ORIGINAL ARTICLE

Caudal Epidural Block versus Combined Ilioinguinal and Iliohypogastric Nerve Block for Post-Operative Analgesia in Pediatric Surgeries Below the Umbilicus

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ABSTRACT

Objective: To compare the duration and effectiveness of postoperative analgesia provided by caudal block versus combined Ilioinguinal and Iliohypogastric nerve block in pediatric infra-umbilical surgeries.

Study Design: Quasi-experimental.

Place and Duration of Study: The study was carried out at the Anesthesia Department of Pak Emirates Military Hospital (PEMH) Rawalpindi, Pakistan, from June 2021 to December 2021.

Materials and Methods: Sample size was calculated from the WHO sample size calculator using the population size received in 6 months. The sample size was filtered down by purposive sampling to 80 (children aged 5-10 years) using a pre-defined inclusion/exclusion criterion scheduled for below umbilicus surgeries. They were alternatively divided into two equal groups (n=40) where Group-C received a caudal block and Group-I received ultrasound-guided Ilioinguinal and Iliohypogastric nerve block. Both groups underwent the same general anesthesia technique with I-gel and similar medications at inductions. Our primary outcome measure was the duration of analgesia using the Revised Faces Pain Scale, where *p*-value <0.05 was considered significant. The secondary outcomes measured were motor block and urinary retention.

Results: Median revised Faces Pain Score (FPS-R) immediately after surgery was 1.50(1) for Group-C and 0.00(1) for Group I, respectively. At 4 hours postoperatively, the median FPS-R in Group-C was 4.00(2), and in Group I, it was 2.00(0). After 8 hours, Group-C had a median FPS-R of 6.50(1) and Group-I had pain scores of 3.00(1). Median pain scores of Group-C and Group-I at 12 hours postoperatively were 8.00(1) and 5.00(1), respectively. The demographic characteristics of the patients were comparable in both groups with similar duration of surgery. Group-C reported some cases of side effects, such as motor block and urinary retention, while Group-I did not have any of these effects. All anesthetic procedures did not otherwise have any adverse events.

Conclusion: Our study demonstrated that combined Ilioinguinal and Iliohypogastric nerve block furnished efficient post-operative analgesia while requiring smaller amounts of local anesthetics and avoiding the adverse effects of the caudal block. It is an ideal regional block technique for infra-umbilical surgeries in pediatric populations at busy centres.

Keywords: *Analgesia, Anesthesia, Hernia, Nerve Block, Orchidopexy, Pain Management, Perioperative Care, Regional Anesthesia.*

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Introduction

Pain is one of the top concerns of any individual undergoing a surgical procedure. When a child who cannot articulate his plight properly undergoes a procedure, it is a cause of much distress in the parents. It leads to an unsatisfactory experience for both the child and the guardian. There have been numerous studies on various pain relief methods

perioperatively: oral or intravenous drugs, nerve blocks, acupuncture, or a whole battery of different methods being used in conjunction with each other for multimodal analgesia.[1] Recently, nerve blocks have gained popularity among anesthesiologists due to their high efficacy, immediate onset, prolonged duration, and recent advancements in imaging techniques.[2]

Herniotomy with or without orchidopexy is the most common procedure in the pediatric population, which is associated with significant post-op discomfort, consequently leading to opioid overprescription.[3] Multiple nerve blocks have been studied as an alternative for post-op pain relief.[4] Among these, caudal block and combined Ilioinguinal, Iliohypogastric nerve blocks are routinely employed for analgesia. The caudal block provides good analgesia but is associated with significant motor blockade and urinary retention.[5] Ilioinguinal, Iliohypogastric nerve block, although not associated with these side effects, is considered a reasonable alternative to caudal block in providing a similar level of analgesia.[6,7]

The rationale of our study was to measure the intensity and duration of analgesia followed by the Ilioinguinal/Iliohypogastric nerve block to compare it to the caudal block to establish its non-inferiority. It was hypothesized that the analgesia coverage of the Ilioinguinal/Iliohypogastric nerve block was not comparable to that of the caudal block, so our study was designed to test this null hypothesis. Ours is a tertiary care hospital that receives pediatric surgery cases from all over the country. With a rapid turnover, our objective was to ascertain a pain relief technique that is efficient, time-saving, with the least complications, and requires minimal rescue analgesia.

Materials and Methods

The Quasi-experimental study was carried out at the Anaesthesiology Department of Pak Emirates Military Hospital (PEMH) Rawalpindi, Pakistan, from June 2021 to December 2021.

Permission was granted from the ethical committee and hospital administration with IERB number A/28/159(1). We did a prospective comparative study which was single-blind. Patients were selected by purposive sampling. The sample size was calculated on Open Epi (https://www.openepi.com/SampleSize) by estimating the total number of cases received over a period of 6 months (480), keeping the confidence interval 95%, prevalence of 50% and the power of the study at 80% which yielded a sample size of 214. When we assumed the difference of pain scores between the two groups as 1, the sample size came out to be around 78. After considering exclusion criteria, a total of 80 patients were selected for the study. Using the purposive sampling method, the patients were alternatively segregated into two groups. Group-C received a caudal block, and Group-I received a combined Ilioinguinal and Iliohypogastric block.

Inclusion criteria: Patients were aged 5-10 years, ASA I-II, inguinoscrotal surgery, indoor admitted cases having informed consent of parents.

Exclusion criteria: Patients were ASA 3 or greater, known allergy to local anesthetics, daycare procedure, inadequate analgesia following block, and refusal by the parent/guardian.

After informed consent and a detailed pre-anesthesia assessment, the child was prepped for surgery. ASA standard monitoring was applied, and Sevoflurane 8% was used for the 'Steal Induction' technique, followed by securing appropriately sized I/V access. Both groups received 2 mg/kg Propofol, 0.1 mg/kg nalbuphine, and 0.1 mg/kg dexamethasone at induction. After the adequate depth of anesthesia was achieved, an appropriately sized disposable I-gel (Intersurgical Ltd.) was placed. The maintenance phase was established with Isoflurane at 1.2 MAC and 100% oxygen. Vitals were monitored during the surgery with pulse oximetry, electrocardiogram, blood pressure, and capnometry. Blocks were applied before the surgical procedure by a consultant anesthesiologist whose area of expertise was regional blocks with specific training in pain management. In Group-C, after placing the child in the left lateral position, antiseptic measures were adopted. Sacral hiatus was identified between the sacral cornu using the landmark technique, and a 23G needle was used to pierce the sacrococcygeal membrane confirming the loss of resistance with air injection. After verifying negative blood and cerebrospinal fluid aspiration, caudal block was administered with 0.25% Bupivacaine with a volume

of 0.5ml/kg as ASRA and ESRA joint guidelines recommended.[8] During the peri-operative period, the patient was observed for time first to rescue analgesia if needed while monitoring the vitals. A rise in heart rate and blood pressure of 20% from baseline was considered the trigger point to administer rescue analgesia, namely paracetamol 10-15mg/kg.

For Group I, the ultrasound machine Mindray model Z6 with a linear probe 7.5MHz frequency was used to locate the nerves. After necessary aseptic measures, an ultrasound probe was placed 1-2cm above the anterior superior iliac spine. Using the in-plane technique, a 20 G 5cm nerve block needle (Locoplex, VYGON-France) was inserted between the internal oblique and transversus abdominis muscle while identifying the nerves and surrounding structures and depositing 0.25% bupivacaine limiting to a maximum dose of 2mg/kg. During the surgery, vital signs were closely observed in response to a surgical stimulus to confirm the adequacy of the block. A 20% rise in heart rate from the baseline was regarded significant enough to consider the block inadequate, and analgesia was then augmented with intravenous paracetamol 10-15mg/kg.

Following surgery, patients were detained in PACU for an hour and then transferred to the post op ward. Duration of analgesia, our primary outcome measure, was assessed immediately, 4 hours, 8 hours, and 12 hours after surgery by using the Faces Pain Scale-Revised (FPS-R). An anaesthesiologist recorded the data. The time to first rescue analgesia (10mg/kg paracetamol given intravenously) was recorded. Additionally, they were also observed for motor blockade and urinary retention. The parents/guardians of the, pediatric patients were involved at every step during the study. They were asked for feedback and satisfaction regarding their ward's pain relief and overall experience. The response was also saved for later scrutiny.

Statistical Analysis

The data collected was analyzed using the IBM SPSS statistics version 23 (IBM Corp). Revised Faces Pain score was used to gauge the intensity of analgesia for both nerve blocks, which was our primary outcome measure at 0 hours, 4 hours, 8 hours, and 12 hours. The time to first rescue analgesia was recorded but not used in the subsequent statistical analysis. Secondary outcome measures were associated with side effects, including motor blockade and urinary retention. The Arithmetic Mean and standard deviation of variables were calculated. Median and Interquartile ranges were calculated for non-parametric quantitative variables. Mann-Whitney U test was used to compare both groups since the data were not normally distributed (Shapiro–Wilk test used because n<50 and resulting p-value was <0.05). In contrast. At the same time, application of the Chi-square test for categorical variables was carried out to present numbers and frequencies (%). We considered *p* value less than 0.05 to be statistically significant.

Results

Statistical analysis of both groups showed a significant difference in the average pain scores, with *p* value being less than 0.05 in all four categories (Table 1). Median Revised Faces Pain Scores immediately after surgery in PACU for Group-C and Group-I showed that the difference between them was a little wide. At 4 hours postoperatively, the median FPS-R in Group-C was 4.00, and in Group I, it was 2.00. After 8 hours, Group-C had a median FPS-R of 6.50, and Group-I had median pain score of 3.00, portraying that the difference had significantly widened between the two groups by 8 hours. 12 hours postoperatively, 8.00 and 5.00 were median pain scores of Group-C and Group-I respectively.

The Demographic characteristics of the patients

Table 1: Postoperative pain p erception in both groups (n=40), IQR: interquartile range

Parameters	Group-C Median (IQR)	Group-I Median (IQR)	*p* Value
Revised Faces Pain Score At Zero Hours	1.50 (1)	0.00 (1)	<0.001
Revised Faces Pain Score At 4 Hours	4.00 (2)	2.00 (0)	<0.001
Revised Faces Pain Score At 8 Hours	6.50 (1)	3.00 (1)	<0.001
Revised Faces Pain Score At 12 Hours	8.00 (1)	5.00 (1)	<0.001

Test Applied: Mann-Whitney U Test

were equally distributed in both groups Table 2.

Table 2: Demographic characteristics of study groups (n=40), IQR: interquartile r ange

Parameters		Group-C Median (IQR)	Group-I Median (IQR)	*p* Value
Age		7.00 (4)	7.00 (4)	0.680
Weight		21.25 (9.5)	24.12 (12.5)	0.424
Duration Of Surgery		35.00 (10)	38.00 (11)	0.349
Duration Of Analgesia		300 (50)	430 (78)	0.027
		Frequency n (%)	**Frequency n (%)**	
Rescue Analgesia		12 (30%)	4 (10%)	0.025
Gender	Male	23(57.5%)	23(57.5%)	>0.99
	Female	17(42.5%)	17(42.5%)	
ASA Status	ASA I	28(70%)	30(75%)	0.617
	ASAII	12(30%)	10(25%)	

Tests Applied: Mann-Whitney U Test, Pearson Chi-Square Test

Their *p-value* was statistically insignificant. The Mean surgery duration was also similar in both groups (p>0.05). Duration of analgesia had a significant difference between both groups, with median duration of 300 min in Group-C and 430 min in Group I.

Table 3: Frequency of complications in the study groups (n=40)

Complications		Group-C Frequency n (%)	Group-I Frequency n (%)	*p* Value
Motor Block	Yes	8(20%)	0(0%)	0.003
	No	32(80%)	40 (100%)	
Urinary Retention	Yes	7 (17.5%)	0(0%)	0.006
	No	33 (82.5%)	40 (100%)	

Test Applied: Chi-Square Test

Group-C reported multiple complications such as motor block and urinary retention, while Group-I did not have any Group-I adverse effects as depicted in Table 3. All anesthetic procedures did not otherwise have any adverse events.

Discussion

We found Iliohypogastric/Ilioinguinal nerve block to provide analgesia comparable to caudal block without its side effects of motor blockade and urinary retention. Caudal Block, though provides immediate onset and dense block. However, its associated complications, albeit rare, are dire and sometimes life-threatening, as described in the case report of total spinal anesthesia by Sisay A et al. from Ethiopia in a five-year-old child undergoing hypospadias surgery.[9] Such incidents necessitate peripheral nerve blocks with greater safety margin since inguinal hernia repair is a common procedure in the pediatric age group, with most surgeries being performed as daycare procedures.[10]

Although a relatively short procedure, inguinal hernia repair results in moderate to severe pain post operatively with a significant number turning into chronic post-operative inguinal pain.[11,12] Anatomically, the sensory innervation of the inguinal region is mostly supplied by the T12–L2 nerves.[13] The ilioinguinal and iliohypogastric nerves, which are branches of T12 and L1, pass during their course between the internal oblique and transversus abdominis muscles at the level immediately superior to the anterior superior iliac spine. It is here that the local anesthetic is deposited.[14]

M H Nafie et al. compared the effect of ultrasound-guided ilioinguinal and iliohypogastric nerve block with caudal block in children aged 1-6 years, showing the former provided faster onset and longer duration

of analgesia with no recorded complications supporting our observation.[15] A prospective cohort study conducted by Yimer Y et al. at Menellik II Hospital found caudal epidural block to give longer duration of analgesia in the pediatric population undergoing inguinal surgeries.[16] They found that the intensity of pain and consumption of analgesics was comparable in both groups, citing the possible reason for shorter duration of IL/IH block in their study due to the imprecise description of the landmarks while focusing on the needle tip resulting in multiple injections.

We used ultrasound guided technique for IL/IH block which could explain the improved duration and intensity of analgesia in IL/IH group. This is also supported by multiple studies showing definitive benefit of point-of-care ultrasound such as Fragga MV et al.[17]

In another scientific review by Toker MK et al. postoperative duration of analgesia was compared between caudal, ilioinguinal/Iliohypogastric, and wound instillation.[18] They found wound instillation to provide inadequate analgesia immediately post-operatively while caudal and ilioinguinal/ iliohypogastric nerve blocks were comparable. However, the concentration of bupivacaine used by them was different for both blocks, that is, 0.5% for caudal and 0.25% for IL/IH block, while we used a concentration of 0.25% for both interventions.

The results matched our observation in a study quite similar to ours by Abdellatif AA.[19] They called Ilioinguinal, Iliohypogastric nerve block an ideal choice for children undergoing unilateral inguino-scrotal surgeries further supporting our study where the technique of block administration was also almost identical.

An area of interest for our further studies in the future would be to observe the effects of adjuncts in regional anaesthesia. There is significant evidence that clonidine and dexmedetomidine added to the local anesthetic in both pediatric neuraxial and peripheral nerve blocks extends the duration as well as density of the analgesia,[20] albeit the associated systemic side effects[21] and unestablished safety of dexmedetomidine in neuraxial anaesthesia.

Limitations of Study

Since this was a single center study, it does not represent the whole population. Only ASA I and II patients were included in the study so the results cannot be extrapolated to ASA III or higher population who have changed pain perception due to organic causes.

Conclusion

We concluded that ultrasound guided Ilioinguinal, Iliohypogastric nerve block was a better technique in imparting good quality post-operative analgesia in children undergoing inguino-scrotal surgeries while avoiding the complications of caudal block and requiring smaller amounts of local anesthetics.

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