Original Research Article

Comparative study of the post-operative analgesic effect of caudal block with ilioinguinal nerve block using bupivacaine in children, 2-7 years old undergoing inguinal surgeries

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Abstract

Background: Caudal epidural block is widely used to provide Post-operative pain relief following below umbilical surgeries in children8,18,19,23. Various studies were undertaken to compare and evaluate the usefulness of caudal epidural and ilioinguinal nerve block for providing post – operative analgesia in children posted for inguinal surgeries3,15,16,17 **Aim:** Quality and intensity of pain relief in both peripheral technique To identify the duration of analgesia in both regional technique **Materials and Methods:** After institutional ethics committee approval and informed consent, this study was conducted in the Department of Anaesthesiology from June 2018 to October 2019. Study was carried in our sree mookambika institute of medical during the period June 2018 to October 2019 after obtaining clearance from the ethical committee of Our innstitute and written informed parental consent. The study population consisted of 40 children aged 2 to 7 years to undergo elective inguinal hernia surgeries and were randomly divided into two groups 1 and 2, with twenty patients in each group. **Result**: patients posted for inguinal hernia surgeries under the study to detect effectiveness of Post-operative pain relief were divided into two groups consisting of 20 patients each. Student 't' test standard error of difference between means was used to calculate the 'P' value statistical significance. On the analysis of the demographic data i.e. the Age, Weight, duration of surgery as well as Post-operative duration of analgesia, there was no statistically significant difference between the two groups. **Conclusion:** Both the techniques are safe, easy to perform and produces good analgesia upto 5 hours in the postoperative period and are associated with very minimal complications. By conducting this study, we found that bupivacaine provides good Post-operative analgesia at lower concentrations i.e. 0.25% without any motor blockade. This study can be improvised by using still lower concentrations i.e. 0.125% and ultrasound guidance can be used for accurate block.

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INTRODUCTION

Control of post-operative pain is important in Paediatric patients because poor pain control may result in increased morbidity or mortality. The failure to provide analgesia for pain results in rewiring the nerve pathways responsible for pain transmission in the dorsal horn of the spinal cord and results in increased pain perception for future painful results In a study conducted by Mather L,Mackie-J-*et al*.,1983, it was reported that 40% of Pediatric patients experienced moderate to severe post-operative pain and that 75% had insufficient analgesia[9]. There is a large body of evidence that post–operative pain is untreated in children, particularly in neonates and infants.[7] Post-operative analgesia in children can be provided by various techniques such as oral or rectal analgesics, NSAIDs, local anesthetic creams, intra muscular injections, continuous intravenous infusions, patient controlled analgesia and regional analgesic techniques and nerve blocks.[6] Owing to

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the side effects and complications produced by various techniques, regional analgesic techniques are preferred[14,21] Shandling and Steward in 1980, demonstrated the efficacy of combining a nerve block with general anesthesia for the purpose of obtaining Post-operative pain relief after hernia repair[6] and found that ilio inguinal nerve block can be used as a safe technique for Post-operative pain relief using 0.25% bupivacaine. Caudal epidural block is widely used to provide Post-operative pain relief following below umbilical surgeries in children.[8,18,19] Various studies were undertaken to compare and evaluate the usefulness of caudal epidural and ilioinguinal nerve block for providing post – operative analgesia in children posted for inguinal surgeries.[3,15,16,17] In a prospective study Markham.S.J, Tomlinson.J and Hain.W.R.(1986) compared caudal block and ilio inguinal nerve block for intra and Post-operative analgesia in children undergoing herniotomy under general anaesthesia using 0.5% bupivacaine and found that both caudal block and ilio inguinal nerve block are equally effective in Post-operative analgesia but in 54% in caudal group and 28% in ilio inguinal group had not walked for 6 hrs. Bupivacaine used in higher concentrations and higher doses is associated with motor blockade. Therefore present study is undertaken by using lower concentrations of bupivacaine i.e. 0.25% at the dose of 0.75ml/kg for caudal block and 0.3ml /kg for ilio inguinal block to evaluate the efficacy of caudal block and ilio inguinal nerve block for providing post operative analgesia in children undergoing inguinal surgeries.

MATERIALS AND METHODS

After institutional ethics committee approval and informed consent, this study was conducted in the Department of Anaesthesiology Of sree mookambika institute of medical sciences. A clinical study entitled "Comparative Study of the Post-Operative Analgesic Effect of Caudal Block with Ilioinguinal Nerve Block Using Bupivacaine in Children, 2-7 years old Undergoing Inguinal Surgeries", was undertaken at Sree mookambika institute of medical sciences during the period June 2018 to October 2019 after obtaining clearance from the ethical committee of Our institution and written informed parental consent. The study population consisted of 40 children aged 2 to 7 years to undergo elective inguinal hernia surgeries and were randomly divided into two groups 1 and 2, with twenty patients in each group.

Group 1 - The children in group 1 received caudal epidural block with 0.75ml/kg of 0.25% bupivacaine.

Group 2 - Children in group 2 received ilioinguinal nerve block with 0.3ml/kg of 0.25% bupivacaine.

Inclusion criteria: Age group 2-7 years, American Society of Anesthesiologist (ASA) status I and II, Patients scheduled for elective inguinal surgeries

Exclusion criteria: Emergency Cases, known allergy to any of the drugs used in the study, Contra indications to caudal and ilioinguinal block including Infection at site, Pilonidal cyst, Coagulopathies, Congenital anomaly of spine or meninges, Patient refusal

RESULTS

Patients posted for inguinal hernia surgeries under the study to detect effectiveness of Post-operative pain relief were divided into two groups consisting of 20 patients each.

Group 1 – received caudal epidural nerve block with 0.75ml/kg of 0.25%bupivacaine at the end of the surgery before reversal of neuromuscular blockade.

Group 2 – received ilioinguinal nerve block with 0.3ml/kg of 0.25% bupivacaine at the end of the surgery before reversal of neuromuscular blockade. The results were tabulated, and data was evaluated using mean and standard deviation. Student 't' test standard error of difference between means was used to calculate the 'P' value statistical significance. On the analysis of the demographic data i.e. the Age, Weight, duration of surgery as well as Post-operative duration of analgesia, there was no statistically significant difference between the two groups.

Table 1: Demographic data of the patients studied

	GROUP 1	GROUP 2
Mean age (years) (SD)	4.47 (2.039)	3.92 (1.9)
Male: female ratio	18:2	17:3
Mean weight (kgs) (SD)	13.93 (4.96)	13.6 (5.08)
Mean duration of surgery (minutes) (SD)	39.4 (5.52)	37.5 (3.56)

OBSERVATIONS AND RESULTS

Table 2: Age distribution

Age (Years)	Group I	Group II
<5	12(60%)	15 (75%)
>5	8(40%)	5(25%)
Minimum age	2 Years.	2 Years.
Maximum age	7 Yrs.	7 Yrs.

Mean age in group 1 is 4.42 and group 2 is 3.92 and p value is not significant.

Table 3: Sex Distribution

SEX	Group I	Group II
MALE	18(90%)	17(85%)
FEMALE	2(10%)	3(15%)

Table 4: Weight Distribution

Weight (Kgs.)	Group I	Group II
< 9	4 (20%)	7 (35%)
9.1-13	6 (30%)	3 (15%)
> 13.1	10 (50%)	10 (50%)
Minimum Wt.	8 Kgs.	8 Kgs.
Maximum Wt.	25 Kgs.	24 Kgs.
Mean Wt. (SD)	13.93 Kgs (4.96)	13.65Kgs. (5.08)

Mean weight in group 1 is 13.93 kgs and group 2 is 13.65 kgs and p value is not significant.

Table 6: Duration of Surgery

Duration (mins)	Group I	Group II
Mean(min)	39.4min	37.5min
(SD)	(5.52)	(3.56)
Minimum duration	30 mins.	30 min
Maximum duration	50 mins.	46 mins.

Mean duration of surgery in group 1 is 39.4 min and group 2 is 37.5 min and p value is not significant.

Table 7a: Duration of analgesia (Group I)

Time in hours.	Pain Score < 4 (No. of Patients)	Pain Score ≥ 4 (No. of Patients)
0.5	20 (100%)	0(0%)
1	20 (100%)	0(0%)
2	18 (90%)	2 (10%)
3	18 (90%)	1 (10%)
4	16 (80%)	1 (20%)
5	12 (60%)	4 (40%)
6	6 (30%)	6 (70%)
7	3 (15%)	3 (85%)
8	0	3

In Group I up to 1 hour all the 20 patients were pain free, 80% were pain free up to 4hrs. Minimum duration of analgesia was 2 hours, maximum duration was 8hrs.and mean duration was 5.7hrs.

Table 7a: Duration of analgesia (Group II)

Time in hours.	Pain Score < 4 (No. of Patients)	Pain Score ≥ 4 (No. of Patients)
0.5	20 (100%)	0(0%)
1	20 (100%)	0(0%)
2	18 (90%)	2 (10%)
3	18 (90%)	0 (0%)
4	16 (80%)	2 (20%)
5	13 (65%)	4 (35%)
6	9 (45%)	4 (55%)
7	2 (10%)	8 (40%)
8	0 (0%)	2 (10%)

In Group II upto 1 hours, all the 20 patients were pain free, 80% were pain free up to 4 hours. Minimum duration of analgesia was 2hours. Maximum duration was 8hrs.and mean duration was 5.9 hours

Onset of pain

The mean duration of time of onset of pain in Group 1 was 120 minutes while that of Group 2 was 123 minutes. Minimum duration of pain free interval in both the groups of patients was 1 hours. P value was insignificant (P value > 0.05).

Duration of analgesia

In Group I up to 1 hour all the 20 patients were pain free, 80% were pain free up to 4hrs. Minimum duration of analgesia was 2 hours, maximum duration was 8hrs.and mean duration was 5.7hrs. In Group II upto 1 hour, all the 20 patients were pain free, 80% were pain free up to 4

hours. Minimum duration of analgesia was 2 hours. Maximum duration was 8hrs.and mean duration was 5.9 hours.

P value

The P value is >0.05 for comparison of pain scores between group 1 and group 2 for both<4 and >4 (0.092 and 0.2 respectively)

DISCUSSION

The relief of pain during post-operative period has been of great interest to mankind down the ages. Mather L,Mackie-J-*et al*., in 1983 reported that 40% of Pediatric patients experienced moderate to severe Post-operativepain and that 75% had insufficient analgesia[9]. Control of Post-operative pain is therefore important in Pediatric patients because poor pain control may result in increased morbidity or mortality. There is a large body of evidence that post – operative pain is untreated in children, particularly in neonates and infants[7]. However, over the last 20 years there has been a substantial increase in understanding and management of paediatric pain. Satisfactory pain relief method after surgery is very essential in paediatric patients. As children cannot be relied upon to ask for analgesia as in case of adult's great efforts are required to anticipate pain. The pain management can be achieved by various methods such as Oral or rectal analgesics and anti-inflammatory drugs, Local anaesthetic creams, Intramuscular injections, Continuous intravenous infusion, Patient controlled analgesia (PCA) and Regional analgesia and nerve blocks. Duedahl TH, Hansen EH.*et al*. 2007; conducted a study in which they could not find any benefit from NSAID administration on pain intensity during the first 24 postoperative hours, PONV during the PACU stay, urinary retention, or pruritus. In a prospective study conducted by Chou R, Thames LL, Dana T, Pappas M, Mitchell JP: *et al*. 2016; complications like Respiratory depression, potential for addiction and abuse, sedation, nausea and vomiting, constipation were observed with patient-controlled analgesia for Post-operative pain relief[44]

In view of the advantages of regional anaesthetic techniques over the other techniques, many authors have conducted studies to evaluate the efficacy of caudal epidural and Ilioinguinal nerve block for Post-operative pain relief in children. Peripheral nerve blocks are an important tool to the anaesthesiologists as the alterations in physiology, biochemistry and there by the mortality and morbidity caused by them are minimal as compared to general anaesthesia.

Peripheral nerve blocks in addition to providing patient comfort can facilitate accelerated recovery by

- Faster intake of oral nutrition
- Reduction in pre-operative stress response and organ dysfunction
- Avoidance of fatigue
- Early mobilization and Post-operative discharge

A study performed at the hospital for sick children in Toronto Shandling and Steward 1980, demonstrated the efficacy of combining a nerve block with general anesthesia for the purpose of obtaining Post-operative pain relief after hernia repair[6]. After induction of general anesthesia caudal epidural block is widely used to provide Post-operative pain relief following below umbilical surgeries in children8181923. Ilioinguinal nerve block for the relief of post–operative pain has also been advocated as a safe technique for providing post–operative analgesia in children by Shandling and Stewart 1980 and Smith and Jones1982.619 Various studies were undertaken to compare and evaluate the usefulness of caudal epidural and ilioinguinal nerve block for providing post – operative analgesia in children posted for inguinal surgeries3151617. S.J.Mackham *et al*., compared the quality of analgesia provided by caudal block and peripheral nerve block using 0.5%bupivacaine in children undergoing herniotomy under general anesthesia. Complications like delayed micturition and delayed walking were observed22. Bupivacaine used in higher concentrations is associated with the motor blockade. Hence in our study, we used 0.25% Bupivacaine. Bupivacaine has much more pronounced and intense effect upon sensory nerves than motor nerves, therefore, intense anesthesia may be obtained with less motor blockade. This is a special advantage in treatment of Post-operative pain[11]. Bupivacaine, a local anaesthetic drug acting on the peripheral nerves, provides distinct advantage over systemically administered opioid and non-steroidal analgesics as the quality of analgesia is better, sedation is nil, function is preserved, and outcome improved. It acts by producing a reversible blockade of Na channels in the nervous tissue preventing the transmission of electrical impulses. Hence in our study we used bupivacaine 0.25%. Both caudal epidural and ilioinguinal nerve blocks using bupivacaine were useful to provide Post-operative analgesia. In the present study an attempt was made to find out the efficacy of caudal epidural and ilioinguinal nerve blocks in children undergoing inguinal hernia surgeries. 40 children of ASA class 1 and 2, aged 2 to 7 years scheduled for elective inguinal hernia surgeries were randomized into two groups.

Group 1 – received Post-operative caudal nerve block with 0.75ml/kg of 0.25%bupivacaine under general anaesthesia.

Group 2 – received post-operative ilioinguinal nerve block with 0.3ml/kg of 0.25% bupivacaine under general anaesthesia. The groups were similar in terms of operating time, duration of anaesthesia, in premedication and intraoperative period. The surgery was performed under general anaesthesia and all patients recovered

uneventfully. Both the nerve blocks were performed as per the standardized technique. Post-operative pain assessment was done using Pediatric objective pain scale. Because of longer duration of analgesia extending into few hours in Post-operative period we employed bupivacaine as local anaesthetic of choice.

Paediatric Objective Pain Scale

Post-operative pain assessment was done initially 30 minutes after the block and then hourly using paediatric objective pain scale adopted as per Hannallah RS *et al* 1987.

	0	1	2
Blood pressure	BP+-10%preoperative	BP>20%preoperative	BP>30%preoperative
Crying	Not crying	Crying but responding to TLC	Crying but not responding to TLC
Movement	None	Restless	Thrashing
Agitation	Patient asleep or calm	Mild	Hysterical
Verbalization of pain	Asleep or states no pain	States pain but cannot localize	Can localize pain

Total pain score = 0-10; 0=no pain; 10=severe pain.

The Post-operative analgesia in the two groups were compared with respect to

1. Quality and intensity of pain relief
2. Duration of analgesia
3. Any untoward side-effects associated with these blocks were also noted. Every half hourly a check was made on possible complications such as nausea and vomiting, haematoma formation, voiding interval, hematuria, limb weakness, ability to walk were assessed.

Results of caudal epidural anaesthesia

Bupivacaine for caudal block was employed by SJ Markham (1986), Raafat S Hannallah(1987), Andrew R Wolf (1988), Quentin A fisher (1993). In a prospective study conducted on 44 patients aged 18 months to 12 yrs, Raafat S Hannallah (1987) *et al* noted that bupivacaine 2.5ml/kg of age produces analgesia upto T10 in 95% of patients. This level is enough to produce Post-operative analgesia for majority of inguinal scrotal surgeries including orchidopexy. Post- operative complications like nausea, vomiting, delayed micturition was observed in 10% of patients. Hence in the present study we employed bupivacaine in a lower dose i.e. 0.75ml/kg for caudal block. In our study we found that both the techniques are safe, easy to perform and produces good analgesia upto 5 hours in the postoperative period and are associated with very minimal complications. In a study conducted by S.J.Markham *et al*. 1986,, the quality of analgesia provided by caudal block and peripheral nerve block were compared using 0.5%bupivacaine in children undergoing herniotomy under general anaesthesia in 52 boys. . Three patients in group A and 5 in group B vomited and one person in each group was pyrexial postoperatively. 54 % in group A and 28% in group B had not walked for 6 hours. Bupivacaine used in higher concentrations i.e 0.5% is associated with motor blockade. Hence in our study we used 0.25% Bupivacaine. In the present study the duration of Post-operative analgesia was assessed by employing Pediatric objective pain scale. It was noted that 80% of the patients had total pain relief upto 4 hours, 60% upto 5 hours, 30% upto 6 hours, 15 % upto 7 hours. Thus, it was seen that in majority of the patient's caudal epidural bupivacaine in a dose of 0.75ml/kg employed in a concentration of 0.25% produces Post- operative analgesia in majority of the patients upto 5 hours. Minimum duration of analgesia was 2 hours and mean duration of analgesia was 5.7 hours. We employed 0.25% bupivacaine in a dose of 0.75ml/kg for caudal block and did not come across any major complications. Post-operative nausea and vomiting was the only complication noted in three patients.

Results of ilioinguinal nerve block

Ilioinguinal nerve block for the relief of Post-operative herniotomy pain in children has been advocated by Shanding and Stewart (1981) and Smith and Jones (1982). Ilioinguinal nerve block has a wide margin of safety and is effective in controlling post herniorrhaphy pain well into Post-operative period. The volume of local anaesthetic used for ilioinguinal nerve block differs among various authors. It ranges from 0.625 mg/kg to 2 mg/kg. In the present study, be have employed 0.25% bupivacaine in a dose of 0.3ml/kg. Ina prospective study conducted on 44 patients of age 18 months to 12years Raafat S Hannallah *et al*.,1987, used 4-6 ml of 0.25% bupivacaine provided effective analgesia in majority of the patients upto 5 hours. But 10% of the patients had Post- operative complications like nausea, vomiting, delayed micturition. Hence in the present study we employed bupivacaine in a lower dose i.e 0.3ml/kg. In a study conducted on 56 boys, SJ Markham *et al*,1986., noted that with ilioinguinal-iliohypogastric nerve

block using 0.5% bupivacaine, 0.5ml/year of age, 100% of patient had analgesia upto 4 hours. But 5 patients vomited, and one person had pyrexia postoperatively.28% of the patients had not walked postoperatively. Bupivacaine used in higher concentrations i.e. 0.5% is associated with motor blockade. Hence in our study we used 0.25% Bupivacaine. In our study we found that both the techniques are safe, easy to perform and produces good analgesia upto 5 hours in the postoperative period and are associated with very minimal complications. Quentin A Fisher *et al* noted that using 0.25% bupivacaine, 0.4ml/kg 74% of the patients were free at 4 hours. In the present study 86 % of the patients had total pain relief at the end of 4 hours. This finding concurs with the studies of Quentin A Fisher *et al*.Various authors have noted various complications transient quadriceps paresis (Roy– Shapira A *et al* 1985), haematoma (Cross GD *et al* 1987), inadvertent bowel perforation (William F Casey 1990) with ilioinguinal – iliohypogastric nerve block. However, in the present study we did not come across any complications, only Post-operative nausea and vomiting seen in two patients. Markham *et al* (1986) employing 0.5% bupivacaine for both caudal and ilioinguinal- iliohypogastric nerve blocks produced equal duration of analgesia. Cross and Barret (1987) also noted that both blocks produced equal analgesic effectiveness. Hanallah *et al* also noted that both caudal and ilioinguinal-iliohypogastric nerve blocks produced equal duration of analgesia. Cross.G.D. andBarrett.R.H. (1987) compared caudal anaesthesia and Ilioinguinal – iliohypogastric nerve block combined with skin infiltration in children undergoing herniotomy and orchidopexy. The study population consisted of 41 patients aged between 1 and 13 years. The children were premedicated with papaveretum 0.3mg/kg and hyoscine 0.006mg/kg given one hour preoperatively. Anaesthesia was induced with either thiopentone 4mg/kg or inhalation of nitrous oxide, oxygen and halothane. The children were randomly divided into two groups A and B. Patients in group A received caudal block with plain bupivacaine 0.25%, 1ml/kg for herniotomy and 1.25ml/kg for orchidopexy (0.25% bupivacaine was used to determine volume less than 20 ml, and 0.19% bupivacaine for determining volumes between 20 and 30 ml). Patients in group B received Ilioinguinal – iliohypogastric nerve block combined with skin infiltration using bupivacaine 0.25% with adrenaline 1:200,000, 2mg/kg (determined volumes were used to a maximum of 20 ml for unilateral block or divided equally between the two sides for a bilateral block to a maximum of 40 ml). Postoperative subjective and objective pain assessment was made at 1, 3, 6, 18 hours. Subjective assessment was made using a 10 cm linear analogue scale, which read from no pain to severe pain. Objective assessment was done by applying a known pressure through thin surgical dressing through the wound site (and arbitrary maximum pressure of 60 mm Hg indicated a totally effective local anaesthetic block). In the present study it was noticed that bupivacaine employed in a dose of 0.75ml/kg of 0.25% bupivacaine for caudal block and 0.3ml/kg of 0.25% bupivacaine for ilio inguinal block. The mean duration of time of onset of pain in Group 1 was 120 minutes while that of Group 2 was 123 minutes. Minimum duration of pain free interval in both the groups of patients was 1 hours. P value was insignificant (P value > 0.05). In Group I up to 1 hour all the 20 patients were pain free, 80% were pain free up to 4hrs. Minimum duration of analgesia was 2 hours, maximum duration was 8hrs.and mean duration was 5.7hrs. In Group II upto 1 hour, all the 20 patients were pain free, 80% were pain free up to 4 hours. Minimum duration of analgesia was 2hours. Maximum duration was 8hrs.and mean duration was 5.9 hours. There were no major complications associated with the use of both the techniques. The only side effect noted was Post-operative nausea and vomiting (three patients in group 1 and two patients in group 2). i.e. about 15% in group 1 and 10% in group 2 They were mild in its intensity and were easily controllable with injection metoclopramide. Nausea and vomiting may be due to surgical handling rather than due to the technique employed. Thus, overall it is seen that caudal epidural and ilioinguinal nerve blocks are technically simple and provides effective analgesia in majority of the patients upto 5 hours with minimal complications, when bupivacaine was employed as the local anaesthetic of choice. In the present study also, we noted that with both the techniques majority (70%) of the patients were pain free upto 5 hours(P>0.05).

P value > 0.05 hence statistically not significant in the present study.

In a study Wilschke and co-workers 2006 found that ultra sound guided technique was associated with significantly higher success rate and a considerable reduction in the number of patients needing supplemental analgesia in the recovery room. Hence our study can be improvised by using ultrasound guidance.

CONCLUSION

From the present study it can be concluded that: Caudal epidural employed using bupivacaine in concentration of 0.25% in a dose of 0.75ml/kg produces satisfactory postoperative analgesia upto 5 hours with minimal complications, i.e. 15% of the patients had Post-operative nausea and vomiting. Ilioinguinal nerve block employed using 0.25% Bupivacaine in a dose of 0.3 ml/kg produces adequate postoperative analgesia upto 5 hours with minimal complications, i.e. 10% of the patients had Post-operative nausea and vomiting, Both the techniques are

safe, easy to perform and produces good analgesia upto 5 hours in the postoperative period and are associated with very minimal complications. By conducting this study, we found that bupivacaine provides good Post-operative analgesia at lower concentrations i.e. 0.25% without any motor blockade. This study can be improvised by using still lower concentrations i.e. 0.125% and ultrasound guidance can be used for accurate block.

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