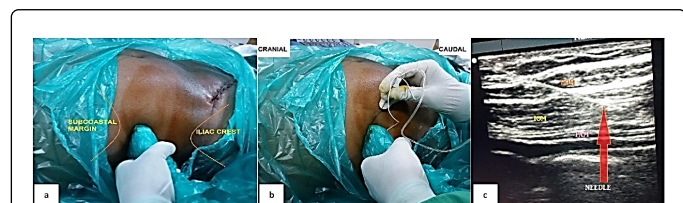


Figure 1: Photograph showing a) Position of the USG probe for TAP block b) Insertion of the needle in real-time under USG guidance c) USG picture of the three muscles with site of needle for drug delivery.

The probe was tilted, rotated, or both to improve visualization of the three layers of the lateral abdominal wall respectively. From medial to lateral direction using the in-plane insertion with ultrasound real-time

assessment a 10 cm, 21 Gauge short-bevelled stimplex needle was advanced (Figure 1b). The point of entry of the needle was distant to the medial side of the probe. Needle's progress was visible as a bright hyper echoic line under direct ultrasonography (Figure 1c). The injection site was defined between Apo neurosis of internal oblique and transversus abdominis muscles. By doing to and fro movements or jiggling of the needle the location of the needle tip was confirmed. Hydro dissection was done with saline (0.9%) 0.5 ml was injected to optimize the tip location once the tip of the needle was confirmed. When the tip was correctly located in the targeted plane, bupivacaine 0.25% 20 ml was injected with intermittent aspiration. After injection the expansion of the local anesthetic (LA) solution as a dark shadow between Apo neurosis of the internal oblique (which moved anteriorly) and the transversus abdominis muscles, pushing the transverse abdominis muscle deeper).

Conventional iliohypogastric/ilioinguinal nerve block (ILN/IHN group)

Similarly as in USG TAP block, conventional ILN/IHN block was given after the surgery was over and before reversing and extubating the patient. The skin of the anterior and lateral parts of the abdominal wall was disinfected with 5% alcoholic povidone-iodine with patient already in supine position. A 10 cm, 21 G short-bevel stimplex needle was used. 20 ml bupivacaine 0.25% was divided into two equal doses. The first half dose of 10 ml was injected with a needle localized at lateral one-third (that is, near anterior superior iliac spine) of a distance, along a line from the anterior superior iliac spine to the umbilicus. Two pop ups were felt first of external oblique and second of internal oblique Apo neurosis. After detection of the second loss-of-resistance when the needle tip crosses the internal oblique muscle Apo neurosis the local anesthetic (LA) solution was injected with intermittent aspiration. The second half of local anesthetic was injected after obtaining the fascia click of external oblique with a needle entry point localized at 1.5 cm above the midpoint of inguinal ligament; this was given to block the femoral branch of genitofemoral nerve (Figure 2).

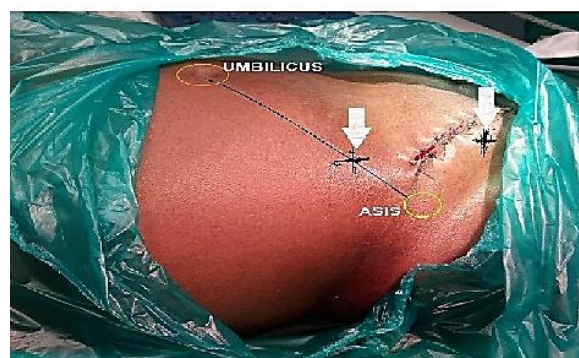


Figure 2: Photograph showing surface markings and the site for conventional INH/ILN blind block.

After the block was given, patients were reversed with neostigmine 0.05 mg/kg and glycopyrrolate 8 mcg/kg and extubated and were observed in recovery room where VAS score was noted on VAS scale and modified aldrete score was also noted. Patients were shifted toward only if VAS<3 on rest and VAS<4 on coughing and if modified aldrete

score > 9. Modified Aldrete score was assessed at every 0, 10, 20, 30 and 40 minutes. Patients who had VAS < 3 on rest and VAS < 4 on coughing and achieved modified Aldrete score of > 9 in recovery room were shifted to ward. Patients were monitored in ward post-operative for 8 hours for pain by noting VAS scores and in between 8 hours if patient's VAS scores were > 3 on rest and > 4 on coughing. They were given rescue analgesia, 1st rescue analgesia given was IV Tramadol 100 mg and after giving 1st rescue analgesia patients were observed for half hour and if pain still persisted then we gave second rescue analgesia i.e. IV Paracetamol 1 gm and again was observed for half hour even if pain persisted lastly IV Morphine 2-3 mcg/kg was given and finally total number of rescues which were required, were noted.

Results

None of 82 cases included to the study were excluded. No significant difference was observed between groups in terms of demographic data (age, weight, height, BMI, ASA) (Table 1). All 82 patients were males in our study. There was no statistically significant difference between the groups in terms of hemodynamics i.e. the systolic arterial pressure and heart rate values preoperatively, in recovery room and in ward. Pre-operative VAS scores were comparable in both the groups. The stay in

recovery room was lower in patients receiving USG TAP block compared to those receiving conventional ILN/IHN block. The mean time in conventional group was 18.29 ± 7.036 minutes and in USG TAP group was 12.2 ± 4.191 minutes, p value: 0.000 which is statistically significant (Table 2). Postoperative VAS SCORES at rest and at coughing at 0, 2, 4, 6 and 8 hours were significantly lower in USG TAP group as compared to conventional ILN/IHN group (Table 3) with all p values < 0.05.

Study Parameter	Conventional		USG		p value
	Mean	Std. Dev.	Mean	Std. Dev.	
ASA I/II/III	29/11/1		23/16/2		0.377
AGE (yrs.)	50.63	18.3	47.12	15.4	0.35
WEIGHT (kgs)	61.59	9.46	62.61	8.81	0.613
HEIGHT (cm)	165	4.3	166.27	4.9	0.208
BMI (kgs/m ²)	22.58	3.38	22.51	2.4	0.916

Table 1: Demographic data.

VAS at Rest	Conventional				USG				Mann-Whitney Test	p value
	Mean	Std. Dev.	Median	IQR	Mean	Std. Dev.	Median	IQR		
Post Op 0 Hrs	1.46	0.64	1	1	1.1	0.37	1	0	-3.101	0
Post Op 2 Hrs	1.68	0.88	1	1	1.15	0.42	1	0	-2.945	0.001
Post Op 4 Hrs	2	1.12	2	2	1.37	0.73	1	1	-2.664	0.003
Post Op 6 Hrs	2.44	0.67	2	1	1.71	0.51	2	1	-3.915	0
Post Op 8 Hrs	2.63	0.62	3	1	2.05	0.59	2	0	-2.808	0

Table 2: Comparison of Vas Scores at Rest.

VAS at Rest	Conventional				USG				Mann-Whitney Test	p value
	Mean	Std. Dev.	Median	IQR	Mean	Std. Dev.	Median	IQR		
Post Op 0 Hrs	2.41	0.71	2	1	1.73	0.67	2	1	-4.133	0
Post Op 2 Hrs	2.66	0.85	2	1	2.02	0.57	2	0	-3.417	0
Post Op 4 Hrs	2.85	0.96	3	1	2.34	0.76	2	1	-2.632	0.005
Post Op 6 Hrs	3.32	0.69	3	1	2.71	0.51	3	1	-3.805	0
Post Op 8 Hrs	3.39	0.54	3	1	3	0.63	3	0	-2.692	0.003

Table 3: Comparison of VAS scores on coughing.

For postoperative rescue analgesia requirements, among 41 (100%) patients who received conventional ILN/IHN block, 10 (24.39%) patients required Tramadol as rescue analgesia, 4 (9.75%) required tramadol and paracetamol as rescue analgesia and only 1 (2.44%) patient required all tramadol, paracetamol and morphine as rescue analgesia. Total 15 patients required rescue analgesia. Whereas

among 41 (100%) patients who received USG TAP block, Only 1 (2.44%) patient required Tramadol as rescue analgesia and 1 (2.44%) required tramadol plus paracetamol as rescue analgesia. Total only 2 patients required rescue analgesia. p value < 0.05 which is statistically significant (Table 4). No block related complications were observed in both the group.

Groups	Tramadol	Tramadol+PCM	Tramadol+PCM+Norphine	Total Rescue required	No Rescue	Total
CONV ILN/INH	10 (24.39%)	4 (9.75%)	1 (2.44%)	15 (36.58%)	26 (63.41%)	41 (100%)
USG TAP	1 (2.44%)	1 (2.44%)	0	2 (4.87%)	39 (95.12%)	41 (100%)

p value: 0.0002 #Chi square test; p value>0.05-not significant; p value<0.05-significant

Table 4: Rescue Analgesia.

Discussion

Inguinal hernia is a common surgical procedure which is generally performed under sub arachnoid block or general anesthesia or under sedation combined with Ilioinguinal/Iliohypogastric (INH) nerve block or surgical field infiltration. European hernia society in 2009 [12] have published a guidelines in adult inguinal hernia treatment, in which they suggested to consider local anesthesia and to avoid subarachnoid block with long acting agents for unilateral inguinal hernia. They also suggested that general anesthesia combined with local infiltration with short acting agents can be an alternative to local anesthesia.

Joshi et al. [12] in their study found out and recommended that field block with or without wound infiltration alone as a sole anesthetic/ analgesic or field block technique combined with general anesthesia are effective methods to reduce post-operative pain. Lucía et al. [13] in their comparative study between General anesthesia and ilioinguinal nerve block versus spinal anesthesia for ambulatory inguinal herniorrhaphy they found that general anesthesia plus ilioinguinal nerve block is better than spinal anesthesia for post-operative analgesia, side effects and satisfaction.

In our study also, under general anesthesia we have compared ultrasound guided transversus abdominis plane block with conventional ilioinguinal/iliohypogastric nerve block for postoperative analgesia in patients undergoing open inguinal hernia surgery. Demirci et al. 2014 [4] in their study to compare the efficacy of iliohypogastric/ ilioinguinal nerve blocks performed with the ultrasound guided and the anatomical landmark techniques for postoperative pain management in cases of adult inguinal herniorrhaphy. They calculated VAS scores at 0 minute, 30 minutes, 2, 4, 8, 12, 18 and 24 hours postoperatively. Comparing the median post-operative VAS scores for USG ILN/IHN group US and anatomical landmark ILN/IHN group AN, they found that the scores for group US were significantly lower than the group AN at rest and at movement with all the p values<0.05 hence statistically significant.

Aveline et al. 2010 [14] in their study of Comparison between ultrasound-guided transversus abdominis plane and conventional ilioinguinal/iliohypogastric nerve blocks for day-case open inguinal hernia repair. In their study they calculated VAS score for both the groups before discharge from the PACU, 4 hrs, 12 hrs, post-operative day one and day two and at 3 months a and found that patients who received a TAP block expressed significantly less pain on VAS scores at 4, 12, and 24 hrs (p values 0.04, 0.014, 0.013 respectively). No significant differences were noted between the two groups for VAS scores at rest in the PACU and on movement at POD1 and POD2.

In our study also, Post-operative VAS scores at rest and on coughing were significantly lower at 0, 2, 4, 6 and 8 hours in USG TAP group compared to conventional ILN/IHN nerve block group hence proving

USG TAP block provides better post-operative analgesia compared to conventional ILN/INH block. Patients receiving USG TAP block achieved higher modified aldrete score earlier and also stay in Recovery room was less in that group i.e. they were discharged earlier to ward.

Post-operative rescue analgesia requirements were far less in USG TAP block group compared to conventional ILN/INH block. Hence proving USG TAP block provides better post-operative analgesia compared to conventional ILN/INH block. Amory et al. 2003 [15] reported a case of a case of accidental puncture of the small bowel during an ilioinguinal/iliohypogastric nerve block procedure for hernia repair. Jöhr and Sossai 1999 [16] drew attention to the preferred needle size in regional blocks reporting colon damage and development of subserosal hematoma. Ghani et al. 2002 [17] determined that the incidence of temporary femoral nerve paralysis in adult herniorrhaphy cases was 6%. Abdurrahman Demirci et al. 2014 [4] in their study observed that there was no block related complication in patients who had IHN/ILN nerve block with the anatomical landmark technique.

Aveline et al. 2010 [14] in their study observed no complications in USG TAP group. Whereas, no complications occur in the IHN group and also except one case of extension of the block to the femoral nerve. This complication was related to an extension of LA solution deep to the transversus abdominis and the fascia transversalis. In our study we observed that there was no block related complications in both USG TAP group and conventional ILN/IHN group as mentioned in the literature.

Conclusion

The USG TAP block is better in terms of providing better analgesia by reducing VAS scores, reduction in rescue analgesia, and reduction in time of stay in recovery room compared to conventional ILN/IHN nerve block.

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