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Study of Ultrasound Guided Hernia Block For Inguinal Hernia Repair in Adults

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Abstract

Background: Open inguinal hernia repair is one of the most common surgical procedure performed. A hernia is defined as an abnormal protrusion of an organ or tissue through a defect in its surrounding walls[1]. Inguinal hernia is one of the commonest variety of hernia found in any age group but mainly found in elderly age group[(2)].

Different anaesthetic techniques have been used for this surgery which includes general anaesthesia, spinal anaesthesia, epidural anaesthesia, local anaesthesia (LA), ilioinguinal/iliohypogastric nerve (IIN/IHN) block. Choosing the most efficient as well as cost effective anaesthetic technique for inguinal hernia repair is necessary.

Hence, USG guided hernia block is safer and an excellent alternative to general anaesthesia and central neuraxial blockade in compromised patients. As a result of these potential benefits, we decided to do the study on hernia repair using ultrasound guided block.

Methods: All the patients underwent a thorough pre anaesthetic checkup which included detailed history, general and physical examinations, laboratory and radiological investigations. Local part was examined and the anaesthetic plan was explained.

- After taking all aseptic precautions, broad band linear array probe(transducer) was placed obliquely on a line joining anterior superior iliac spine and the umbilicus immediately superior to anterior superior iliac spine, Then probe was tilted as necessary in cephalad or caudal direction until a clear optimized image of 3 lateral abdominal muscles and transverse abdominis plane(TAP) was obtained.
- Color Doppler image was then utilized to identify the deep circumflex iliac artery After localizing the nerve, a 23 G 1.5 inch block needle was inserted via in plane approach. The needle was advanced till it reaches very close to the nerve under direct vision.
- When proper needle tip placement was confirmed, 15-20 ml local anaesthetic solution injected after negative aspiration with minimal resistance encountered. While injecting the local anaesthetic, downward bowing of the transverse abdominis muscle was observed as the drug enters the facial plane between the internal oblique and transverse abdominis muscles and spreads it apart.
- For genitofemoral nerve block, the probe was placed transversely just lateral to the pubic tubercle, parallel and above the inguinal ligament. next to it 8-10 ml local anaesthetic was injected after negative aspiration..
- Sensory block on incision site and in whole inguinal region were assessed by pinprick.

Results

We performed USG guided inguinal hernia block in 30 patients of ASA I to IV undergoing elective inguinal hernia repair. All patients were males above 18 years age and weight ranging from 40 to 90 kilograms. A detailed history was taken and patients were thoroughly examined. The procedure to be performed was explained to the patients and written informed consent was obtained from each patient before surgery. The mean age of patients in the study was 51.7 years with standard deviation of 15.44.The mean time to execute the block was 6.36±1.49 minutes. The mean time for sensory onset was 4.3 ± 0.79 minutes. The mean time taken for complete sensory blockade was 9.8 ± 1.27 minutes. The mean time of perceiving pain by the patient was 269.67 ± 71.50 minutes.

Conclusion

Ultrasound guided Ilioinguinal nerve, Iliohypogastric nerve and Genital branch of genitofemoral nerve block can be served to be a standalone anaesthesia and analgesia for inguinal hernia surgery providing good quality of block, significantly reducing amount of local anaesthetics as well as avoiding all the peri-operative complications of regional and general anaesthesia with excellent hemodynamic stability and patient satisfaction.

Keywords: Color Doppler Image, Central Neuraxial Blockade, Hernia Block

Introduction

Open inguinal hernia repair is one of the most common surgical procedure performed. A hernia is defined as an abnormal protrusion of an organ or tissue through a defect in its surrounding walls[1]. Inguinal hernia is one of the commonest variety of hernia found in any age group but mainly found in elderly age group[(2)].

Different anaesthetic techniques have been used for this surgery which includes general anaesthesia, spinal anaesthesia, epidural anaesthesia, local anaesthesia (LA), ilioinguinal/iliohypogastric nerve (IIN/IHN) block. Choosing the most efficient as well as cost effective anaesthetic technique for inguinal hernia repair is necessary.

General anaesthesia carries risks of possible airway

complications and haemodynamic stress response. It has potential for drug interactions due to polypharmacy. Also there are other risks like post-operative nausea, vomiting, drowsiness and sore throat.

Spinal and epidural anaesthesia are feasible but have been associated with side effects like hemodynamic instability, vomiting, urinary retention, post-dural puncture headache and backache. Bony deformities like kyphosis, scoliosis make spinal block technically more difficult and may also cause unpredictable spread of local anaesthetic drug along the subarachnoid space. Opioid analgesics have been associated with sedation, nausea, vomiting and respiratory depression and elderly patients are more vulnerable to these side effects. Moreover certain comorbidities, such as ischemic heart disease, valvular heart disease, hypertension, COPD, chronic respiratory failure, chronic cough, severe liver impairment, chronic malnutrition and weakness, age-related changes, coagulopathies, and cardiomyopathy make choice of anaesthesia more difficult[3,4].

Local anaesthesia is the most suitable type of anaesthesia in elderly, fragile patients and patients with ASA grades II-IV as it avoids airway manipulation and the unwanted effects of induction agents and muscle relaxants, reduced perioperative opioid requirements and lesser complications of general anaesthesia, central neuraxial blockade and hospitalization cost[2,3,5].

Peripheral nerve block can be given by two techniques either landmark guided technique or using ultra sonographic guidance. Peripheral regional anaesthesia always works, as long as you put the right dose of the right drug in the right spot[(6)] which is more accurate and confirmatory with ultrasonogram guided regional anaesthesia than the blind nerve block technique. When we go for blind nerve block technique, there are chances of block failure and risks include bowel hematoma, bowel puncture, pelvic hematoma and femoral nerve block.

Ultrasonography is a safe and effective form of imaging. In recent years, ultrasound guidance has gained popularity among anaesthetists, in regional anaesthesia, and in soft tissue evaluation because accurate needle positioning with visual confirmation of correct drug distribution due to the advantage of "living pictures" or "real-time" images. Direct visualisation of nerves and vessels may be beneficial in reducing the risk of intraneural, intravascular or intraperitoneal injections. As a result, the risks of drug toxicity (Local anaesthetic systemic toxicity-LAST), block failure due to any anatomical variation, and the need for a high drug volume are reduced[7, 8].

The blockade of all three nerves, IIN/IHN with genital branch of genitofemoral nerve (GFN) block are commonly utilised as the sole anaesthetic method for inguinal hernia surgery. With the block of IIN and IHN, GFN block has been suggested to improve the quality of perioperative anaesthesia and analgesia. As the genital branch of the genitofemoral nerve (GFN) supplies the spermatic cord, scrotum, and skin sensation of proximal thigh so inadequate blockade of this nerve during sac manipulation may result in tachycardia and tachypnoea[(9)]. GFN block also alleviates the discomfort caused by traction on the hernia sac[3].

Hence, USG guided hernia block is safer and an excellent alternative to general anaesthesia and central neuraxial blockade in compromised patients. As a result of these potential benefits, we decided to do the study on hernia repair using ultrasound guided block.

Material and Methods

- In this Observational study, we included unilateral

hernia repair under USG guided hernia block for elective surgeries of males above 18 years, with ASA grade I-IV after obtaining hospital Institutional Review Board approval.

- Study was conducted on 30 patients during period of July 2019 to October 2021.

Inclusion Criteria

- Age above 18 years
- American Society of Anaesthesiologists (ASA) Grade I to IV
- Patients who are willing to enroll in the study

Exclusion Criteria

- Patient who gives negative consent for the procedure
- Infection at local site to be injected
- Allergy to local anaesthetic solution
- Obstructed, irreducible or recurrent hernia
- Obese patient

Equipments prepared

A portable sterile tray containing:

- Disposable syringes of 10 ml.
- Disposable needles 23 gauge (1.5 inch and/or 3 inch)
- Bowls containing povidone iodine, spirit and normal saline solutions.
- Sponge holding forceps.
- Sterile gauze pieces.
- Sterile towel and towel clip.

Drugs

- Pre medication drugs: Ondansetron, glycopyrrolate, midazolam and fentanyl.
- 2% lignocaine with adrenaline (1:2,00,000) solution.
- Bupivacaine solution 0.5%.
- Normal saline for injection.
- Emergency drugs.
- 20% intralipid emulsion was kept ready.

Resuscitation equipments

The anaesthesia work station.

Oxygen supply with bain's circuit and appropriate sizes of masks.

Working laryngoscopes and blades of various sizes.

Oral and nasal airways of different sizes.

Laryngeal mask airways.

Endotracheal and tracheostomy tubes.

Working suction apparatus.

Intravenous cannula of various sizes.

IV fluids (Ringer lactate, normal saline, DNS).

Defibrillator.

Ultrasound machine and its probe properly cleaned and aseptically prepared for the procedure.

Method

All the patients underwent a thorough pre anaesthetic checkup which included detailed history, general and physical examinations, laboratory and radiological investigations. Local part was examined and the anaesthetic plan was explained. VAS was explained on the night before the surgery. Informed written consent was taken from the patients and their close relatives. All patients were advised nil by mouth as per fasting guidelines.

On the arrival in the operation theatre, all the standard monitors (electrocardiogram, non-invasive blood pressure and pulse-oximetry) were attached to the patient and baseline vitals were noted. A peripheral venous line was secured with 18 or 20 G intravenous cannula and intravenous fluid started.

Under all aseptic condition following solution was prepared.

Table 1:

Local anaesthetic drug	Amount of drug (ml)
2% lignocaine with adrenaline (1:2,00,000)	15 ml
0.5% bupivacaine	20 ml
Normal saline	15 ml
Total amount	50 l

Position: Supine. After taking all aseptic precautions, broad band linear array probe(transducer) was placed obliquely on a line joining anterior superior iliac spine and the umbilicus immediately superior to anterior superior iliac spine, the probe in this position lies perpendicular to the anatomical course of the two nerves. The probe can be adjusted so that the cross-sectional images of the two nerves can be easily obtained. The ovoid hypoechoic ilioinguinal nerve was then identified within the fascial plane between internal oblique and transverse abdominis muscle. The iliohypogastric nerve may also be seen to be lying medial to the ilioinguinal nerve within this fascial plane.

Then probe was tilted as necessary in cephalad or caudal direction until a clear optimized image of 3 lateral abdominal muscles and transverse abdominis plane(TAP) was obtained.

Color Doppler image was then utilized to identify the deep circumflex iliac artery which lies within this fascial plane in proximity to ilioinguinal nerve so should be avoided during needle placement.

After localizing the nerve, a 23 G 1.5-inch block needle was inserted via in plane approach. The needle was advanced till it reaches very close to the nerve under direct vision.

When the needle tip lies within the fascial plane adjacent to ilioinguinal nerve, 2-3 ml normal saline is injected under continuous ultrasound imaging to re-confirm the accurate placement of the needle tip. When proper needle tip placement was confirmed, 15-20 ml local anaesthetic solution injected after negative aspiration with minimal resistance encountered. While injecting the local anaesthetic, downward bowing of the transverse abdominis muscle was observed as the drug enters the facial plane between the internal oblique and transverse abdominis muscles and spreads it apart.

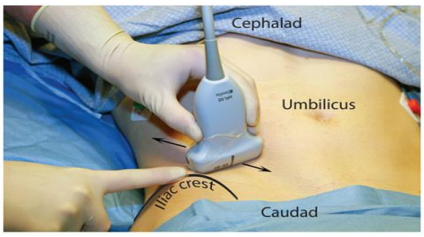


Figure 1: Probe placement for IIN and IHN

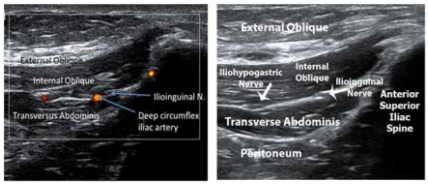


Figure 2: Sonoanatomy of IIN and IHN

For genitofemoral nerve block, the probe was placed transversely just lateral to the pubic tubercle, parallel and above the inguinal ligament. At this point, the spermatic cord can be easily identified. The probe can also be placed over the femoral vessels and then moved cranially and medially, above the inguinal ligament towards the pubic tubercle till the spermatic cord is easily identified, next to it 8-10 ml local anaesthetic was injected after negative aspiration.

Wait for few minutes after infiltration of LA.

Figure 3: Probe placement for GFN

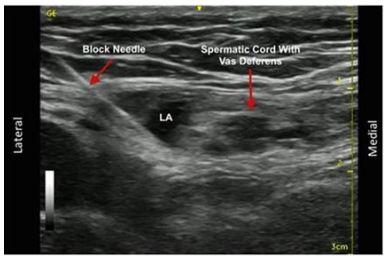


Figure 4: Sonoanatomy of GFN

Sensory block on incision site and in whole inguinal region were assessed by pinprick.

During surgery, if patient feels pain of dragging or pulling while handling of hernia sac, in such cases we can instruct surgeons to deposit 5-7 ml of LA in sac itself.

Following parameters were noted:

Time taken to execute block.

Time taken to achieve complete sensory block.

Onset and duration of sensory block.

Supplementary anaesthesia needed.

Patient satisfaction.

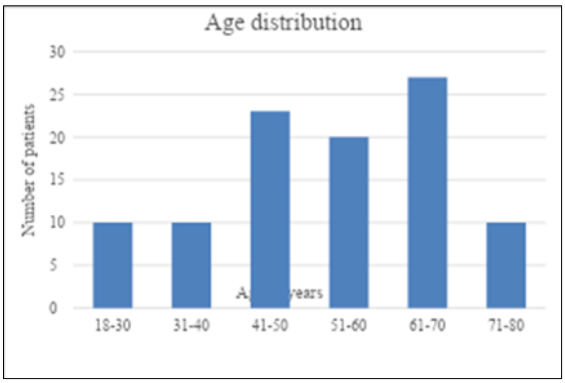
Onset of pain for the first time post procedure.

Incidence of complications.

Observations and Results

In our study we included 30 patients, with age above 18 years old and weight ranging from 40 to 90 kilograms as illustrated below.

Graph 1: Bar Diagram Showing Age Distribution



In this study, mean age of the patients was 51.7 ± 15.44 years.

Table 2: ASA Grade Distribution

ASA grades	Number of patients
ASA I	18
ASA II	7
ASA III	4
ASA IV	1
Total	30

In our study, we have included all ASA grades patients, ASA grades I, II, III and IV. Out of total 30 patients,18 patients belonged to ASA grade I, 7 from ASA grade II, 4 belonged to ASA grade III and 1 from ASA IV.

Table 3: Time Taken To Execute Block

Time taken (mins)	Number of patients
4 min	4
5 min	5
6 min	7
7 min	6
8 min	6
9 min	2

The mean time to conduct the block was 6.36±1.49 minutes.

Table 4: Time of Sensory Onset

Sensory onset (mins)	Number of patients
3 min	5
4 min	12
5 min	12
6 min	1

The mean time for sensory onset was 4.3 ± 0.79 minutes.

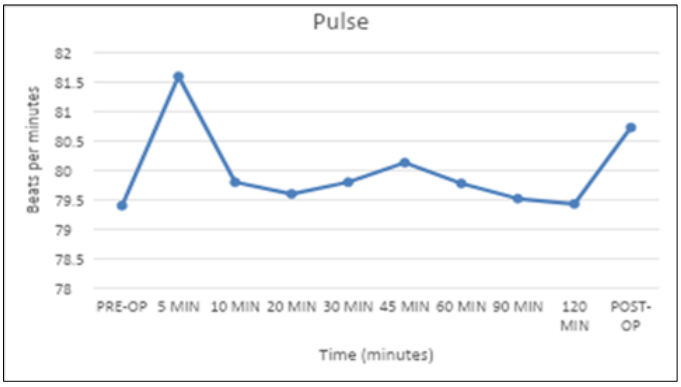
Table 5: Time Taken For Complete Sensory Block

Time taken for complete sensory block (min)	Number of patients
8 min	5
9 min	8
10 min	9

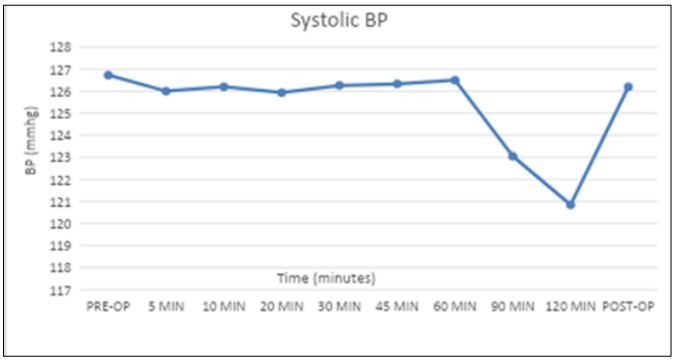
11 min	4
12 min	4

The mean time taken for complete sensory blockade was 9.8 ± 1.27 minutes

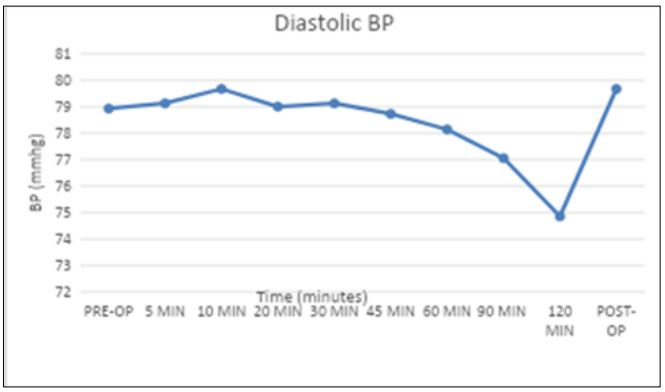
Graph 2: Linear Diagram Showing Peri-Operative Pulse-Rate



Graph 3: Linear Diagram Showing Peri-Operative Systolic Blood Pressure



Graph 4: Linear Diagram Showing Peri-Operative Diastolic Blood Pressure



As shown in tables and charts, mean pulse rate with standard deviation is within range of 79.43 ± 12.14 to 81.6 ± 10.67 minutes, mean systolic blood pressure with standard deviation is within range of 120.85 ± 11.82 to 126.73 ± 11.78 mmhg and mean diastolic blood pressure with standard deviation is within range of 74.85 ± 4.87 to 79.67 ± 6.72 mmhg.

As illustrated above, the hemodynamic parameters of patients remained stable throughout procedure, except sometimes there was tachycardia, which may be attributable to the anxiety response caused by the needle prick during procedure, they remained very close to baseline values throughout the operation.

Table 6: Calculation of The Safe Doses Given To The Patients According To Weight

Weight of patients (kg)	Dose given in this study (ml)
41-50	25-35 ml
51-60	28-40 ml
61-70	30-38 ml
71-80	30-40 ml
81-90	30-40 ml

Patients were given lignocaine with adrenaline 6 mg/kg and bupivacaine 2 mg/kg according to safe calculated dose. Mean local anaesthetic volume used in our study was 33.10 ml.

Table 7: Grade of Analgesia and Relaxation

Grade of analgesia and relaxation	Number of patients
Excellent	28
Good	1
Poor	1

In our study, out of 30 patients, one case can be considered as a failure as sensations were present after giving block and was supplemented with general anaesthesia.

One patient was anxious and felt discomfort during surgery, he was managed with sedation (Inj. Midazolam

0.02 mg/kg IV and Inj. Fentanyl 1 mcg/kg IV).

Table 8: Duration of Complete Sensory Blockade

Complete sensory blockade (mins)	Number of patients
<100	1
101-150	2
151-200	5
201-250	3
251-300	16
301-350	2
>351	1

Total mean sensory blockade occurred at 251.17 ± 70.364 mins.

Table 9: Time of Onset of Pain

Onset of pain (mins)	Number of patients
<100	1
101-150	1
150-200	4
201-250	4
251-300	11
301-350	7
>351	2

When complete sensory regression occurred, the first complaint of pain was registered at mean time of 269.66 ± 71.50 minutes as illustrated.

Table 10: Patient Satisfaction

Patient satisfaction	Number of patients
Very satisfied	28
Satisfied	1
Unsatisfied	1

In the patient with complete and adequate effect of block, they graded the experience as being very satisfied with the anaesthetic technique.

Complications

No side effects or adverse reactions were observed peri-operatively whatsoever.

Post-operative mobilization and hospital stay

Mean time of post-operative mobilization of patients was 5.13 ± 1.27 hours.

Total mean duration of hospital stay was 24.53 ± 6.16 hours.

Discussion

Inguinal hernia repair is one of the commonest day-care surgical procedure. Significant part of the pain for hernia surgeries arises from the abdominal wall incision that is somatic pain.

Various modes of anaesthesia can be administered for surgical repair of inguinal hernia with their own advantages and limitations. In recent times, in most centres, the choice of anaesthesia rests on the spinal or epidural anaesthesia. The effect of this regional anaesthesia on autonomic nervous system, urinary retention and other side effects like hemodynamic instability are risks for using spinal or epidural anaesthesia in elderly patients undergoing hernia repair surgery.

So, the obvious alternate choice remains hernia block (block of IIN/IHN/GFN) for inguinal hernia repair by ultrasound guidance. The main aim of the study was to observe the advantage of ultrasound guidance for the procedure, time to execute block, sensory onset of block, duration of block, peri-operative complications, patient's satisfaction, length of hospital stay, duration of analgesia provided by the local anaesthetic and total amount of local anaesthetic required for a successful block.

In the study, we used the combined method of IIN, IHN and GFN nerve block under ultrasound guidance for repair of inguinal hernia. We blocked genital branch of genitofemoral nerve nearby pubic tubercle. This leads to minimization of pain during cord structure handling

which is the main reason for intra operative discomfort and pain to the patients.

Conclusion

From the above study, we have concluded that ultrasound guided Ilioinguinal nerve, Iliohypogastric nerve and Genital branch of genitofemoral nerve block can be served to be a standalone anaesthesia and analgesia for inguinal hernia surgery providing good quality of block, significantly reducing amount of local anaesthetics as well as avoiding all the peri-operative complications of regional and general anaesthesia with excellent hemodynamic stability and patient satisfaction.

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