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RESEARCH ARTICLE
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COMPARISON OF THE POSTOPERATIVE OUTCOME OF CAUDAL BUPIVACAINE VERSUS SYSTEMIC NALBUPHINE IN CHILDREN UNDERGOING ELECTIVE INGUINAL HERNIA REPAIR AT TERTIARY CARE HOSPITAL, KARACHI

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ABSTRACT

INTRODUCTION: Inguinal herniotomy is one of the most commonly electively done procedures in children. Post-operative pain management had always been a major concern of parents as well as pediatric anesthetists. There are some options that are found and being used currently by pediatric anesthetists. However, there is no consensus over a single best method.

OBJECTIVE: To compare the postoperative outcome of caudal bupivacaine versus systemic nalbuphine in children undergoing elective inguinal hernia repair at Tertiary Care Hospital, Karachi.

STUDY DESIGN: Randomized control trial.

STUDY SETTING: The study was conducted at the Department of Anesthesia, Dow University of Health Sciences, Civil Hospital, Karachi.

DURATION OF STUDY: Six months after approval from 17-07- 21 To 17-01-22.

SUBJECTS AND METHODS: Data were prospectively collected from patients after taking consent. 94 patients who met the diagnostic criteria were included. Quantitative data were presented as simple descriptive statistics giving mean and standard deviation and qualitative variables were presented as frequency and percentages.

RESULTS: A total of 94 patients who met the inclusion and exclusion criteria were included in this study. Mean FACES pain score at 4 hours in the bupivacaine and nalbuphine group was 1.76±0.63 and 1.57±0.49 respectively. P-value was 0.01. Rescue analgesia use in the bupivacaine group showed that 19 (40.4%) and 28 (59.6%) required and did not require rescue analgesia respectively. Whereas, the nalbuphine group showed that 06 (12.8%) and 41 (87.2%) required and did not require rescue analgesia. P-value was 0.01. **CONCLUSION:** Nalbuphine is better than caudal block for postoperative pain management after inguinal herniotomy in children

KEYWORDS: Caudal bupivacaine, systemic nalbuphine, inguinal hernia repair, and inguinal herniotomy.

INTRODUCTION

Pain is an important and complex protective phenomenon. Good postoperative pain relief is important as it alleviates patient distress and aids in a rapid, uncomplicated recovery.[1] Inguinal hernia and hydrocele, which are common problems in children, are frequently treated by herniotomy. [2] Unfortunately, the number of analgesic agents available for postoperative use in pediatric populations

is very limited, particularly when a patient has "nothing per oral" status. [3] Narcotic analgesics are a mainstay in pediatric surgery in this context. According to the studies, children in the surgical ward feel more pain than children in the medical ward, and prevalence was found to be 44% and 13% respectively. And it was found that about 64% of pediatric patients after surgery experience moderate to severe pain while 29% experience mild pain. [4-5]

Studies have described the indications for pediatric caudal block, the level of analgesia, recommended doses, and pharmacokinetics of local anesthetics used in CA and the general or specific advantages and disadvantages of this technique. [6] In children, CA is most effectively used as adjunct to general anesthesia and has an opioid-sparing effect, permitting faster and smoother emergence from anesthesia. [7] One of the major limitations of the single-injection technique is the relatively short duration of postoperative analgesia. The most frequently used method to further prolong postoperative analgesia following caudal block is to add opioids to local anesthetics. [8]

Nalbuphine is a semi-synthetic opioid analgesic that belongs to the phenanthrene family. It is commonly used for pain management in children but is associated with certain side effects such as respiratory and central nervous system depression, emesis, and pruritus due to its effect on μ2 receptors. [9-10] These side effects require intense postoperative care and vigilant nursing. [11] It's considered that post-operative pain management in children is essential as it reduce the pain as well as anxiety of the parents regarding post-operative pain. [12] There are some options which are found and being used currently by pediatric anesthetists. However there is no consensus over a single best method. [13] Reyad et al evaluated postoperative pain outcomes in caudal bupivacaine versus systemic nalbuphine in children undergoing elective inguinal hernia repair and found mean FACES pain score at 4 hour post surgery in caudal bupivacaine group (3.64±1.39) and systemic nalbuphine group (2.40±1.41). [14] Need for rescue analgesia in both (7.3% vs 0%).[14] Liaqat et al found the requirement of rescue analgesia in caudal bupivacaine group 34% and systemic nalbuphine group 14%. Whereas mean FACES pain score at 4-hour post-surgery (1.56±1.24 vs 1.14±1.08). [15]

DATA COLLECTION PROCEDURE:

This study was conducted after approval from College of Physicians and Surgeons Pakistan. Children undergoing inguinal hernia repair at Department of Anesthesia, Dow University of Health Sciences, Civil Hospital, Karachi were enrolled in this study who fulfilled the inclusion criteria. Permission from the institutional ethical review committee was taken prior to conduction of study. Brief history about demographic data was taken from each patients parent. All of the patients were drawn from the elective list of the pediatric surgical team of our hospital. Patients were randomly allocated using sealed opaque envelop bearing Group B= Receive 0.25% bupivacaine 1 ml/kg body weight given caudally and Group N= Receive nalbuphine 0.1 mg/kg given intravenously. Only the anesthesiologist for the specific case were aware of the treatment allocation until the end of the surgical procedure. All patients were administered standard anesthetics including propofol (1.5–2.0 mg/kg) for induction. Atracurium (0.5 mg/kg) was used to facilitate endotracheal intubation. Maintenance of anesthesia was accomplished with low-flow oxygen (0.5–1.0 L/min) plus 1.0– 1.5% isoflurane. In addition, atracurium (0.1 mg/kg as a bolus dose) if required for maintenance. Either 0.25% bupivacaine 1 ml/kg body weight was given caudally or nalbuphine 0.1 mg/kg given intravenously to patients before the start of surgery. The parameters monitored during the procedure included heart rate (using a three-lead electrocardiograph), systolic and diastolic blood pressure, mean arterial pressure, and fingertip pulse oximetry. Those patients in group B who developed increase in heart rate more than 20% of the baseline were given rescue analgesia with Fentanyl and was excluded from the study (Block failure) All patients were extubated and shifted to recovery. Patients were assessed with respect to postoperative pain intensity using the Wong-Baker Faces Pain Scale at 4 h after surgery, by an on-duty doctor who were unaware of the drugs given to the patients. Rescue

analgesia (children developing pain score ≥8 was e given paracetamol 10-15 mg/kg) was noted. The findings of quantitative variable (age, FACES pain score in group B and N, length of hospital stay and duration of surgery) and qualitative variables (gender, site of inguinal hernia and postoperative pain outcome) was entered in Performa attached as annexure.

RESULT

A total of 94 patients who presented at the Department of Anesthesia, Dow University of Health Sciences, Civil Hospital, Karachi and met the inclusion and exclusion criteria were included in this study. Out of 47 patients in the bupivacaine group minimum age of the patient was 2 while maximum age of the patients was 12 years. Mean age in our study was 6.86 years with the standard deviation of ±2.66. Whereas, mean duration of surgery and length of hospital stay in our study was 2.36±1.47 hours and 4±1.78 days. Similarly, of 47 patients in the nalbuphine group minimum age of the patient was 2 while maximum age of the patients was 12 years. Mean age in our study was 7.12 years with the standard deviation of ±2.16. Whereas, mean duration of surgery and length of hospital stay in our study was 2.45±1.69 hours and 3±1.42 days. As shown in Table 1.

Frequency distribution of age showed that out of 47 patients in the bupivacaine group, 26 (55.3%) and 21 (44.7%) were in age group 2-7 years and 8-12 years respectively. Whereas out of 47 patients in the nalbuphine group, 15 (31.9%) and 32 (68.1%) were in age group 2-7 years and 8-12 years respectively. As presented in Table 2. Frequency distribution of gender showed that out of 47 patients in the bupivacaine group, 27 (57.4%) and 20 (42.6%) were male and female respectively. Whereas out of 47 patients in the nalbuphine group, 18 (38.3%) and 29 (61.7%) were male and female respectively. As presented in Table 3. Frequency distribution of duration of surgery showed that out of 47 patients in the bupivacaine group, 35 (74.5%) and 12 (25.5%) had duration of surgery ≤ 2 hours and > 2 hours respectively. Whereas out of 47 patients in the nalbuphine group, 30 (63.8%) and 17 (36.2%) had duration of surgery ≤ 2 hours and > 2 hours respectively. As presented in Table 4.

Frequency distribution of length of hospital stays showed that out of 47 patients in the bupivacaine group, 22 (46.8%) and 25 (53.2%) had length of hospital stay ≤ 3 days and > 3 days respectively. Whereas out of 47 patients in the nalbuphine group, 12 (25.5%) and 35 (74.5%) had length of hospital stay ≤ 3 days and > 3 days respectively. As presented in Table 5.

Frequency distribution of site of inguinal hernia showed that out of 47 patients in the bupivacaine group, 29 (61.7%) and 18 (38.3%) had hernia on the right and left side respectively.

Whereas out of 47 patients in the nalbuphine group, 20 (42.6%) and 27 (57.4%) had hernia on the right and left side respectively. As presented in Table 6.

Mean FACES pain score at 4 hours in the bupivacaine and nalbuphine group was 1.76±0.63 and 1.57±0.49 respectively. P- value was 0.01. As presented in Table 7.

Stratification for age with postoperative pain at 4 hours in bupivacaine group versus nalbuphine group showed that out of 47 patients in each group, mean pain score was 1.76±0.71 and 1.13±0.35 in the age group 2-7 years respectively. P-value was 0.01. Stratification for age with postoperative pain at 4 hours in bupivacaine group versus nalbuphine group showed that out of 47 patients in each group, mean pain score was 1.76±0.53 and 1.21±0.55 in the age group 8-12 years respectively. P-value was 0.01. As presented in Table 8. Stratification for gender with postoperative pain at 4 hours in bupivacaine group versus nalbuphine group showed that out of 47 patients in each group, mean pain score was 1.77±0.64 and 0.94±0.41 in the male group respectively. P-value was 0.01. Stratification for gender with postoperative pain at 4 hours in bupivacaine group versus nalbuphine group showed that out of 47 patients in each group, mean pain score was 1.75±0.63 and 1.34±0.48 in the female group respectively. P-value was 0.01. As presented in Table 9. Stratification for duration of surgery with postoperative pain at 4 hours in bupivacaine group versus nalbuphine group showed that out of 47 patients in each group, mean pain score was 1.77±0.64 and 1.20±0.55 in the ≤ 2 hour duration of surgery group respectively. P-value was 0.01. Stratification for duration of surgery with postoperative pain at 4 hours in bupivacaine group versus nalbuphine group showed that out of 47 patients in each group, mean pain score was 1.75±0.62 and 1.17±0.39 in the > 2 hour duration of

surgery group respectively. P-value was 0.01. As presented in Table 10.

Stratification for length of hospital stays with postoperative pain at 4 hours in bupivacaine group versus nalbuphine group showed that out of 47 patients in each group, mean pain score was 1.77±0.68 and 1.08±0.28 in the ≤ 3 days length of hospital stays group respectively. P-value was 0.01. Stratification for length of hospital stays with postoperative pain at 4 hours in bupivacaine group versus nalbuphine group showed that out of 47 patients in each group, mean pain score was 1.76±0.59 and 1.22±0.54 in the > 3 days length of hospital stays group respectively. P-value was 0.01. As presented in Table 11. Stratification for site of inguinal hernia with postoperative pain at 4 hours in bupivacaine group versus nalbuphine group showed that out of 47 patients in each group, mean pain score was 1.82±0.60 and 1.10±0.44 in patients who had hernia on the right side respectively. P-value was 0.01. Stratification for site of inguinal hernia with postoperative pain at 4 hours in bupivacaine group versus nalbuphine group showed that out of 47 patients in each group, mean pain score was 1.66±0.68 and 1.25±0.52 in patients who had hernia on the left side. P-value was 0.01. As presented in Table 12. Rescue analgesia use in bupivacaine group showed that 19 (40.4%) and 28 (59.6%) required and did not require rescue analgesia respectively. Whereas, nalbuphine group showed that 06 (12.8%) and 41 (87.2%) required and did not require rescue analgesia respectively. P-value was 0.01. As presented in Table 13.

Stratification for age with respect to rescue analgesia use in bupivacaine and nalbuphine group showed that 13 (50%) and 01 (10%) required analgesia in age group 2-7 years respectively. P-value was 0.01. Whereas age with respect to rescue analgesia use in bupivacaine and nalbuphine group showed that 06 (28.6%) and 05 (15.6%) required analgesia in age group 8-12 years respectively. P-value was 0.25. As presented in Table 14. Stratification for gender with respect to rescue analgesia use in bupivacaine and nalbuphine group showed that 11 (40.7%) and 02 (11.1%) required analgesia in male group respectively. P-value was 0.06. Whereas gender with respect to rescue analgesia use in bupivacaine and nalbuphine group showed that 08 (40%) and 04 (13.8%) required analgesia in female group respectively. P-value was 0.78. As presented in Table 15.

Stratification for duration of surgery with respect to rescue analgesia use in bupivacaine and nalbuphine group showed that 11 (31.4%) and 06 (20%) required analgesia in patients who had duration of surgery ≤ 2 hours respectively. P-value was 0.29. Whereas duration of surgery with respect to rescue analgesia use in bupivacaine and nalbuphine group showed that 08 (66.7%) and 00 (00%) required analgesia in patients who had duration of surgery > 2 hours respectively. P-value was 0.01. As presented in Table 16. Stratification for length of hospital stays with respect to rescue analgesia use in bupivacaine and nalbuphine group showed that 08 (36.4%) and 01 (8.3%) required analgesia in patients who had length of hospital stays ≤ 3 days respectively. P-value was 0.07. Whereas length of hospital stays with respect to rescue analgesia use in bupivacaine and nalbuphine group showed that 11 (44%) and 05 (14.3%) required analgesia in patients who had length of hospital stays > 3 days respectively. P-value was 0.01. As presented in Table 17. Stratification for site of inguinal hernia with respect to rescue analgesia use in bupivacaine and nalbuphine group showed that 12 (41.4%) and 02 (10%) required analgesia in right sided inguinal hernia group respectively. P-value was 0.01. Whereas site of inguinal hernia with respect to rescue analgesia use in bupivacaine and nalbuphine group showed that 07 (38.9%) and 04 (14.8%) required analgesia in left sided inguinal hernia group respectively. P-value was 0.06. As presented in Table 18.

TABLE-1 DESCRIPTIVE STATISTICS IN BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) n=94

VARIABLE	MEAN ± SD	STANDARD DEVIATION	MIN-MAX
AGE BUPIVACAINE GROUP (YEARS)	6.86	±2.66	2-12
AGE NALBUPHINE GROUP (YEARS)	7.12	±2.16	2-12
DURATION OF SURGERY BUPIVACAINE GROUP (HOURS)	2.36	±1.47	1-3

DURATION OF SURGERY NALBUPHINE GROUP (HOURS)	2.45	±1.69	1-3
LENGTH OF HOSPITAL STAY BUPIVACAINE GROUP (DAYS)	04	±1.78	3-7
LENGTH OF HOSPITAL STAY NALBUPHINE (DAYS)	03	±1.42	3-7

TABLE-2 AGE DISTRIBUTION IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) n=94

AGE	BUPIVACAINE GROUP	NALBUPHINE GROUP
2-7 YEARS	26 (55.3%)	15 (31.9%)
8-12 YEARS	21 (44.7%)	32 (68.1%)
TOTAL	47 (100%)	47 (100%)

TABLE -3 GENDER DISTRIBUTION IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) n=94

GENDER	BUPIVACAINE GROUP	NALBUPHINE GROUP
MALE	27 (57.4%)	18 (38.3%)
FEMALE	20 (42.6%)	29 (61.7%)
TOTAL	47 (100%)	47 (100%)

TABLE-4 DURATION OF SURGERY IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) n=94

DURATION OF SURGERY	BUPIVACAINE GROUP	NALBUPHINE GROUP
≤2 HOURS	35 (74.5%)	30 (63.8%)
>2 HOURS	12 (25.5%)	17 (36.2%)
TOTAL	47 (100%)	47 (100%)

TABLE-5 LENGTH OF HOSPITAL STAYS DISTRIBUTION IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) n=94

LENGTH OF HOSPITAL STAY	BUPIVACAINE GROUP	NALBUPHINE GROUP
≤3 DAYS	22 (46.8%)	12 (25.5%)
>3 DAYS	25 (53.2%)	35 (74.5%)
TOTAL	47 (100%)	47 (100%)

TABLE-6 SITE OF INGUINAL HERNIA DISTRIBUTION IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47)n=94

SITE OF INGUINAL HERNIA	BUPIVACAINE GROUP	NALBUPHINE GROUP
RIGHT	29 (61.7%)	20 (42.6%)
LEFT	18 (38.3%)	27 (57.4%)
TOTAL	47 (100%)	47 (100%)

TABLE-7 FACES PAIN SCORE AT 4 HOURS IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) (n=94)

GROUPS	BUPIVACAINE GROUP	NALBUPHINE GROUP	P VALUE
FACES PAIN SCORE AT 4 HOURS	1.76±0.63	1.57±0.49	**0.01**

TABLE-8 FACES PAIN SCORE AT 4 HOURS IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) ACCORDING TO AGE (n=94)

AGE (YEARS)	BUPIVACAINE GROUP	NALBUPHINE GROUP	P VALUE
2-7	1.76±0.71	1.13±0.35	**0.01**
8-12	1.76±0.53	1.21±0.55	**0.01**

TABLE-9 FACES PAIN SCORE AT 4 HOURS IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) ACCORDING TO GENDER (n=94)

GENDER	BUPIVACAINE GROUP	NALBUPHINE GROUP	P VALUE
MALE	1.77±0.64	0.94±0.41	**0.01**
FEMALE	1.75±0.63	1.34±0.48	**0.01**

TABLE-10 FACES PAIN SCORE AT 4 HOURS IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) ACCORDING TO DURATION OF SURGERY (n=94)

DURATION OF SURGERY	BUPIVACAINE GROUP	NALBUPHINE GROUP	P VALUE
≤ 2 HOURS	1.77±0.64	1.20±0.55	**0.01**
> 2 HOURS	1.75±0.62	1.17±0.39	**0.01**

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TABLE-11 FACES PAIN SCORE AT 4 HOURS IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) ACCORDING TO LENGTH OF HOSPITAL STAY (n=94)

LENGTH OF HOSPITAL STAYS	BUPIVACAINE GROUP	NALBUPHINE GROUP	P VALUE
≤ 3 DAYS	1.77±0.68	1.08±0.28	**0.01**
> 3 DAYS	1.76±0.59	1.22±0.54	**0.01**

TABLE-12 FACES PAIN SCORE AT 4 HOURS IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) ACCORDING TO SITE OF INGUINAL HERNIA (n=94)

SITE OF INGUINAL HERNIA	BUPIVACAINE GROUP	NALBUPHINE GROUP	P VALUE
RIGHT	1.82±0.60	1.10±0.44	**0.01**
LEFT	1.66±0.68	1.25±0.52	**0.01**

TABLE-13 RESCUE ANALGESIA USE IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) (n=94)

GROUPS	RESCUE ANALGESIA USE		P-VALUE
	YES	NO	
BUPIVACAINE GROUP	19 (40.4%)	28 (59.6%)	
NALBUPHINE GROUP	06 (12.8%)	41 (87.2%)	**0.01**

TABLE-14 RESCUE ANALGESIA USE IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) ACCORDING TO AGE(n=94)

AGE (YEARS)	RESCUE ANALGESIA BUPIVACAINE GROUP		RESCUE ANALGESIA NALBUPHINE GROUP		P VALUE
	YES	NO	YES	NO	
2-7	13 (50%)	13 (50%)	01 (6.7%)	14 (93.3%)	**0.01**
8-12	06 (28.6%)	15 (71.4%)	05 (15.6%)	27 (84.4%)	**0.25**

TABLE-15 RESCUE ANALGESIA USE IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) ACCORDING TO GENDER (n=94)

GENDER	RESCUE ANALGESIA BUPIVACAINE GROUP		RESCUE ANALGESIA NALBUPHINE GROUP		P VALUE
	YES	NO	YES	NO	
MALE	11 (40.7%)	16 (59.3%)	02 (11.1%)	16 (88.9%)	**0.06**
FEMALE	08 (40%)	12 (60%)	04 (13.8%)	25 (86.2%)	**0.78**

TABLE-16 RESCUE ANALGESIA USE IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) ACCORDING TO DURATION OF SURGERY (n=94)

DURATION OF SURGERY	RESCUE ANALGESIA BUPIVACAINE GROUP		RESCUE ANALGESIA NALBUPHINE GROUP		P VALUE
	YES	NO	YES	NO	
≤ 2 HOURS	11 (31.4%)	24 (68.6%)	06 (20%)	24 (80%)	**0.29**
> 2 HOURS	08 (66.7%)	04 (33.3%)	00 (00%)	17 (100%)	**0.01**

TABLE-17 RESCUE ANALGESIA USE IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) ACCORDING TO LENGTH OF HOSPITAL STAY (n=94)

LENGTH OF HOSPITAL STAY	RESCUE ANALGESIA BUPIVACAINE GROUP		RESCUE ANALGESIA NALBUPHINE GROUP		P VALUE
	YES	NO	YES	NO	
≤ 3 DAYS	08 (36.4%)	14 (63.6%)	01 (8.3%)	11 (91.7%)	**0.07**
> 3 DAYS	11 (44%)	14 (56%)	05 (14.3%)	30 (85.7%)	**0.01**

TABLE-18 RESCUE ANALGESIA USE IN CAUDAL BUPIVACAINE GROUP (47) VERSUS SYSTEMIC NALBUPHINE GROUP (47) ACCORDING TO SITE OF INGUINAL HERNIA (n=94)

SITE OF INGUINAL HERNIA	RESCUE ANALGESIA BUPIVACAINE GROUP		RESCUE ANALGESIA NALBUPHINE GROUP		P VALUE
	YES	NO	YES	NO	
RIGHT	12 (41.4%)	17 (58.6%)	02 (10%)	18 (90%)	**0.01**
LEFT	07 (38.9%)	11 (61.1%)	04 (14.8%)	23 (85.2%)	**0.06**

DISCUSSION

Inguinal hernia is a common condition requiring surgical repair in the pediatric age group. The incidence of inguinal hernia is approximately 3 to 4% in terms infants and 12% in infants born premature. As more infants survived in premature life, more hernias are diagnosed in this age group. Day care surgical repair of inguinal hernia was re commended since long in 1938 and now become a common practice. Although it is most commonly performed surgery in children. Early surgery is usually advised to prevent the risk of incarceration of bowel and other complications. The frequency of complications varies in different series. The recurrence rate after primary inguinal hernia ranged from 0.8% to 3.8%.

Our study included a total of 94 patients who met the inclusion and exclusion criteria. Mean FACES pain score at 4 hours in the bupivacaine and nalbuphine group was 1.76±0.63 and 1.57±0.49 respectively. P-value was 0.01. Rescue analgesia use in bupivacaine group showed that 19 (40.4%) and 28 (59.6%) required and did not require rescue analgesia respectively. Whereas, nalbuphine group showed that 06 (12.8%) and 41 (87.2%) required and did not require rescue analgesia. P-value was 0.01.

Another study evaluated FACES pain scale in our study which is a verified scale for pain assessment in children with the age range of 3-12 years. There was no significant difference between the two study groups as regard side effects, as 14.8% of group 2 (Caudal Group) cases had side effects compared to 3.6% for group 1 (Nalbuphine cases(p=0.052). As regard the need for rescue analgesia, no significant difference was found between the two study groups. Regarding our study, there was no significant difference between the two study groups as regard pain scale at 1 hour. However, a highly significant difference was found between the two study groups as regard pain score at 2, 4, and 8 hours with higher pain among caudal block group. Conclusion: nalbuphine is better than caudal block for post-operative pain management after inguinal herniotomy in children. [16.]

Another randomized control trial included 100 patients included to compare the effect of intravenous Nalbuphine and Caudal for postoperative pain management in pediatrics. The mean pain scores were less in nalbuphine group at 0,1,2 and 4 hours, however it was significant at 0 and 1 hour. The requirement of rescue analgesia was less in Nalbuphine group than Caudal group (14% vs 34%, p <0.05. [17]

Another study found the mean age of patients were found as 4.15 ± 3.32 years in group A and 4.88 ± 3.18 years in group B. All the other demographics were comparable in both groups.

The mean pain scores were less in nalbuphine group at 0,1,2 and 4 hours, however it was significant at 0 and 1 hour. The requirement of rescue analgesia was less in group B than group A (14% vs 34%, p <0.05). The only side effect was observed was vomiting in 12% of patients in group B while in none of patient in group A. [18]

FLACC pain scores were much less in LN group compared to L group (p value < 0.001) after the second hour in another study. The first time for postoperative analgesic requirement was significantly longer in LN group (384 ± 23.1 min) compared to L group (202.20 ± 23.42 min) (p value > 0.001). The total dose of postoperative supplementaryanalgesia (intravenous paracetamol infusion) in the first 12 h was significantly lower in LN group (200.5 ± 65.5 mg) in comparison with L group (355.25

± 69.9 mg) ($P < 0.05$).[19]

CONCLUSIONS

Effective postoperative analgesia children continues to evolve with innovative methods of therapy using newer drugs or older drugs introduced via novel routes. Age appropriate pain assessment tools continue to be critically evaluated, validated and improved as one of the most critical components of pain management. Nalbuphine is better than caudal block for post- operative pain management after inguinal herniotomy in children. Additionally, it decreases the postoperative analgesic requirements in children having inguinal hernia repair. We conclude that this technique may be a good alternative for postoperative analgesia in day-care operation, for children undergoing inguinal herniorrhaphy.

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