

Research Article

Regional Block, Wound Infiltration, and Caudal Block For Post Operative Pain Management in Children Undergoing Inguinal Herniotomy: A Randomized Controlled Trial

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Abstract

Background: Pain management postoperatively for such a common condition plays an important role, as unmanaged pain may cause behavioral and sleep changes, and parental distress.

Objective: To compare regional block, caudal block, and wound infiltration for post-operative pain management in pediatric inguinal herniotomy.

Methods: A randomized, controlled trial (NCT 05969613) was carried out in Pediatric Surgery Department, KEMU from January till December 2019, and 300 patients undergoing inguinal herniotomy were enrolled after informed consent. They were randomly allocated in 3 groups and underwent regional block in Group A, wound infiltration in Group B, and caudal block in Group C using Bupivacaine. Rescue analgesia was given if pain scores were ≥ 4 . Postoperative pain scores, duration of analgesia and complications like urinary retention and wound infection were compared.

Results: Postoperative FLACC scores revealed need of rescue analgesia in 9(9%) patients at 2nd hour in Group C (p value <0.001), and at 8th hour, 12(12%) in Group A, 19(19%) in Group B, and 30(30%) in Group C had score ≥ 4 (p value 0.000). Wong Baker Score also revealed higher scores and need of rescue analgesia in Group C than Group A or B after 4 hours postoperatively (p value <0.001). Duration of analgesia was 288.16 ± 23.7 min in Group A, 338.55 ± 19.79 min in Group B, and 262.43 ± 15.4 min in Group C (p value <0.001). Urinary retention was present in 9 (9%) children in Group C (p value <0.001). Six (6%) children had wound infection in Group A, three (3%) in Group B, and 15 (15%) in Group C (p value 0.005).

Conclusion: Regional block and wound infiltration were more effective as compared to caudal block in terms of pain control. Caudal block also had more complication rates.

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Introduction

Inguinal hernia is so common that around 5% of

children develop it and only 10% of these patients have a positive family history. Incidence is higher in twins, premature infants, and males. It is more common on right side (60% cases).¹

Pain management postoperatively for such a common condition plays an important role, as unmanaged pain may cause behavioral and sleep changes, and parental distress.^{2,3} It has been treated by different modalities



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and trials are available comparing narcotic/ non-narcotic analgesics, infiltration of various medications and caudal/ regional blocks.^{4,5}

Caudal block is the most preferred technique in children for any sub-diaphragmatic surgical procedures. It reduces post-operative blood loss and provides good analgesia, though may have side effects like urinary retention or during application, subcutaneous infiltration, dural and/or venous rupture.⁴ On the other hand, regional blocks have fewer side effects like nerve injury and can even be administered in patients with deranged bleeding profiles. These may be site limited, still are gaining popularity.⁵ The easiest method used is wound infiltration. It may have risk of wound infection and systemic toxicity of local anesthetic infiltrated.⁶

There is no conclusive evidence regarding the superiority of these techniques for pain relief using Bupivacaine. Amminikutty et al showed superiority of local bupivacaine infiltration over caudal block in terms of analgesia duration.⁶ While Jahromi et al showed equivocal results,⁷ and Bhattaria et al showed superiority of regional block over caudal block.⁸ Owing to this controversy in literature, we planned to compare regional block, wound infiltration and caudal block for post operative pain management in pediatric inguinal herniotomy.

Methods

This randomized, controlled trial was carried out in Pediatric surgery over a year from January till December 2019. Approval was taken from institute (IRB no 314/RC/KEMU/ dated 12/12/2018) and trial registered (NCT 05969613). Using purposive sampling technique, sample size of 300 patients (100 patients in each group) was estimated by using 5% level of significance, 90% power of test with expected mean value caudal block group as 2.5 ± 5.29 and regional block and wound infiltration groups as 1.58 ± 0.9 .¹⁰

All children with inguinal hernia presenting to Pediatric surgery department, KEMU/Mayo hospital, Lahore were included if more than 3 years of age and under 13 years, and had no history of allergy to Bupivacaine, or infection at the site of regional, caudal, or local infiltration. Patients presenting with irreducible, obstructed or strangulated inguinal hernia, or with deranged bleeding profiles, or spinal deformities were excluded. Informed consent was taken from parents/guardians

and patients were randomized in three groups by a computer-generated table (100 patients in each group). In group A (regional block group), iliohypogastric and ilioinguinal nerves (IL/IH) were blocked by using 0.25% bupivacaine (2ml/kg and combined with skin infiltration of adrenaline 1:200000). In group B (wound infiltration group), 0.25% bupivacaine @ 0.5ml/kg was infiltrated at the surgical site, before wound closure. In group C (caudal block group), 0.25% Bupivacaine around 1ml/kg was administered at the caudal space in the sacral portion of the epidural space. Caudal anesthesia involved needle penetration of the sacrococcygeal ligament covering the sacral hiatus, created by the unused S4 and S5 laminae. All patients underwent inguinal herniotomy as per routine of the department. Patients were assessed for pain intensity using FLACC pain scale in children less than 8 years of age and Wong-Baker Faces pain scale in children 8 years or older, at 0,1,2,4,8,24 hours post-operatively. Patients were discharged after 24 hours, if stable. When pain score was ≥ 4 Ketorolac (0.5 mg/Kg/dose) was given as rescue analgesia. Duration of analgesia was recorded for each group. Urinary retention was observed over 24 hours, and wound infection was noted on follow-up at day 7 (see Figure 1). All observations were made by a doctor on duty who was blinded for group allocation.

Data was analyzed using SPSS version 26. Quantitative variables like age, duration of analgesia, pain scores were presented as mean \pm Standard deviation and qualitative variables like gender, need of rescue analgesia was presented as frequency and percentage. The ANOVA test was applied to compare the efficacy of regional block, wound infiltration, and caudal block between three groups. Complications were compared by chi-square. p-value of less than 0.05 was taken as significant.

Results

A total of 300 patients were enrolled and the age was between 3-12 years in all treatment groups. Mean age of patients in Group A, B and C was 7.69 ± 2.83 years, 7.54 ± 2.98 years and 8.17 ± 2.86 years.

In Group-A 47(47%) were male and 53(53%) were female. In Group-B 50(50%) were male and 50(50%) were female, while in Group-C 48(48%) were male and 52(52%) were female.

At 0 and 1st hour no child had scores ≥ 4 and there was

no significant difference in FLACC score in treatment groups (p value 0.12 and 0.53). At 2nd hour, 9(9%) children scored ≥ 4 in Group C, while none needed rescue analgesia in Group A or B (p-value<0.001). At 4th hour, 7(7%) children in Group A, 12(12%) children in Group B and 23(23%) children in Group C scored ≥ 4 (p-value = 0.004). At 8th hour, 12(12%) children in Group A, 19(19%) children in Group B and 30(30%) children in Group C scored ≥ 4 (p-value 0.000) and 24th hour (p-value=0.004) as seen in Table 1.

For Wong Baker score no significant difference was seen at 0 hour (p-value 0.987), 1st (p-value 0.497) and 2nd hours (p-value 0.06). At 4th (2.48±0.51 vs 2.58±0.49 vs 2.85±0.71 p-value<0.001), 8th (2.87±0.78 vs 2.9±0.82 vs 4.83±0.84 p-value<0.001) and 24th hour (4.32±1.12

Table 1: FLACC Pain Scores in Treatment Groups

Groups	FLACC SCORE	POSTOPERATIVE HOUR					
		0-10	0	1 ST	2 ND	4 TH	8 TH
Group A	0	51	52	0	0	0	0
	1-3	49	48	100	93	88	81
	4-6	0	0	0	7	12	15
	7-10	0	0	0	0	0	4
Group B	0	63	48	0	0	0	0
	1-3	37	52	100	88	81	77
	4-6	0	0	0	12	19	17
	7-10	0	0	0	0	0	6
Group C	0	50	44	0	0	0	0
	1-3	50	56	91	77	70	60
	4-6	0	0	9	23	20	24
	7-10	0	0	0	0	10	16
P value		0.121	0.527	<0.001	0.004	0.000	0.04

vs 4.48±1.15 vs 6.45±0.67 p-value<0.001) significant difference was seen in Wong Baker score. Higher scores were seen for Group-C patients (Figure 2).

Duration of analgesia was 288.16±23.7 minutes in Group A, 338.55±19.79 minutes in Group B, and 262.43 ±15.4 minutes in Group C (p value <0.001), indicating longer analgesia in wound infiltration and then regional block.

Urinary retention was seen in 9(9%) patients in Group C, while no patient had urinary retention in Group A or B (p value <0.001).

Six patients (6%) suffered from wound infection in Group A, while three (3%) children in Group B, and

15(15%) patients in Group C (p-value=0.005). Binary logistic regression didn't reveal any significant association between pain scores and wound infection. Separate group analysis also revealed no association.

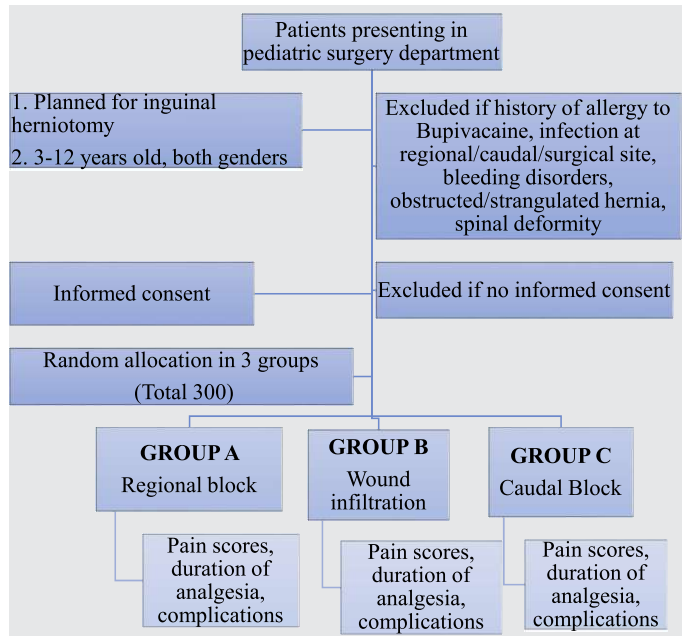


Figure-1: Flow chart of patient recruitment, allocation, intervention, analysis.

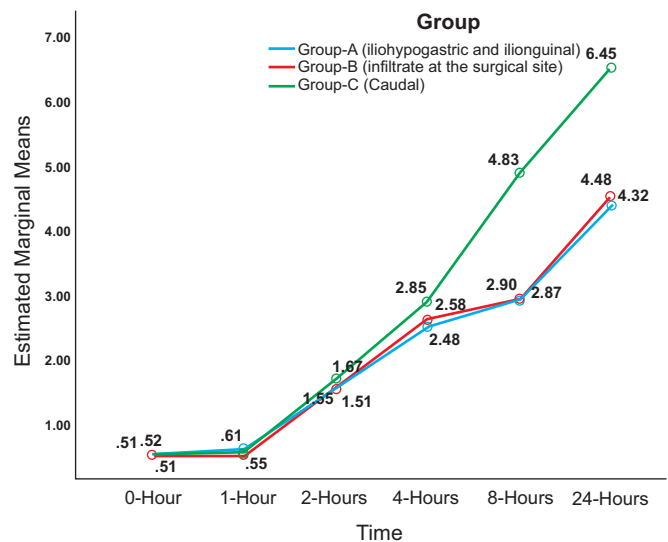


Figure-2: Wong Baker Score in Treatment Groups at different time Intervals

Discussion

Post operative pain after inguinal herniotomy is frequently under managed,^{2,11} and through this trial we compared the 3 commonly used techniques (regional

block, caudal block, and wound infiltration) for postoperative pain management in children undergoing inguinal herniotomy. We found significant difference for duration of analgesia in the three treatment groups and need of rescue analgesia, and children suffering less pain in wound infiltration and regional block group than caudal block group.

Caudal block is often taken as a gold standard, but analgesia is usually of short duration, as seen in our study as well. It may have undesired motor blockade, and other complications like accidental dural/ bone marrow/ venous puncture, intestinal injury, infection and/or epidural hematoma formation. Contraindications in children including spinal deformities, bleeding disorders, local inflammation or infection demand an alternative method.^{4,12} The alternate gaining popularity is regional block and ultrasound guided IL/IH block is almost comparable to caudal block for postoperative pain management in children.¹³ The IL/IH blocks provide similar or greater duration of analgesia, though the IL/IH nerve block has reported success rate of 70-80%.¹⁴ Complications include intestinal injury, pelvic hematoma, femoral nerve palsy, and transient paresis.^{5,15} Most practical analgesic technique in pediatric herniotomy is local infiltration of the surgical site. It requires less time and is cheaper and more acceptable to surgeons. Wound infiltration is superior in terms of prolonged action, and significantly reduces postoperative opioid consumption.^{6,16} None of our patients suffered any such side effects. Urinary retention was noted in 9% children of Group C, and wound infection was noted in all groups (more in Group C, p value 0.005) necessitating need to improve aseptic measures. A previous study conducted in the same department reported high microbial contamination in theatres (around 33.3% in environment and 17% in personnel).¹⁷ Similarly, another study from the same department showed higher growth yield in wound swabs,¹⁸ questioning the current aseptic practices and the need to involve infection control department.

Varsha R and his team members compared caudal block with ultrasound guided ilioinguinal iliohypogastric block in pediatric inguinal surgeries. They reported almost no difference in the pain control between the groups (analgesia time 720.3 ± 430.1 min and 808.4 ± 453.1 min, respectively).¹⁹

Another prospective study reported that caudal block

or an IL/IH block yielded a similar duration of postoperative pain relief in pediatric inguinal herniotomy. However, wound-site instillation had inadequate effects compared to caudal and IL/IH blocks.²⁰

Our study however stated that regional block and wound infiltration were superior to caudal block in terms of pain control and duration of analgesia (288.16 \pm 23.7 minutes in Group A, 338.55 \pm 19.79 minutes in Group B, and 262.43 \pm 15.4 minutes in Group C), indicating longest analgesia in wound infiltration and then regional block, and finally caudal block.

Similarly, a study from Egypt compared ultrasound-guided IL/IH block with caudal block for pediatric inguinal herniotomy, and found that nerve block was found to be more effective with better pain control and longer analgesia time.²¹ Other studies have reported the effectiveness of wound infiltration for postoperative pain control in pediatric herniotomy.^{16,22} Local infiltration of bupivacaine is taken as an alternative to caudal bupivacaine for pediatric herniotomy.²³

Extended-release epidural morphine and analgesics like capsaicin, ketamine, gabapentin, dexmedetomidine are being investigated currently, along with different routes for patient-controlled analgesia, to further improve pain management.²⁴

The limitation of our study was that cry/ irritability may not be entirely due to pain but was recorded as need of postoperative analgesia. Another limitation was non-availability of ultrasound in operation theatre for regional block, practically making it a blind procedure, and shorter follow up after surgery. The need to keep the patients for a day in the ward to observe for side-effects of caudal block like urinary retention, and to monitor for duration of analgesia or need for rescue analgesia, made this day care procedure as a routine elective operation, and may be considered as a limitation of this study.

Conclusion

Regional block and wound infiltration were more effective in controlling pain and resulted in longer duration of analgesia and less need for rescue analgesia after pediatric inguinal herniotomy, as compared to caudal block. Urinary retention was noted with caudal block. Wound infection was high especially in caudal block group.

Ethical Approval: The Institutional Review Board, KEMU approved the study vide letter No. 314/ RC/ KEMU.

Conflict of Interest: The authors declare no conflict of interest.

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Authors' Contribution:

MA: Acquisition of data, Conception & design, drafting of article, final approval of the version

FN: Conception & design, analysis & interpretation of data, drafting of article, critical revision for important intellectual content, final approval

AJ: Data analysis & final approval of the version

MSK: Data analysis & final approval of the version

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