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Original Research Article

Comparative study of 0.25% bupivacaine and 0.25% bupivacaine with fentanyl for caudal epidural anaesthesia and analgesia in children undergoing lower abdominal surgery

[1]Dr. Karnakar V, [2]Dr. Yugandhar Kandula, [3]Dr. Suresh Janapati, [4]Dr. Kiran Kumar Suggala

[1]Junior Resident, Mamata Medical College and General Hospital, Khammam, Telangana, India
[2]Associate Professor, Mamata Medical College and General Hospital, Khammam, Telangana, India
[3]Assistant Professor, Mamata Medical College and General Hospital, Khammam, Telangana, India
[4]Professor & HOD, Mamata Medical College and General Hospital, Khammam, Telangana, India

Corresponding Author:
Dr. Karnakar V

Abstract

Background: Caudal epidurals are commonly performed for postoperative pain management in children undergoing abdominal and lower limb surgeries. Bupivacaine is considered the most common local intrathecal anesthesia for children. Various adjuvants were combined with the local anesthetic to increase intrathecal block quality and extend analgesia duration. Present study was aimed to compare bupivacaine versus bupivacaine with fentanyl for caudal epidural anaesthesia and analgesia in children undergoing lower abdominal surgery.

Material and Methods: Present study was comparative, double blind, observational study, conducted in children aged between 1 and 10 years, either gender, ASA class I and II, scheduled to undergo lower abdominal surgery, parents consented for participation. Children were divided as Group A, receiving bupivacaine 0.25% 2 mg/kg with fentanyl (1µg/kg) & Group B receiving bupivacaine 0.25% 2 mg/kg only.

Results: Onset of Sensory block (mins) & Time to achieve the optimum level (mins) were comparable among both groups & difference was not significant statistically. We noted more duration of motor block (176.4 ± 64.4 min vs 154.5 ± 52.13 min), Prolonged duration of postoperative analgesia (320.3 ± 41.19 min vs 288.3 ± 43.1 min), less amount of rescue analgesic (73.33 ± 44.28 mg vs 85.17 ± 44.45 mg) & late requirement of rescue analgesic (272.67 ± 37.38 min vs 236.83 ±10.63) in A group as compared to Group B & difference was significant statistically. PONV & pruritis were noted in 1 patient each from group A as compared to 3 cases of PONV & 1 case of pruritis & difference was not significant statistically.

Conclusion: 1µg/kg fentanyl with 0.25%bupivacaine 2mg/kg when administered caudally provide satisfactory surgical anesthesia and post-operative analgesia with prolonged period of analgesia with without any major postoperative complications. Fentanyl produces a faster onset of analgesia with fewer side effects like nausea, vomiting.

Keywords: Bupivacaine, caudal‑ epidural analgesia, fentanyl, pediatric surgery

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Introduction

Caudal epidurals are commonly performed for postoperative pain management in children undergoing abdominal and lower limb surgeries [1]. Caudal anaesthesia is also an epidural anaesthesia achieved through sacral hiatus. The advantage of epidural over spinal anaesthesia is the ability to maintain continuous anaesthesia after placement of an epidural catheter, thus making it suitable for procedures of long duration. Following surgery, lower concentrations of anaesthetic drugs can also be introduced to relieve surgical pain [2].

0.25%Bupivacaine is considered the most common local intrathecal anesthesia for children. Various adjuvants were combined with the local anesthetic to increase intrathecal block quality and extend analgesia duration [3]. The frequently used adjuvants contain α2 stimulants (e.g., clonidine and dexmedetomidine), opioids (e.g., Fentanyl and nalbuphine), midazolam (e.g., gamma-aminobutyric acid (GABA) receptor agonists), and N-methyl-D-aspartate receptor antagonist (e.g., Ketamine) [4].

Fentanyl acts on the substantia gelatinosa in the dorsal horn of spinal cord, where it blocks the neural fibers carrying pain impulses both at pre-synaptic and post synaptic levels [5]. Addition of opioid to local anesthetics gives the opportunity to use more diluted local anaesthetic solutions for better analgesia, and reduces systemic toxicity risk and motor block incidence in local anesthetics [6]. Present study was aimed to compare bupivacaine versus bupivacaine with fentanyl for caudal epidural anaesthesia and analgesia in children undergoing lower abdominal surgery.

Material and Methods

Present study was comparative, double blind, observational study, conducted in department of anaesthesiology, at Mamata medical college & hospital, Khammam, Telangana, India. Study duration was of 2 years (July 2021 to July 2022). Study was approved by institutional ethical committee.

Inclusion criteria: Children aged between 1 and 10 years, either gender, ASA class I and II, scheduled to undergo lower abdominal surgery, parents consented for participation.

Exclusion criteria

- Children with active respiratory tract infection, bleeding disorders, neuromuscular abnormalities,
- Children with deformities of the caudal space,
- Children allergic to nonsteroidal anti‑inflammatory drugs or any of the study drugs

Study was explained to parents of children posted for elective lower abdominal surgery & a written informed consent was taken. All the patients were kept nil per orally for 6 hours and premedicated with Injection glycopyrrolate 10 μg.kg-1 intramuscularly 45 minutes before the surgery. Standard monitoring consisted of the electrocardiogram, non-invasive blood pressure & pulse oximetry.

The children were randomized using a computer‑generated randomization table. Double blinding was ensured by not allowing the parents of the child and the person who assessed the postoperative pain in the operation theatre while giving the block. Injection ketamine 1-2 mg kg-1 intravenously was given before giving caudal block. The caudal block was performed in lateral position under aseptic conditions with 24 gauze hypodermic needle and space localization was confirmed by "whoosh" test.

Then the allocated dose of the drug was injected as.

- Group A, bupivacaine 0.25% 2 mg/kg with fentanyl (1μg/kg).
- Group B bupivacaine 0.25% 2 mg/kg.

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After completion of the block the child was turned supine. Onset of anaesthesia was determined by the loss of cremasteric reflex in males and loss of patellar reflex in females. Determination of the level of anaesthesia was done by skin pinching every one to two minutes. Motor block was judged by applying nociceptive stimuli aimed at eliciting withdrawal movement. Duration of motor block was assessed by noting when patient began to move their legs. The block was supplemented with intravenous ketamine intermittently in a dose of 0.5mg kg-1 intraoperatively if the child moved in between the surgery.

Patients were monitored for heart rate, systolic blood pressure, respiratory rate and SpO2 every 5 minutes intraoperatively and thereafter every 30 minutes for the next 10 hours postoperatively. Hannallah`s paediatric objective pain score (OPS) was used to measure duration of caudal analgesia. Injection Paracetamol (5 mg/kg) intravenously was given when the OPS was = 4. During the postoperative period complications like nausea, vomiting, pruritus, respiratory depression and urinary retention etc. if occurred, were noted.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

Results

In present study, each group allocated 30 cases. General characteristics such as age (years), gender (male/female), weight (kg), ASA class I/II & Duration of surgery (min) were comparable among both groups & difference was not significant statistically.

Table 1: General characteristics

Parameters	Group A (n=30)	Group B (n=30)	P value
Age (years)	7.5 ± 1.9	6.7 ± 2.1	> 0.05
Gender			> 0.05
Male	24	25	
Female	6	5	
Weight (kg)	18.3 ± 7.7	18.1± 8.8	> 0.05
ASA class			> 0.05
ASA I	27	28	
II	3	2	
Duration of surgery (min)	71.03 ± 20.54	68.63 ± 18.85	> 0.05

In present study, various surgeries were Herniotomy, Orchidopexy, Hydrocele, urethroplasty & Circumcision among both groups & difference was not significant statistically.

Table 2: Type of surgeries

Type of surgery	Group A (n=30)	Group B (n=30)	P value
Herniotomy	10	12	> 0.05
Orchidopexy	8	6	
Hydrocele	5	5	
Urethroplasty	4	5	
Circumcision	3	2	

Onset of Sensory block (mins) & Time to achieve the optimum level (mins) were comparable among both groups & difference was not significant statistically. We noted more duration of motor block (176.4 ± 64.4 min vs 154.5 ± 52.13 min), Prolonged duration of postoperative analgesia (320.3 ± 41.19 min vs 288.3 ± 43.1 min), less amount of rescue analgesic (73.33 ± 44.28 mg vs 85.17 ± 44.45 mg) & late requirement of rescue analgesic (272.67 ± 37.38 min vs 236.83 ±10.63) in A group as compared to Group B & difference was significant statistically.

Table 3: Anaesthesia characteristics

Parameters	Group A (n=30)	Group B (n=30)	P value
Onset of Sensory block (mins)	7.27 ± 0.39	8.32 ± 1.43	>0.05
Time to achieve the optimum level (mins)	13.20 ± 8.83	14.24 ± 9.38	>0.05
Duration of motor block (min)	176.4 ± 64.4	154.5 ± 52.13	<0.05
Duration of postoperative analgesia (minutes)	320.3 ± 41.19	288.3 ± 43.1	<0.05
Total amount of rescue analgesic (mg)	73.33 ± 44.28	85.17 ± 44.45	<0.05
Time to rescue analgesic (min)	272.67 ± 37.38	236.83 ±10.63	<0.0001

PONV & pruritis were noted in 1 patient each from group A as compared to 3 cases of PONV & 1 case of pruritis & difference was not significant statistically.

Table 4: Side effects and complication

Parameters	Group A (n=30)	Group B (n=30)	P value
PONV	1	3	0.48
Pruritus,	1	1	
Respiratory depression	0	0	
Urinary retention	0	0	

Discussion

Regional anaesthesia with local anaesthetics has been shown to inhibit the stress response to surgery and can also influence postoperative outcome by its beneficial effects on organ function [7]. Caudal epidural anaesthesia, either in form of continuous infusion or bolus is the commonest regional technique that provides analgesia both peri and post-operation in children [8]. Although it has huge advantages such as early extubation, low risk of infection and ambulation, its use is limited due to short term effect of analgesia [9].

Ranjita A *et al.*, [10] randomly divided 90 children into three groups as group I (only Bupivacaine 2mg/kg), group II (bupivacaine 2mg/kg with fentanyl 0.5mcg/kg) and group III (bupivacaine 2mg/kg with fentanyl 1mcg/kg) caudally. The duration of postoperative analgesia was significantly longer in group III (9.11±0.62 hours) as compared to group II (7.1±0.66 hours) and group I (3.26±0.59 hours). Similarly the mean pain score was significantly more in group I as compared to group II and group III. Caudal fentanyl with bupivacaine provides prolonged and good quality postoperative analgesia as compared to plain bupivacaine in children undergoing infra-umbilical surgeries. However, fentanyl at dose of 1 μg kg-1 produces longer postoperative analgesia as compared to the dose of 0.5 μg kg-1 without any adverse effects. Similar findings were noted in present study.

Muralidar V *et al.*, [11] compared post-operative pain in children receiving caudal Levobupivacaine with Fentanyl and Levobupivacaine Alone, using CHIPPS scale at 2, 4, 6, 12 and 24 hours and exhibited a p-value of 0.545, 0.492, 0.626, 0.166, and 0.329 respectively. Mean duration of analgesia was 14.60 in Group L & 17.67 in Group LF, difference was statistically significant. Combination of fentanyl with levobupivacaine when compared to levobupivacaine alone for caudal block was better in children less than 3 years undergoing

infra umbilical procedures.
Gaitini LA *et al*., [12] has reported improved efficacy of the combination of small dose fentanyl (1µ/kg) and bupivacaine 0.25%, over bupivacaine 0.25% alone when used for caudal anesthesia. Similarly Baris *et al*., [13] reported that caudal block with 0.75ml/kg 0.25% bupivacaine and 50µ/kg midazolam or 1µg/kg fentanyl provides additional analgesic benefit to bupivacaine alone when administered in children operated for unilateral inguinal hernia.
Local anaesthetic and opioid combination has shown to be more effective as their effects start rapidly and last longer when compared with local anaesthetics given alone [14]. Adequate pain control is an extremely important aspect of postoperative care. This helps in the psychological wellbeing of the patient, decreases the stress response to surgery resulting in a favourable outcome [15].
Caudal block is notable for its simplicity, safety and effectiveness. It hastens awakening, permits early ambulation, shortens recovery room stay, pain free postoperative period and provides ideal psychological condition for the recovering child and the family. Caudal block can be used as adjunct to GA for lower abdominal surgeries due to the availability of safe local anesthetics. It prevents the establishment of winding up by blocking sensory input which induces central sensitization [16]. An opioid analgesic with local anesthetics by caudal route is a safe, effective and reliable method of postoperative pain relief.

Conclusion

1µg/kg fentanyl with 0.25%bupivacaine 2mg/kg when administered caudally provide satisfactory surgical anesthesia and post-operative analgesia with prolonged period of analgesia without any major postoperative complications. Fentanyl produces a faster onset of analgesia with fewer side effects like nausea, vomiting.

Conflict of Interest: None to declare

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