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Original Article

Pre-emptive Analgesia: A Comparative Study between Ilioinguinal-Iliohypogastric Combined Nerve Block and Incision Line Local Anaesthetic Infiltration in Paediatric Inguinal Hernia Repair

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Mastura Binte Matin[1], Mohammad Ahad Hossain[2], Md. Mazharul Anwar[3], Muslema Begum[4], Mohammad Abdul Hannan[5], Chandra Sekhar Karmakar[5], Sumaiya Akter[6]

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ABSTRACT

Background*: Painful interventions may have serious adverse physical and psychological impact in children. Acute postoperative pain is one of the most adverse stimuli experienced by children. In the paediatric age group pain is most often remain under-treated. Acute postoperative pain following open inguinal hernia repair is maximum during the first 24 hours. In order to reduce this significant postoperative pain various modalities are currently being used. Ilioinguinal-iliohypogastric combined nerve block and incision line infiltration with local anaesthetics is being performed to reduce pain intensity postoperatively which is easy to perform, cost effective and are associated with less adverse effects. The present study was aimed to evaluate & compare pre-emptive ilioinguinal-iliohypogastric combined nerve block and surgical incision line local anaesthetic infiltration for management of postoperative pain in paediatric inguinal hernia repair.*

Methodology: *This randomized control trial which was carried out in 60 paediatric patients scheduled for inguinal hernia repair under general anaesthesia (GA) in Dhaka Medical College and Hospital, Dhaka. The study population were divided randomly into two groups having 30 patients in each. Group A received 1mg/kg of 0.25% bupivacaine for surgical incision line infiltration and group B received 1mg/kg of 0.25% bupivacaine for pre-emptive ilioinguinal-iliohypogastric combined nerve block with USG guidance, then following parameters had been recorded and compared between two groups: intensity of*

1. Assistant surgeon, Sheikh Hasina National Institute of Burn and Plastic Surgery, Dhaka
2. Junior consultant (Anaesthesiology), Kurmitola General Hospital, Dhaka,
3. Assistant Professor of Anaesthesia and ICU, Kurmitola General Hospital, Dhaka, Bangladesh
4. Associate Professor of Anaesthesiology, Dhaka Medical College
5. Assistant Professor of Anaesthesiology, Bangabandhu Sheikh Mujib Medical University, Bangladesh
6. Reproductive endocrinology and infertility subspeciality trainee, Bangabandhu Sheikh Mujib Medical University, Bangladesh.

pain by FLACC Behavioural Pain Assessment Scale, time of first analgesic requirement and the consumption of total amount of rescue analgesics in first 24 hours and postoperative adverse effects. After pre anaesthetic check-up & discussion about study procedures written informed consent was taken from the legal guardians. Separate case record form was used in each case. Data analysis was done by SPSS version 26. The demographic profile was well matched in both groups (p>0.05). Mean duration of analgesia for group A was 127.4±13.6 minutes and for group B was 356.42±20.62 minutes, (p<0.05). Post-operative pethidine used within first 24 hours (44.24±12.73 mg vs. 30.43±10.53 mg; p<0.05) was also higher in group A. Overall postoperative adverse effects were minimum among group B. ***Conclusion:*** *This study concluded that both ilioinguinal-iliohypogastric nerve block and surgical incision line local anaesthetic infiltration provided effective pre-emptive analgesia in postoperative period after inguinal hernia repair in children. Ilioinguinal-iliohypogastric nerve block provided longer postoperative analgesia than surgical incision line local anaesthetic infiltration with reduced opioid consumption.*

Key words: *Ilioinguinal-iliohypogastric nerve block, incision line infiltration, pre-emptive analgesia, inguinal hernia repair, postoperative pain, bupivacaine, children.*

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INTRODUCTION:

One of the most feared symptoms of diseases is pain, which a human being is always trying to alleviate and conquer since ages[1]. In most of the cases pain remain untreated in children because of the myths that children and infants do not feel pain, they do not remember painful episodes and there are no untoward consequences of experiencing pain in children[2]. On the other hand, severe pain in children has significant long-term effects sometimes even more than an adult[1]. Quality of recovery, good surgical outcome, reduced hospitalization, reduced convalescence along with parental satisfaction are depending on adequate postoperative analgesia[3]. Various modalities have been adopted to reduce this pain which includes parenteral opioids, nonsteroidal anti-inflammatory drugs (NSAID), central neuraxial analgesia, TAP block, ilioinguinal/iliohypogastric (II/IH) nerve blocks, and wound infiltration[4]. Considering the side effects of opioid and NSAID physicians have started using local anaesthetics for postoperative analgesia, with either an epidural block, peripheral nerve block or subcutaneous tissue infiltration as an adjuvant to GA or as the sole anaesthetic technique for surgery[4].

Infiltration of bupivacaine is an effective and simple method of postoperative analgesia for patients in many kinds of elective surgery such as inguinal herniorrhaphy, tonsillectomy, diagnostic laparoscopic procedures, gynecological procedures, appendectomy and some orthopedic procedures[5].

Under USG guidance this block can be achieved with significantly smaller volumes of local anaesthetics [6]. The National Institute for Health and Clinical Excellence (NICE)[7] guidelines recommend the use of a 2-D imaging ultrasound as a preferred method for peripheral nerve block and regional anaesthesia in adults and children This study had been done to evaluate and compare pre-emptive ilioinguinal/ iliohypogastric (II/IH) combined nerve block and surgical incision line local anaesthetic infiltration for postoperative analgesia in paediatric inguinal hernia repair.

METHODOLOGY

This randomized controlled trial was conducted in Department of Anaesthesia, Analgesia, Palliative and Intensive care medicine of Dhaka Medical College and Hospital from September 2018 to March 2021. With proper approval by the Ethical Review Committee, this study was carried out in 60 paediatric patients (Age 1-7 years) belonging to American Society of Anesthesiologists (ASA)[8] physical status I or II, scheduled for surgical repair of inguinal hernia under general anaesthesia over a period of 31 months. Randomization was achieved by computer-generated random number table and the patients were distributed into group A and group B. The principal investigator performed the II/IH nerve block and surgical incision line LA infiltration. Trained appointed observers in the post anaesthesia care unit (PACU) collected the data in the postoperative period who were blinded to the group assignment and they were trained and instructed on how to assess pain by using FLACC scale[9], collected data were recorded in a data collection form.

During pre-anaesthetic visit, the patients' legal guardians were explained about the study purpose, advantages and risks of the procedure and informed written consent was obtained. Patients' parents were instructed to demand analgesia as per requirement of their children.

Fasting guideline[10] was, nothing by mouth 6 hours to solid food, 4 hours to breast milk, 6 hour to formula milk and 2 hours to clear fluid. No premedication was administered. On arrival in the theatre baseline heart rate and mean arterial pressure were recorded. All patients were induced with halothane (1-4.0%) incremental doses in 100% oxygen via Mapleson D (Bain Circuit) for patients > 25 kg or Mapleson F breathing circuit (Jackson Rees modification of the Arye T piece) for patients < 25kg weight. After inhalational induction of anaesthesia intravenous (IV) access was secured with a 22–24-gauge cannula and the airway was secured with an appropriately sized LMA. Anesthesia was maintained with 1 minimum alveolar anesthetic concentration of halothane in oxygen/nitrous oxide, 40:60. The Patients were allowed to breathe spontaneously.

After securing the airway, in case of patients in group A, surgical incision line infiltration with bupivacaine was performed under all aseptic precautions. According to the incision line marked by surgeon, infiltration was done starting from a point 2.5 cm medial to the anterior superior iliac spine and continued further medially. Infiltration of 1mg/kg of 0.25% bupivacaine was done subcutaneously along this line of incision parallel to the surface of the skin, intradermal along this incision line making a skin wheal with 23- gauge, 1-inch needle.

Patients in group B had received, USG-guided II & IH combined nerve block (using SonoSite™ Micromax machine, linear high-frequency probe, 6–13 MHz).

RESULTS

Current study aimed at evaluating and comparing II-IH combined nerve block & incision line local anaesthetic infiltration as Pre-emptive analgesic techniques in paediatric inguinal hernia repair for postoperative pain management. For this purpose, data was analyzed for 60 patients as they were randomly allocated into two groups. Group-A had received incision line LA infiltration and group-B had received ilioinguinal-iliohypogastric nerve block. The patients in two groups had been compared in respect to demographic criteria, HR & MAP, mean pain score in FLACC scale during post-operative period, time of 1st dose of

analgesic (pethidine) requirement, total pethedine consumption during first 24 hours and adverse effects in post-operative period. The baseline characteristics of the study participants are presented in table:

Table I: Demographic profile & duration of surgery of the patients:

Criteria	Group A n=30	Group B n=30	P value
Age(year)	4.52 ± 3.47	4.78 ± 3.70	0.542
Gender ratio (M/F)	27/03	28/02	0.674
Weight(kg)	14.3± 3.26	15.34±4.21	0.543
ASA classification Class I	25(84%)	23(76%)	0.439
ASA classification Class II	5 (16%)	7 (24%)	0.258
Duration of surgery (min)	47.53± 13.62	46.17± 15.56	0.376

Values are described as mean ±SD except for ASA status (expressed as percentage).
P values were determined by chi-square test and student's t – test No statistical difference was found regarding the demographic criteria between two groups. The mean duration of surgery (min) was almost same in both groups.

Perioperative mean heart rate (HR) of the patients (in beats/min):

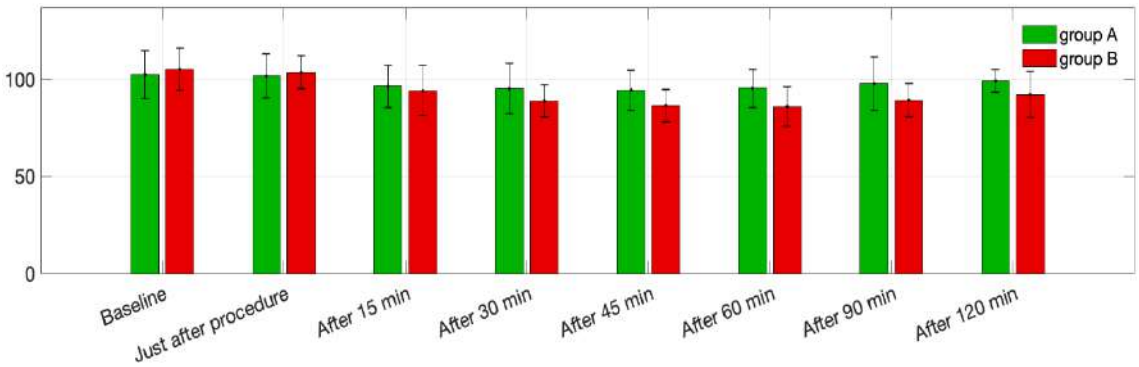

Figure 4: Trends in perioperative mean heart rate (Beats/min) of the patients.

This figure shows that there was reduction in mean heart rate at 30 minutes in both groups, but more evidenced in group B. Mean heart rate

continued to fall in both groups until 60 minutes after the procedures but were close to baseline value and then mean heart rate started to raise toward baseline but in group B not reached to baseline within 120 minutes of performance of the procedure.

Perioperative mean arterial pressure (MAP) of the patients (in mmHg):

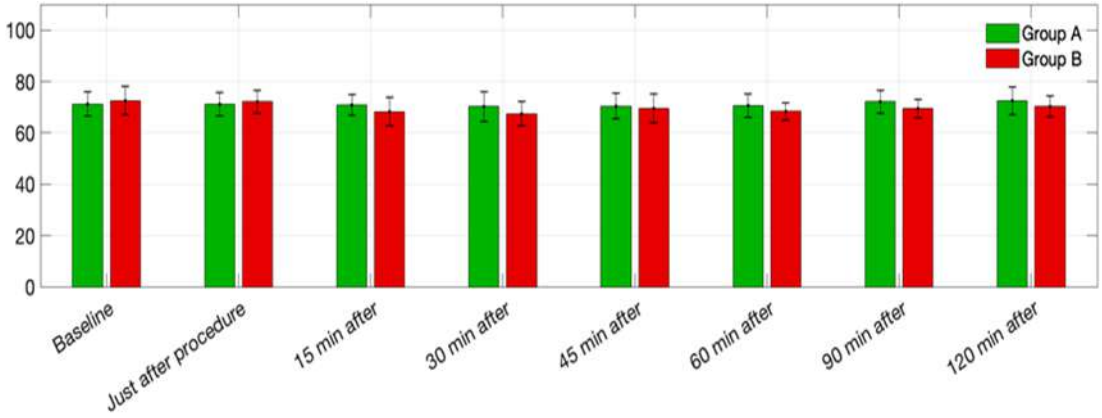

Figure 5: Trends in perioperative mean arterial pressure (MAP) (in mmHg) of the patients

Values of mean arterial pressure are close to the baseline value in both groups at different time points. Which indicates that both II-IH combined nerve block and surgical incision line local anaesthetic infiltration maintained haemodynamic stability in perioperative period.

Table II: FLACC score of the patients at different follow-up points

Time	Group A (n=30)	Group B (n=30)	P- Value
2 hrs	4.45±2.3	2.13±1.4	0.001
4 hrs	2.43±2.1	2.84±2.3	0.213
6hrs	2.12±2.4	4.37±2.2	0.001
8 hrs	3.23±2.2	2.13±2.1	0.065
10 hrs	4.65±2.5	2.38±1.8	0.001
12 hrs	2.62±2.1	4.75±2.3	0.001
16 hrs	4.23±2.4	2.26±2.1	0.001
24 hrs	3.21±2.3	2.15±1.9	0.072

Values are expressed as mean ± standard deviation.Student's t - test was performed to compare the mean FLACC score of both groups.

Mean values of FLACC score were significantly higher at 2 hours, 10 hours and 16 hours in group-A during post-operative period (<0.05). In case of group-B mean values of FLACC score were higher at 6 hours and 12 hours. The

rescue analgesic was given during this time. At the end of 24 hours mean FLACC score was higher in Group A but not statistically significant (>0.05).

Table III: Distribution of patients by FLACC score ≥ 4 at different points of time

Time	Group A (FLACC score ≥ 4) Number of patients	Group B (FLACC score ≥ 4) Number of patients
2 hr	23 (76%)	0 (0%)
4 hr	4 (13%)	7 (23%)
6 hr	6 (20%)	20 (66%)
8 hr	10 (33%)	8 (26%)
10 hr	20 (66%)	2 (6%)
12 hr	1 (3%)	22 (73%)
16 hr	20 (66%)	3 (10%)
24 hr	1 (3%)	2 (6%)

Values are expressed as number (percentage)

According to this table at 2 hours maximum patients (76%) in group-A had pain sore ≥ 4 and required rescue analgesia. Then at 10 hours and 16 hours higher number of patients in group-A (66%) had pain score ≥4. At these time points they needed rescue analgesic. Whereas 66% patients at group-B showing score ≥4 at 6 hours. Maximum patients in group-B required rescue analgesic at 12 hours as 73% of patients in group-B achieved pain score ≥ 4 at 12 hours. At the end of 24 hours only 3% and 6% patients respectively in group-A and B had FLACC score ≥4. At the end of 24 hours good analgesia was maintained in both groups.

Table IV: Time of first analgesic requirement and total opioid (Pethidine) consumption in first 24 hours:

Variable	Group A (n=30)	Group B (n=30)	P-value
Time of first analgesic requirement (min)	127.4±13.6	356.42±20.62	0.0015
Total Opioid (Pethidine)	44.24±12.73	30.43±10.53	0.005

consumption in first 24 hours (mg)

Data was expressed as mean± SD.

Student's - t test was done to analyze the data. Mean duration of analgesia for group A was 127.4±13.6 minutes and for group B was 356.42±20.62 minutes. Mean values of post-operative pethidine requirements were 44.24±12.73 mg and 30.43±10.53 mg respectively in group A and group B. Statistically significant differences (P value <0.05) were found in duration of analgesia (min) and total opioid (Pethidine) consumption in first 24 hours between the groups. Among the participants in group B duration of analgesia was higher and postoperative pethidine consumption was less.

Table V: Comparison of adverse effects during post-operative period in two groups

Adverse effects	Group-A (n= 30)	Group-B (n= 30)	P-value
Nausea	6 (20%)	2 (6%)	
Vomiting	3 (10%)	1 (3%)	
Bradycardia	3 (10%)	0	
Tachycardia	6 (20%)	3 (10%)	
Oxygen desaturation	2 (6%)	0	
Total	20 (66.67%)	6 (20%)	0.001

Values are expressed as number (percentage)

P-values were determined by chi-square test.

In group-A, 20% patients had post-operative nausea, 10% patients had post-operative vomiting, 10% had Bradycardia, 20% had tachycardia, 6% had oxygen desaturation. In group- B, only 6% patients had post-operative nausea and 3% patients had vomiting and 10% had tachycardia. Significant statistical difference was found in adverse effects between two groups and adverse effects were higher among the patients in group A (P value <0.05). Adverse effects are partly due to increased consumption of opioid analgesic (pethidine) and due to pain in. Causes of bradycardia could not be identified.

DISCUSSION

Efficacy and safety ilioinguinal & iliohypogastric (II & IH) nerve blockade is a popular option of postoperative analgesia in children, especially when it is done under USG guidance11. On the other hand, incision line LA infiltration is easy to perform, safe with no extra cost attached to its application. The current

study aimed to evaluate and compare pre-emptive II-IH combined nerve block and surgical incision line LA infiltration for postoperative analgesia in surgical repair of paediatric inguinal hernia, with respect to time of first analgesic requirement and total rescue analgesic consumption in first 24 hours of postoperative period. According to present study no statistical difference was found in aspect of age, gender, ASA classification, weight of the patients and the mean duration of surgery (min) (P>0.05) between two groups (group-A & group-B).

According to the current study it has been observed that heart rate and MAP at different points of time in perioperative period were close to the baseline value in both groups. These findings indicated that II, IH nerve block and incision line LA infiltration did not produce any adverse effects on the vital signs of the patients. These findings are consistent with the study done by Sujatha et al4 (2017) who found that heart rate and mean arterial pressure were stable in pre-emptive II/IH block group and TAP block group. Similar study done by karim et al12 (2020), compared the analgesic efficacy of the pre-emptive II/IH nerve block with wound infiltration in children (6months-7 years).

The current study has shown that mean value of FLACC score was higher at 2 hours, 10 hours and 16 hours in group A (P<0.05), while FLACC score was higher at 6 hours and 12 hours in group-B. Which indicates better analgesia in group-B with reduced opioid requirement. Similar study done by Toker et al (2016) compared pre-emptive regional (caudal, II/IH nerve block and local anaesthetic infiltration) analgesic modalities for unilateral inguinal hernia repair in children13.

According to the findings of present study bupivacaine infiltration was effective in first two hours as 76% of patients in group-A had FLACC score ≥4 at the end of 2nd hour. At 4th hour 13% in group-A and 23% in group-B had score ≥4 and required rescue analgesic. Similar study done by Salman & Jwad (2017), have compared the postoperative analgesia provided by simple bupivacaine wound instillation and ultrasound guided inguinal field block14. Their study had shown that bupivacaine instillation was effective only in the first two hours as compared to field block with significant difference (p-value < 0.05) for analgesia requirement which is consistent with the finding of present study.

Current study has documented significant differences in between groups regarding time of first analgesic requirement and total opioid consumption in first 24 hours. Both of the techniques reduced opioid consumption to some extents. II-IH combined block provided prolonged analgesia of 356.42±20.62 minutes. II-IH nerve block also has significant opioid sparing property comparing to surgical incision line local anaesthetic infiltration. These techniques allowed judicious use of opioid which is appropriate in day surgery, because indiscriminate use of long-acting opioids causes adverse effects that may prevent discharge.

Similar study done by Karim et al (2020) documented that need for rescue analgesia was significantly lower in the II & IH nerve block group when compared with infiltration group (P < 0.001). Their study also had shown that total opioid consumption (mg) was significantly lower in block group than in infiltration group. Their findings are consistent with present study.

The current study has documented that patient in group-B had significantly less postoperative adverse effects than in group-A (P=0.001) regarding nausea,

vomiting, bradycardia, tachycardia, oxygen desaturation. Adverse effects were more among the patients in group-A probably due to increased opioid consumption and due to pain.
No adverse events such as nausea, vomiting or sedation were noted in similar study done by Karim et al (2020) in both group (II/IH nerve block, wound infiltration).

Above discussion highlighted that local anaesthetic based pre-emptive analgesic technics with either a peripheral nerve block or incision site LA infiltration can reduce postoperative pain. But II-IH nerve block has more opioid sparing effects. As a consequence of which patients in group-B suffered less from opioid related side effects.

CONCLUSION:

1. Both ilioinguina-iliohypogastric combined nerve block and surgical incision line local anaesthetic infiltration provided pre-emptive analgesia for postoperative pain management in paediatric inguinal hernia repair.
2. Ilioinguinal-iliohypogastric combined nerve block provided longer period of postoperative analgesia than surgical incision line local anaesthetic infiltration with reduced opioid consumption and less adverse effects.

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