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A COMPARATIVE STUDY BETWEEN ULTRASOUND GUIDED VERSUS CONVENTIONAL ILIOINGUINAL AND ILIOHYPOGASTRIC NERVE BLOCKS FOR POST OPERATIVE ANALGESIA FOR INGUINAL HERNIA REPAIR.

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ABSTRACT **Back Ground:**Elective surgical repair of an inguinal hernia is one of the most common surgical procedures.Ilioinguinal and iliohypogastric nerves block have been shown to significantly reduce pain associated with herniorraphy, regardless of whether the blocks are used as the primary anesthetic,or for pain control after general or spinal anesthesia. Use of ultrasound to guide placement of needles and catheters for regional anesthesia and analgesia has become increasingly popular. **Aim:**To compare the efficacy and duration of pain relief after ultrasound guided verses conventional ilioinguinal and iliohypogastric nerve block. To study time of requirement of supplemental parenteral analgesics in both the groups. To compare hemodynamic stability in both the groups. **Materials and Methods:**This prospective, randomized and double blinded study was conducted in a tertiary care hospital. Data was collected from adult malesof American Society of Anesthesiologists (ASA) physical status I and II scheduled for elective open surgery of inguinal hernia repair.Sixty patients were divided into two groups, group A and group B, of 30 each, using computer generated randomized sequence. The presence and severityof pain, was assessed by visual analogue scale(VAS) in the post anesthesia care unit upto 24 hours after the nerve blockade. **Results:**Patient characteristics were collected and subjected to ANOVA and students t-test. It revealed that ultrasound guided nerve block had prolonged duration of blockade compared to conventional method with a significant P valve of 0.041. And comparison of the success rate of nerve block between the two groups showed a very significant P valve of 0.004 confirming that ultrasound guidance has greater efficacy than the conventional nerve block **Conclusion:**Ultrasound guided ilioinguinal/ iliohypogastric nerve block has greater success, efficacy and longer duration of pain relief than conventional nerve block. Hemodynamic stability was same in both the groups.

KEYWORDS : Inginal hernia repair, ilioinguinal, iliohypogastric nerve block, conventional, ultrasound, VAS scores.

INTRODUCTION:

Elective surgical repair of an inguinal hernia is one of the most common surgical procedures.The treatment, however, presents several challenges regarding typeof anaesthesia and postoperative analgesia.Local, general and regional anaesthesia are all used for inguinal hernia repair. Options available for postoperative hernia repair are regional blocks, nonsteroidal anti-inflammatory drugs,opioids. Post-herniorrhaphy pain is moderate to severe and often poorly controlled with opioids as single modal therapy.

Ilioinguinal and iliohypogastric nerves block have been shown to significantly reduce pain associated with herniorraphy, regardless of whether the blocks are used as the primary anesthetic1or for pain control after general2or spinal3anesthesia. Ilioinguinaland iliohypogastric nerves block can be done by two methods, based on anatomical landmarks that is conventional method or by ultrasound guidance.

Use of ultrasound to guide placement of needles and catheters for regional anesthesia and analgesia has become increasingly popular 4. One of the major problems with procedures relying on landmarks is the presence of anatomic variation, which can lead to a high failure rate. Ultrasound provides direct visualization and imaging of various soft tissues: muscles, ligaments, vessels, nerves, joints and bony surfaces. With the use of a high resolution probe, thin nerves (<2mm) can be visualized5. It allows real time needle advancement and appreciation of the spread of injectate, which improves the accuracy of the technique and minimizes the risk of intravascular injection. It also aids in the potential diagnosis of associated conditions that may be related to the patient pain syndrome.

AIMS & OBJECTIVES

1. To compare the efficacy and duration of pain relief after ultrasound guided verses conventional ilioinguinal/ iliohypogastric nerve block.
2. To study time of requirement of supplemental parenteral analgesics in both the groups.
3. To compare hemodynamic stability in both the groups.

MATERIALS AND METHODS

INCLUSION CRITERIA:

1. Patient with informed consent.
2. Age 15-80 yrs.
3. ASA I to ASA II.
4. Weight 40 to 80 kg.
5. Open hernia repair.

EXCLUSION CRITERIA:

1. Patients in whom central neuraxial block is contraindicated
- Preoperative coagulopathy
- Localized infection
- Cerebral vascular insufficiency

2. Allergy to study medications.
3. Laparoscopic repair of hernia defect.

With approval of our hospital ethical committee and written informed consent, this prospective, randomized and double blinded study was conducted in a tertiary care hospital, during the period of june-2011 to june-2012. Sixty patients of American Society of Anesthesiologists (ASA) physical status I and II scheduled for elective open surgery (Lichtenstein technique) of inguinal hernia repair were divided into two groups, group A and group B, of 30 each, using computer generated randomized sequence.

One day prior to surgery all patients had a pre-anesthetic evaluation done and were explained about regional anesthesia technique and visual analogue scale for pain assessment and consent obtained. Routine blood test reports like complete blood picture, random blood sugar, serum creatinine, blood grouping and typing and a baseline electrocardiogram were all recorded.

On the day of surgery, the patients fasting status was confirmed. An intravenous access was achieved with 18G cannula and an infusion of crystalloids started. Baseline readings of heart rate, blood pressure, respiratory rate, saturation of oxygen were recorded. Patients were

blinded to the technique of block by a screen or eye pad. All patients received spinal neuraxial blockade with 3ml of 0.5% heavy bupivacaine hydrochloride. After the spinal block was established group A patients received ilioinguinal / iliohypogastric (IL/ IH) nerve blockade by conventional technique and group B patients by ultrasound guidance with 10 ml of 0.375% of bupivacaine hydrochloride[6].

Conventional IL & IH nerve block :

Patients were placed in supine position. The skin of the anterior and lateral parts of the abdominal wall was disinfected with 2% chlorhexidine solution. A 23-guage, 50 mm hypodermic needle was used. A total of 10 ml of 0.375% bupivacaine hydrochloride was divided into two equal doses. The first dose of 5 ml was injected with needle entry point localized at one third of a distance along a line from anterior superior iliac spine (ASIS) to umbilicus and after detection of the second loss of resistance when the needle tip crosses the internal oblique muscle aponeurosis. The second dose of 5 ml was injected after obtaining the first fascial click with a needle entry point localized at one third of a line joining the pubic tubercle and the ASIS.

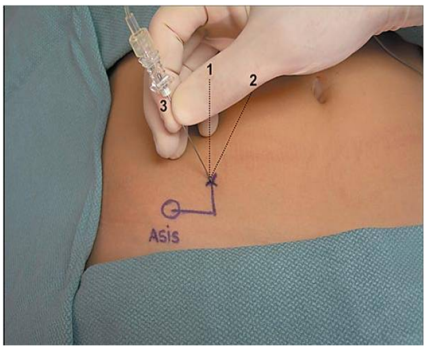

Figure1:shows the anatomical landmarks for conventional ilioinguinal and iliohypogastric nerve block and the needle entry point. ASIS- Anterior Superior Iliac Spine.

Ultrasound guided IL & IH nerve block :

Because of the superficial nature of the nerves, a linear probe of high frequency (6- 13 Hz) was used. The orientation of the probe should be perpendicular to the inguinal line joining the ASIS and pubic tubercle, with the lateral end of the probe just above or posterior to the ASIS7. The probe was then tilted until all 3 layers of muscles (TA, IO, EO) are visualized. A 23-guage, 50 mm hypodermic needle8 was used. The nerves were blocked by the short axis out of plane approach with 10 ml of 0.375% bupivacaine hydrochloride.

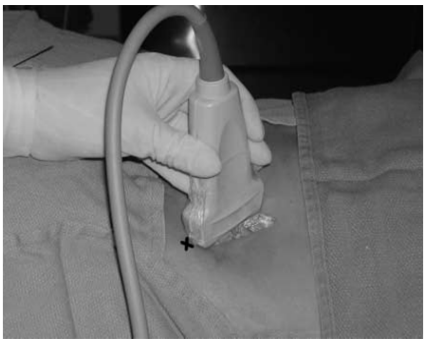

Figure 2 shows Ultrasound transducer positioned at the short axis to the nerve course. X marks the needle entry point.

After completion of the surgical procedure, the patientswere transferred to thepost anesthesia care unit (PACU). The presence and severityof pain, was assessed systematically in the PACU at 2, 4, 8, 12, 16, 24 hours after the nerve blockade. All patients were asked to give scoresfor their pain. Pain severity was measuredusing a visual analogue scale 9. The VAS scale has 0 – 10 markings, 0 representing no pain and 10 representing maximum pain. No other analgesic was given to the patient in postoperative period until the patient complaints of pain. Time of rescue analgesic was recorded whenever the patient complained of pain. Patients were given injection tramadol 100 mg intravenously as rescue analgesic if VAS score was above 3. Study was done up to rescue analgesia time, then it was concluded. Complications of the techniques and drug were noted. (Local anaesthetic toxicity, inadvertent arterial injection, wrong plane injection10etc.)

Visual Analogue scale (VAS score):

VAS score ranges from 0 for no pain to 10 for worst pain imaginable. (Table 1)

Table 1:

Pain perception	VAS score
No pain	0
Mild pain	1-2
Moderate pain	3-5
Severe pain	6-8
Overwhelming pain	9-10

OBSERVATION AND RESULTS:

This prospective study randomized 60 patients into two groups (A &B) each of 30 patients. Group A: received conventional IL /IH nerve blockade andGroup B: received ultrasound guided IL/IH nerve blockade after spinal neuraxial blockade.

Mann Whitney test, t-test, modified t-test, brown-forsythe test, analysis of variance ratio test were the statistical hypothesis tests11 used to assess significance of difference in patient characteristics, success rate of each method and the duration of analgesia provided. Probability (P) value of ≤ 0.05 was considered to be significant.

Students t-test for age reveals the P value of 0.056 indicating that there is no significant effect of the variance in the age of patients between the groups. Similarly t test shows P values for height of 0.747, for weight of 0.435, for ASA grading of 0.310,which revealed that there is no significance of the differences in the patient characteristics.

Similarly Mann Whitney test reveals the P valve for Age of 0.055, height of 0.045, for weight of 0.301, for ASA grading of 0.468 showing that there is no significance of the differences in the patient characteristics. T test for the duration of spinal neuraxial blockade reveals P valve 0.575 and Mann Whitney shows 0.360 which is not of statistical significance.

Out of 30 patients undergoing ultrasound guided nerve blockade, 2 patients complained of pain immediately when the spinal effect weaned off. Out of 30 patients undergoing conventional nerve blockade, 11 patients complained of pain immediately when the spinal effect weaned off.

VAS score at base line that is 0 hr and 2 hr was 0 as the patients were under spinal neuraxial blockade. Weaning of spinal effect was as early as 2.34 hrs and longest was 4.20 hrs. So the P valve for VAS scores at 4hr,8hr,12 hr,16hr and 24hr respectively was 0.415,0.534, 2.335,1.167, 0.142 which were of no significance.

Complications of the techniques and drug (local anaesthetic toxicity, inadvertent arterial injection, wrong plane injection etc.) were not found in our study.

DEMOGRAPHIC DATA

1. **Age:** The minimum age recorded in the study was 28 yr and maximum age was 80 yrs. Mean age in group A was (57.00±10.416) yrs, whereas the mean age in group B was (61.767 ± 8.447) yrs. The majority of patients in both the groups were in the age range 46 to 75 yrs. There was statistically no significant difference between the ages of the patients between two groups (p=0.056)
2. **ASA grade:** Out of sixty, patients with ASA grade I was 30 and ASA grade II was 30. Out of 30 patients in group A 17 were of ASA grade I and 13 of grade II. Out of 30 patients in group B 13 were of ASA grade I and 17 of grade II. The probability valve of ASA grades between groups was 0.310 which was not significant.
3. **Height:** The minimum height recorded in the study was 154 cm and maximum height was 170cm. Mean height in group A was (162.533±3.560) cm, whereas the mean height in group B was (162.83 ± 3.621) cm. The majority of patients in both the groups were in the height range 160-170 cm. There was statistically no significant difference between the height of the patients between two groups (p=0.747).
4. **Weight distribution of patients:** The minimum weight recorded in the study was 54kg and maximum weight was 80kg. Mean weight in group A was (64.80±5.985)Kg, whereas the mean weight in group B was (66.067±6.486) Kg. The majority of

patients in both the groups were in the weight range 56-70kg. There was statistically no significant difference between the weight of the patients between two groups (p=0.435)

5. **Heart Rate:** The P valve for heart rate/ min at 0 (baseline),2hr, 4hr, 8hr,12 hr,16hr and 24hr respectively was 0.424, 0.921, 0.900, 0.347, 0.808, 0.145, 0.406 which were of no significance.
6. **Systolic Blood Pressure:** The systolic blood pressure variations at 0 (baseline), 2hr, 4hr, 8hr, 12 hr, 16hr and 24hr respectively was 0647, 0.206, 0.445, 0.967, 0.130, 0.866, 0.754 which were of no significance. Systolic blood pressure mean in group A was 123.69 mmHg and in group B 122.419 mm Hg.
7. **Diastolic Blood Pressure:** The diastolic blood pressure variations at 0 (baseline) , 2hr, 4hr, 8hr,12hr,16hr and 24hr respectively was 0.136,0.036,0.133,0.383,0161,0.039,0.014 which were of not much significance. Diastolic blood pressure mean in group A was 77.929 and in group B was 77.671mm Hg.
8. **Respiratory Rate:** The P valve for respiratory rate/ min at 0 (baseline), 2hr, 4hr, 8hr, 12 hr, 16hr and 24hr respectively was 0.904, 0.335, 0.436, 0.621 ,0.853, 0.381, 0.582 which were of no significance.
9. SPO2 %:The P valve for SpO2 % at 0 (baseline), 2hr, 4hr, 8hr, 12 hr, 16hr and 24hr respectively was 0.661, 0404, 0.109, 0.214, 0.304, 0.393, 0.289 which were of no significance.
10. **Visual analogue scale:** VAS score between the groupsat base line that is 0 hr and 2 hr was 0 as the patients were under spinal neuraxial blockade. So the P valve for VAS scores at 4hr,8hr,12 hr,16hr and 24hr respectively was 0.415,0.534, 2.335,1.167, 0.142 which were of no significance.

The minimum duration of spinal analgesia in Group A was 2.34 hrs and in Group B was 2.30 hrs. The maximum duration of spinal analgesia in Group A was 4.20 hrs and in Group B was also 4.20hrs.The p valve of duration of spinal neuraxial blockade between groups was 0.575 which was of no significance.

Table 2: ANOVA for Duration of Nerve Blockade in Hours

Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability		^{2}	p^2	^{2}
Between Groups	1.000	45.903	45.903	4.386	0.041	*	0.070	0.070	0.051
Within Groups	58.000	607.031	10.466	0.000	0.000	***	0.000	0.000	0.000
Total	59.000	652.933	11.067						

The above frequency distribution in table 3 reveals a P value of 0.041 which was of significance with regard to total duration of nerve blockade. The ANOVA test for duration of ilioinguinal and iliohypogastric nerve blockade reveals P valve of 0.041 (table 2) which was a significant valve. The maximum duration of analgesia with ilioinguinal and iliohypogastric nerve blockade in Group A was 12hr.20min and in Group B was 14 hrs.

Source of Variations	Df	Sum of Squares	Mean Squares	F Ratio	Probability		^{2}	p^2	^{2}
Between Groups	1.000	16.245	16.245	1.962	0.167		0.033	0.033	0.016
Within Groups	58.000	480.163	8.279	0.000	0.000	***	0.000	0.000	0.000
Total	59.000	496.408	8.414						

ANOVA for Extended Blockage :

The maximum duration of analgesia with ilioinguinal and iliohypogastric nerve blockade after weaning of spinal anesthesia in Group A was 11hr.05min and in Group B was 8hrs.05min. ANOVA for duration of extended IL/IH nerve blockade after weaning of spinal effect has p- valve of 0.167 which is notsignificant (table 3).

Variable	Ultra Sound		Std. Err.	Conventional		Std.Err.	T Test	Probability		Mann Whitney	Probability
Age(Year)	61.767	±	1.542	57.000	±	1.902	1.947	0.056		341.000	0.055
ASA	1.567	±	0.092	1.433	±	0.092	1.025	0.310		444.000	0.468
Height(Cm)	162.833	±	0.661	162.533	±	0.650	0.324	0.747		441.000	0.450
Weight (Kg)	66.067	±	1.184	64.800	±	1.093	0.786	0.435		414.000	0.301
Duration of SA/ Hrs	3.215	±	0.090	3.286	±	0.089	0.564	0.575		425.000	0.360
Duration of Nerve Block/ Hrs	7.436	±	0.680	5.687	±	0.486	2.094	0.041	*	327.000	0.035
Extended Blockage	3.441	±	0.596	2.401	±	0.443	1.401	0.167		354.000	0.080
Block present /absent	0.933	±	0.046	0.633	±	0.089	2.977	0.004	**	407.000	0.266

Table 4: ANOVA for Blockage

Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability		^{2}	p^2	^{2}
Between Groups	1.000	1.350	1.350	8.864	0.004	**	0.133	0.133	0.104
Within Groups	58.000	8.833	0.152	0.000	0.000	***	0.000	0.000	0.000
Total	59.000	10.183	0.173						

The ANOVA for the method of blockade(ultrasound guided verses conventional nerve blockade) shows p valve of 0.004 which is a significant value (table 4).

DISCUSSION

Elective surgical repair of an inguinal hernia is one of the most common surgical procedures.The treatment, however, presents several challenges regarding anaesthesia for the procedure and postoperative analgesia. Local, general, and regional anaesthesia are all used for hernia repair. Options available for postoperative hernia repair are regional blocks, nonsteroidal anti-inflammatory drugs and opioids. The aim of the study was to know the advantage of ultrasound guidance over conventional blind techniques especially for postoperative analgesia for inguinal hernia repair.

Several descriptions of the conventional technique have been published, all of which are based on the subjective feeling of a “fascial click” when the needle pierces the deep fascia of the external oblique muscle. There is no agreement, however, about where the needle should be placed. One expert recommends starting 2 cm medial and 2 cm cephalad to the ASIS; another recommends that the needle be inserted 2 in medial and 2 in inferior to the ASIS.In fact, the site where the nerve perforates the internal oblique muscle is subject to great anatomic variability. This inconclusiveness of recommendations about the block technique, somewhere medial from the ASIS, merely confirms the ambiguity in the nerve pathway. Conversely, the nerve passes consistently between the internal oblique and transverse muscles above the ASIS. Such a deep needle insertion seems dangerous for a routine peripheral nerve block because of proximity to the abdominal cavity and intestines. In reality, the courses of both the IL and the IH nerves are consistent with those described in anatomy texts in only 41.8% of patients. The absence of one or both is estimated as high as 12.5%, whereas the rate of occurrence of an accessory IL or IH nerve is approximately 5%.

Although anatomic deviation could potentially be overcome by a large-volume local anesthetic injection and a “fanlike” deposition of the injectant, visualization of applied anatomy seems to be more feasible, predictable, and safe. Sonography is the only routinely available tool for real-time soft tissue imaging.

Ultrasound provides direct visualization and imaging of various soft tissues: muscles, ligaments, vessels, nerves, joints and bony surfaces. With the use of a high resolution probe, thin nerves (<2mm) can be visualized. It allows real time needle advancement and appreciation of

the spread of injectate, which improves the accuracy of the technique and minimizes the risk of intravascular injection. It also aids in the potential diagnosis of associated conditions that may be related to the patient pain syndrome.

In this study the precise administration of local anesthetic under ultrasound guidance resulted in effective ilioinguinal and iliohypogastric nerve blocks with prolonged pain relief, decreased need for opioids, reduced failure rate and no complications which is consistent with the study done by H.Willschke12 in 2005. High resolution imaging of the IL/IH nerves with the high frequency linear probe was possible in all our patients. The nerves were found in close proximity to one another between the internal oblique and external abdominal muscles. There was no correlation between the position of the nerve in relation to ASIS,the depth of the nerves on the distance from the nerves to the peritoneum.

By using real time imaging,the precise location of the needle tip between the IL and IH nerves and within the correct fascial plane could be detected and the spread of the local anaesthetic around both nerves could be observed. Although we did not alter the dose of the local anesthetic for comparison purpose,ultrasound guidance can significantly decrease the dose of local anesthetics. This is particularly relevant for neonates and infants who are at risk of local anesthetic toxicity.

There are a number of limitations to this study:

First, the study limited assessment of postoperative analgesia to the first 24 postoperative hours. However, our data doesnot indicate the chronic pain associated with hernia repair.Secondly, patients with large inguinal hernia could not be blocked even with ultrasound guidance due to lack of visualization of nerves. Third, all blocks were performed by the same investigator. Although this was done to decrease variability in the performance of the block, this approach may limit the extent to which our findings can be generalized.

Fourth, the study was not large enough to assess safety. There is a risk of inadvertent peritoneal/ bowel puncture or femoral blockade with this block. We have not encountered complications relating to peritoneal puncture in both the techniques we performed. The use of ultrasound to confirm needle position seems to have further reduced the risk of this complication.

In our study, most of the ultrasound guided block was done by experienced anesthesiologist. Future studies to determine the success rate of the block, particularly when performed by less experienced users, are required. Finally, we did not perform a dose-response study to determine if a lower dose or volume of bupivacaine would lead to the same results.

SUMMARY

This was a study done among sixty patients of ASA grade I or II, undergoing elective inguinal hernia repair under spinal neuraxial blockade. The aim of the study was to compare the efficacy and duration of pain relief after ultrasound guided verses conventional ilioinguinal/ iliohypogastric nerve block and to compare hemodynamic stability in both the groups.

All patients in this study underwent inguinal hernia repair under spinal anesthesia. For postoperative analgesia 30 patients received conventional ilioinguinal / iliohypogastric nerve block and 30 patients received ultrasound guided block with 10ml of 0.375% bupivacaine. Post operative pain assessment was done by VAS score.

Patient characteristics were collected and subjected to ANOVA and students t-test. It revealed that ultrasound guided nerve block had prolonged duration of blockade compared to convention method with a P valve of 0.041 which is significant. And comparison of the success rate of nerve block between the two groups showed a very significant P valve of 0.004 confirming that ultrasound guidance has greater efficacy than the conventional nerve block.

CONCLUSION:

To conclude ultrasound guided ilioinguinal/ iliohypogastric nerve block has greater success, efficacy and longer duration of pain relief than conventional nerve block. Hemodynamic stability was same in both the groups.

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