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Original Research Article

Comparison of USG Guided Ilioinguinal Nerve Block and USG Guided Erector Spinae Block for Postoperative Analgesia in Pediatric Inguinal Surgeries: A Randomized Prospective Interventional Study

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Abstract

Background: This study is designed to compare the efficacy of ultrasound (USG) guided Ilioinguinal nerve block (IIN) versus USG guided Erector spinae plane block (ESP) for paediatric inguinal surgeries with respect to postoperative analgesia.

Methods: Hospital based randomized prospective interventional study. 50 children of either sex aged 2 to 10 yrs of ASA grade IorII scheduled for elective inguinal surgery were included in study.

Interventions: Patients were randomized into 2 groups with 25 patients in each group undergoing elective inguinal surgeries (n=25/group). In group A, ESP block was performed with 0.5 ml/kg of 0.2% ropivacaine and in group B IIN block was performed with 0.5ml/kg of 0.2% ropivacaine. The post-operative pain was assessed by using CHEOPS Score. The time of need to first rescue analgesic was noted. CHEOPS score was assessed every 30 minutes, 1hr, 2hr, 4hr, 6hr, 12hr, 16hr and 24hr postoperatively.

Results: Significant difference was observed between the groups on post-operative CHEOPS scores at the 16th and 24th hour (p value < 0.05). In group A - 3 (12%) patients required rescue analgesia. While in group B 11(44%) patients required rescue analgesia. There differences were statistically significant. The total dose of rescue analgesia and mean dose of analgesia postoperatively were significantly higher in IIN group.

Conclusions: The ESP group showed a better CHEOPS score and a longer duration of analgesia than the IIN group for controlling postoperative pain in pediatric inguinal surgeries.

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Introduction

Regional anaesthesia is an essential aspect of modern paediatric anaesthesia in providing superior and long-lasting analgesia without the risk of respiratory depression. [1] It is complimentary to general anaesthesia. USG guided nerve block resulted in a revolutionary change over landmark-based regional anaesthetic techniques as it gives real time visualization, shows the spread of local anaesthetics, decreases the dose of local anaesthetic and reduce mechanical complications due to proximity to important structures. USG guided IIN block has shown to be as effective as caudal block for paediatric inguinal surgeries. In this technique, the needle tip is placed in close proximity to the two nerves in the correct anatomical plane between the internal oblique and the transverse abdominis muscles. Therefore, intramuscular and intraperitoneal injection of LA is safely avoided. [2,3] USG guided ESP block is a novel block, first described by Forero et al. [4] in 2016 for the treatment of chronic thoracic neuropathic pain and postoperative pain in thoracic surgery. ESP block is preferred over other interfascial block as it provides extensive analgesia with a single puncture. The anterior spread of injectate into the paravertebral and epidural space would block not only spinal nerve roots but also rami communicantes transmitting sympathetic fibres, thus leading to relief from visceral pain. [5] Various cadaveric and contrast study [9,10] shows that this block is supposed to work at the origin of spinal nerves. Ultrasound guided ESP block targets the transverse process, which is easily identifiable and is relatively distant from neural or major vascular structures and the pleura. An advantage is that it provides extensive analgesia with a single

puncture. Thus, it is possible to perform the block at upper or lower levels relatively distant from the surgical zone, thereby avoiding local problems that could contraindicate the puncture at a specific point. As already mentioned above, ESP is relatively avascular so this block can be given even in patients with coagulation disorders. Aksu and Gürkan11 reported an opioid-sparing effect of ESP in pediatric patients undergoing bilateral inguinal hernia repair.

The hypothesis studied was if the ESP block would provide analgesia similar to the IIN block in the initial 24 hours of follow-up, with a lower incidence of adverse effects.

Primary Outcome: To determine the proportion of patients receiving postoperative rescue analgesia in both groups.

Secondary Outcome: To determine the mean time of need to first rescue analgesia within 24 hours in both groups, mean dose of postoperative rescue analgesia, difference in mean of postoperative CHEOPS Score at various time intervals, difference in changes in hemodynamic variables at various time intervals in both groups.

Considering the above facts, the present study is designed to compare the efficacy of USG guided IIN block versus USG guided ESP block for paediatric inguinal surgeries with respect to postoperative analgesia.

Methodology

We conducted hospital based randomized prospective interventional double blinded study, after due permission from the institutional ethics committee and research review board and written informed parents' consent. The study was registered with clinicaltrials.gov (CTRI/2022/07/044492). The sample size calculation was performed using G*Power version 3.1.9.2 software. 50 children of either sex aged 2 to 10 yrs of ASA grade IorII scheduled for elective inguinal surgery were included in study. Children with hepatic, renal, cardiac, respiratory or neurological condition or with known allergy to local anaesthetic drug or with local infection at site and coagulopathy were excluded from study. Randomization was performed using computer-generated random number tables and concealment of allocation using the sealed opaque envelope technique was done. Perioperative anaesthesia management was done by an anaesthetist blinded to the study, in line with the departmental guideline. All blocks in both the groups were performed by the other trained anesthetist who was experienced in USG guided blocks. Patients were randomized into 2 groups with 25 patients in each group undergoing elective inguinal surgeries (n=25/group). GROUP A (n=25)-Patient undergoing elective inguinal surgery under general anesthesia with ESP Block GROUP B(n=25)-Patient undergoing elective inguinal surgery under general anesthesia with IIN block.

In the operating room, patients were secured with standard monitors-pulse oximetry, electrocardiography and non-invasive blood pressure measurement. Intravenous fluid was started as per hospital protocol through already secured IV line. Children were premedicated with Inj. Glycopyrolate 0.005 mg/kg, Inj. Midazolam 0.05mg/kg and Inj. Fentanyl 2 µg /kg.

After preoxygenation with 100% oxygen, induction of anaesthesia was done with i.v. Propofol 2mg/kg and relaxation obtained with Inj. Atracurium 0.5mg/kg. Airway was secured with endotracheal tube and maintained with 2% sevoflurane in 50% nitrous oxide and oxygen.

Group A patients received USG guided ESP block with ropivacaine 0.2% 0.5 ml/kg given and group B received USG guided IIN block using 0.5 mL/kg of Ropivacaine (0.2%). Hemodynamic parameters were recorded at definite time intervals as per the study protocol.

Block Technique: Blocks were performed using a Sonosite ultrasound machine equipped with a multifrequency linear probe (6-19 MHz) and a 22G, 50 mm B-Braun Sonoplex needle.

Group A ESP Block- After intubation patient was placed in lateral decubitus position. Following aseptic precautions of the skin and probe, USG probe was moved 1-2 cm laterally on the parasagittal plane of L1 vertebra to visualize the transverse process. Using an inplane technique needle was inserted deep into Erector spinae muscle. After confirming the correct needle position using 0.5-1 ml of normal saline, the LA drug was injected.

Group B IIN Block- Patient was kept in supine position. Following aseptic technique, the probe was placed on the anterior abdominal wall immediately medial and slightly cephalic to the upper aspect of anterior superior iliac spine to get short axis view of the nerves situated between internal oblique and transverse abdominis muscle. Using an in plane technique, the needle was advanced until a characteristic tenting of the interface between external and internal oblique was seen. The needle was further advanced between IO and TA muscle, the drug was injected after confirmation under real time visualization of the solution surrounding 2 hypoechoic IIN.

At the end of the surgery all anaesthetic agents were discontinued and the patient were taken on 100% O2 and residual neuromuscular blockade was reversed with Inj. Neostigmine (0.06mg/kg) +Inj.

Glycopyrolate (0.01mg/kg). Patient was extubated when fully awake, breathing spontaneously and was shifted to recovery. The post-operative pain was assessed by using CHEOPS Score. Patients were allowed to receive rescue analgesic on CHEOPS score of >6. Intravenous paracetamol 10mg/kg body weight was given as rescue analgesic. Heart rate, mean arterial pressure and oxygen saturation were recorded at baseline, after induction, at 5minutes, 15 minutes, 30 minutes, 45 minutes, 60 minutes and at end of procedure. The time of need to first rescue analgesia was noted. CHEOPS score was assessed every 30 minutes, 1hr, 2hr, 4hr, 6hr, 12hr, 16hr and 24hr postoperatively. All data were entered in Microsoft excel sheet and the statistical analysis was done using International Business Machine Statistical Package for Social Sciences (IBM SPSS) for Windows version 20.0 software (IBM Corp., Armonk, NY, USA).

The Kolmogorov–Smirnov test was used to test the normality of data distribution. Continuous data was summarized in form of mean and standard deviation and categorical variables were expressed as counts (percentages). Difference in mean of two groups was analyzed using student "t" test. Categorical variables were compared between the groups using Fisher's exact and Chi-square test. The level of significance was kept 95% for all statistical analysis. P value < 0.05 was taken as statistically significant.

Results:

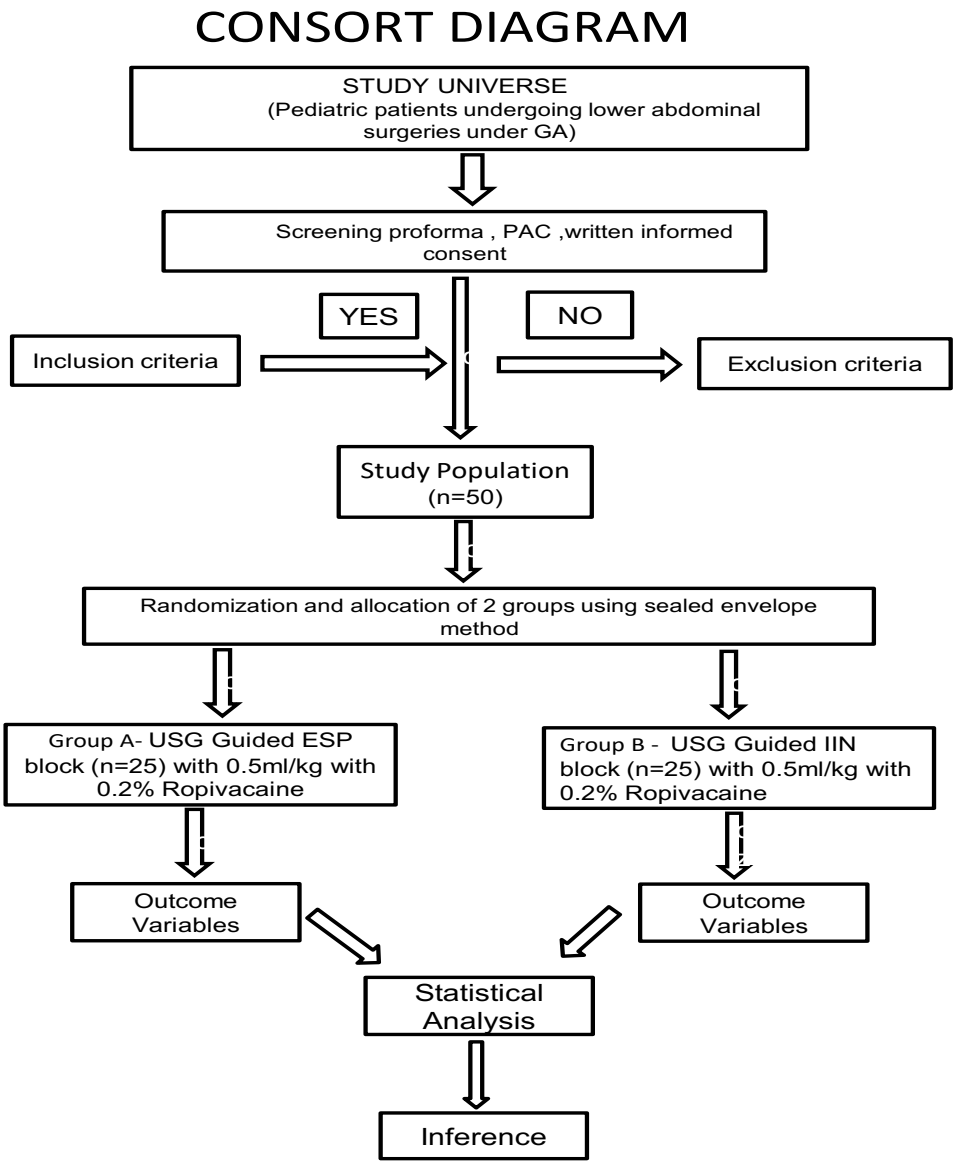

Figure 1:

This study was conducted over a period of 1 year. A total of 50 children aged 2 to 10 yrs were included in study. 25 children were included in each group. The two groups were comparable without any significant difference regarding age, gender, weight or duration of surgery. (Table 1) The number of patients with CHEOPS scores of ≥ 6 were 3 and 11 in the ESP and IIN group respectively. In the ESB group, the median (IQR) of the CHEOPS score ranged from 4 (4-4) to 4 (5-4) during the first 16 postoperative hours, while at 24 hours postoperatively it was 6 (6-4) when the patients started to request analgesia. (Table 2)

In the IIN group, the median (IQR) of the CHEOPS score ranged from 4 (4-4) to 5(5.5-4) during the first 12 postoperative hours, while at 16 hours postoperatively it was 6 (8-5) when 11 patients received supplementary analgesia.

The pain score started to decrease during the following postoperative hours due to supplementary analgesia. In our study, we found that there was a significant difference observed during the 16th and 24th hour with p value of 0.0007 and 0.03 respectively. The ESP group showed a better CHEOPS score and a longer duration of analgesia than the IIN group for controlling postoperative pain.

In group A - 3 (12%) patients required rescue analgesia. While in group B 11(44%) patients required rescue analgesia. There differences were statistically significant with P value of 0.027, 95% CI: 0.076-0.563. (Table 3) Mean time of need to first rescue analgesia i.e, duration of analgesia within 24 hours in patients receiving USG guided ESP block was 22±5.4 hours, while Mean time of need to first rescue analgesia within 24 hours in patients receiving USG guided IIN block was 16.1 ±10.3hours. Thus the duration of analgesia was significantly higher in group A (p=0.012) 95% CI: 76.4-637.6. In ESP group total 3 patients required IV PCM out of which 1 patient required IV PCM 10mg/kg only once and 2 patient's required 2 doses of IV PCM. Mean total number of doses in ESP block were 5 ± 0.57. In IIN group total 11 patients required IV PCM out of which 5 patients required IV PCM only once and 6 patients required twice. The mean total number of doses in IIN block were 17 ± 0.51. The difference was statistically significant with P value =0.023. (Table 4) On comparing the total dose of rescue analgesia requirement in 24 hours postoperative period, Mean dose of analgesia for ESP group was 36 ± 101.65mg, while that for IIN group was 192 ±261.9 mg. The results were statistically significant with p value of 0.043 (Independent's' test) 95% CI: 43.3-268.6. (Table 5)

The heart rate, mean arterial pressure and Spo2 at baseline, after induction, after 5 min, after 15 min, after 30 min, after 45min, after 60 min and at end of procedure for both groups were comparable with no significant difference.

Table 1: Demographic Data of the Studied Groups

Group	ESP (n=25)	IIN(n=25)	P value
Age(in years)	5.68±1.49	5.76±1.66	0.86
Gender (Male/Female)	18/7	18/7	0.62
Weight (in kg)	23.24±5.93	26.12±6.24	0.75
Duration of Surgery (in min)	47±7.9	47.2±10.31	0.22
Type of Surgery (Inguinalhernia/Undescended Testis)	20/5	19/6	

Table 2: Comparison of median of CHEOPS score in groups

	Duration	30 min	1hr	2hr	4hr	6hr	12hr	16hr	24hr
Median CHEOPS score	**Group A**	**4**	**4**	**4**	**5**	**5**	**4**	**4**	**6**
	Group B	**4**	**4**	**4**	**4**	**5**	**5**	**6**	**5**
Interquartile range	Group A	IQR = Q3-Q1 = 4 - 4 = 0	IQR = Q3-Q1 = 5 - 4 = 1	IQR = Q3-Q1 = 6 - 4 = 2	IQR = Q3-Q1 = 5.5 - 4 = 1.5	IQR = Q3-Q1 = 5.5 - 4 = 1.5	IQR = Q3-Q1 = 5 - 4 = 1	IQR = Q3-Q1 = 5 - 4 = 1	IQR = Q3-Q1 = 6 - 4 = 2
	Group B	IQR = Q3-Q1 = 4 - 4 = 0	IQR = Q3-Q1 = 5.5 - 4 = 1.5	IQR = Q3-Q1 = 5.5 - 4 = 1.5	IQR = Q3-Q1 = 5 - 4 = 1	QR = Q3-Q1 = 6 - 4 = 2	IQR = Q3-Q1 = 5.5 - 4 = 1.5	IQR = Q3-Q1 = 8 - 5 = 3	IQR = Q3-Q1 = 5 - 4 = 1
p value		0	0.6818	0.9124	0.2224	0.4237	0.543	0.00076	0.0307

Table 3: Proportion of patients requiring rescue analgesia and Mean time of need to first rescue analgesia in 24 hours in both the groups

GROUP	Group- A (n=25)	Group- B (n=25)	P value
Patients receiving pain rescue medication in 24hr	3(12%)	11(44%)	0.027
Mean time of need to first rescue analgesia within 24 hours	1324±324 minutes	967 ±618 minutes	0.012

Table 4: Total number of rescue analgesia within 24hours in both the groups.

Groups	Group A	Group B	P value
Total number of rescue analgesic doses in 24 hours	5 ± 0.57	17 ± 0.51	0.023
PCM frequency- 1	1(4.0%)	5(20.0%)	
PCM frequency- 2	2(8%)	6(32.0%)	

Table 5: Mean dose of rescue analgesia within 24hours in both the groups.

Mean dose of rescue analgesia in 24 hours	Group- A (n=25)	36 ±101.65 milligrams	p value = 0.043
	Group- B (n=25)	192 ± 261 milligrams	

Discussion:

ESP is a novel block being tried for lower abdominal surgery. This is an inter-fascial plane block where a local anesthetic is injected in a plane between the ESM and transverse process. Proportion of patients requiring rescue analgesic doses in ESP group was 12% and in IIN group was 44%. Their differences were statistically significant with P value of 0.027. These results were comparable to study by EL emam et al. [9] Like in our study proportion of patients requiring rescue analgesia in there study were less in ESP Group 23% as compared to IIN group i.e 50%.

Mohammed and Kamal et al. [13] compared US-guided ilioinguinal/ iliohypogastric (II/IH) nerve block and US-guided transversus abdominis plane (TAP) block in 50 patients for pediatric unilateral inguinal herniorraphy using 0.2 ml/kg of 0.25% levobupivacaine. The total number of patients in IIN group requiring paracetamol as a rescue analgesic was 33.3%, which was comparable to our study.

The present study was designed to compare the analgesic efficacy of USG guided ESP block (using 0.5ml/kg of 0.2% ropivacaine) and USG guided IIN block (using 0.5ml/kg of 0.2% Ropivacaine) in children undergoing inguinal surgery. Pain scores were assessed using CHEOPS score which is a valid and reliable method of assessing pain in children.

The median postoperative CHEOPS Score in both the groups was 4 till 2 hours after the surgery, after which it began to rise. In the ESP group, the median (IQR) of the CHEOPS score remained same i.e, from 4 (4-4) to 4 (5-4) during the first 16 postoperative hours, while at 24 hours postoperatively it was 6 (6-4) when the patients required rescue analgesia. In the IIN group, the median (IQR) of the CHEOPS score ranged from 4 (4-4) to 5(5.5-4) during the first 12 postoperative hours, while at 16 hours postoperatively it was 6 (8-5) when 11 patients received supplementary analgesia. The pain score started to decrease thereafter due to supplementary analgesia. In our study, we found that there was a significant difference observed during the 16th and 24th hour with p value of 0.0007 and 0.03 respectively. The ESB group showed a better CHEOPS score and a longer duration of analgesia than the IIN group for controlling postoperative pain for a longer time.

El Emam et al. [9] in 2019 compared US-guided ESP nerve block vs IIN nerve block in children undergoing inguinal surgeries. They observed the patients for 6 hrs in the PACU and none of the patients had FLACC Score of 4 in 6 hrs in both the groups. After that the patients were discharged. The results were comparable to our study.

Abdelrazik et al. [12] in 2022 compared US-guided ESP nerve block using 0.16ml/kg of 0.25% bupivacaine and USG guided caudal block using 1ml/kg of 0.25% bupivacaine in patients undergoing pediatric lower abdominal surgeries. They used FLACC score for pain assessment and observed the FLACC score ≥ 3 at 12 hours postoperatively for ESP group requiring rescue analgesia. In our study we used CHEOPS Score for pain assessment and observed CHEOPS Score of ≥ 6 at 24 hrs postoperatively. The difference with our study could be explained with the lesser volume of local anesthetic used in their study (0.16ml/kg of 0.25% bupivacaine versus 0.5ml/kg of 0.2% ropivacaine in our study)

The time from beginning of post-operative period to the first administration of analgesic when the CHEOPS score was ≥ 6 is taken as duration of analgesia. Mean time of need to first rescue analgesia for patients who received ESP block in our study was 22.06 hours, which was significantly higher than IIN group patients i.e. 16.11 hours, P value=0.012.

The improved analgesia demonstrated with the ESP nerve block may be attributed to the anterior spread of injectate into the paravertebral and epidural space. This would block not only spinal nerve roots but also rami communicantes transmitting sympathetic fibres, thus leading to relief from visceral pain. This was highlighted by Law et al. [14] who reported in their meta-analysis that paravertebral block is more potent than other forms of nerve block for inguinal herniorrhaphy and also by Chin et al. [15], who reported significant relief of visceral pain after ESP blocks seen in three bariatric patients undergoing laparoscopic abdominal surgery.

A similar study done by Aksu C, Gurkan Y, et al. [11] on the analgesic effect of ESPB(0.5ml/kg 0.25 % bupivacaine) for pediatric bilateral inguinal hernia surgeries showed the duration of analgesia with USG Guided ESP block was 24 hours. The results were comparable to our study. [4] When comparing the total number of analgesic requirements between the groups ESB and IIN, we found that 1 patient required IV PCM 10mg/kg only once and 2 patients required 2 doses of PCM. Mean total number of doses being 5 ± 0.57 while in IIN group 5 patients required PCM only once and 6 patients required 2 doses of PCM. Mean total number of doses required was 17 ± 0.51. The difference was statistically significant with P value =0.023.

The mean total dose of rescue analgesia requirement in 24 hours postoperatively for ESP group was 36 ± 101.65mg, while that for IIN group was 192 ±261.9 mg. The results were statistically significant with p value of 0.043.

In the study by Mostafa et al. [16] in 2019, 13 out of 30 patients in the ESB group required postoperative acetaminophen. In the ESB group, 9 patients received acetaminophen once and 4 patients received 2 doses. The total postoperative consumption of acetaminophen was lesser in the ESB group.

Heart rate, mean arterial blood pressure, oxygen saturation were recorded at regular intervals throughout the period of the surgery. There was no significant difference in heart rate, blood pressures, and oxygen saturation when preoperative values were compared with intra-operative values. Our study was in concordance with the study of El Emam (2019) et al. [9] where he compared postoperative analgesic effects of ultrasound guided IIN Block and ESP block. We evaluated the outcomes for 24 hrs post operatively in contrast to 6 hr evaluation in El Emam study. He reported stable vital parameters with no significant difference. There are some limitations of our study. The block was given under general anaesthesia, so success of block was not checked by dermatomal spread.

Conclusion

From our study we concluded that though both USG guided ESP block and USG guided IIN block are safe and effective in providing postoperative analgesia in pediatric inguinal surgeries, USG guided ESP block resulted in a longer duration of postoperative analgesia as compared to USG Guided IIN Block. The number of patients requiring rescue analgesia were lower with lesser rescue analgesic dose in ESP group as compared to II N group.

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