Original Research Article

Comparative study of 0.25% bupivacaine versus 0.25% bupivacaine with fentanyl for caudal epidural anaesthesia and analgesia in children undergoing infra umbilical surgeries

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Abstract

Background: For the purpose of controlling postoperative pain following abdominal and lower limb procedures, caudal epidurals are typically administered to children. The most popular local intrathecal anaesthetic for children is bupivacaine. To improve the quality of the intrathecal block and lengthen the analgesic effect, several adjuvants are added to the local anaesthetic. In the current study, caudal epidural analgesia and anaesthesia for children having lower abdomen surgery were compared between bupivacaine and bupivacaine combined with fentanyl. **Materials and methods:** This is an observational study, approved by the institutional ethical committee. An individual informed consent was taken from all patients selected for the study. All patients belonging to ASA grade 1 and 2, between the age group of 1 to 10 years posted for infra umbilical surgeries. Total 60 children undergoing infra umbilical surgeries were included and divided into two groups. **Conclusion:** When delivered caudally, 1µg/kg fentanyl and 0.25% bupivacaine offer adequate surgical anaesthetic and post-operative analgesia with a longer period of analgesia and no significant postoperative sequelae. It is well known that fentanyl has a quicker onset of analgesia and fewer adverse effects like nausea and vomiting.

Keywords: Bupivacaine, caudal- epidural analgesia, fentanyl, pediatric surgery.

Introduction

For the purpose of controlling postoperative pain following abdominal and lower limb procedures, caudal epidurals are typically administered to children[1]. Caudal anaesthesia, which is brought on by a sacral hiatus, is also referred to as epidural anaesthesia. With the capacity to maintain continuous anaesthesia following the insertion of an epidural catheter, epidural is preferable to spinal anaesthesia for lengthy procedures. Lower doses of anaesthetic medications might be used after surgery to lessen any discomfort[2] 0.25%

The most popular local intrathecal anaesthetic for children is thought to be bupivacaine. To improve the quality of the intrathecal block and lengthen the analgesia, a variety of adjuvants were added to the local anaesthetic[3]. Two stimulants, such as clonidine and dexmedetomidine, opioids, such as fentanyl and nalbuphine, midazolam (such as gamma-aminobutyric acid (GABA) receptor agonists), and N-methyl-D-aspartate receptor antagonists, such as ketamine, are among the commonly used adjuvants[4].

Fentanyl inhibits neural fibres transporting pain impulses both at pre-synaptic and post-synaptic levels by acting on the substantia gelatinosa in the dorsal horn of the spinal cord[5]. The addition of opioid to local anaesthetics allows for the use of more dilute local anaesthetic solutions for improved analgesia and lowers the risk of systemic toxicity and the occurrence of motor block in local anaesthetics[6]. In the current study, caudal epidural analgesia and anaesthesia for children having lower abdomen surgery were compared between bupivacaine and bupivacaine combined with fentanyl.

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Materials and methods

The current investigation was an observational, comparative, double-blind study carried out in the anesthesiology department at Alluri Sitarama Raju Academy of Medical Sciences in Eluru, Andhra Pradesh, India. The study lasted two years (September 2020 to September 2021). The institutional ethical committee approved the study. Total 60 children undergoing infra umbilical surgeries were included and divided into Group A (30) & Group B (30).

Inclusion criteria

Children between the ages of 1 and 10 who are both male and female, in ASA classes I and II, and who are undergoing lower abdominal procedures are eligible to participate with parental agreement.

Exclusion criteria

- Kids with active respiratory infections, clotting issues, and neuromuscular difficulties,
- Caudal space malformations in kids,
- Kids who are sensitive to either of the study medications or nonsteroidal anti-inflammatory medicines

Parents of children scheduled for elective lower abdomen surgery were informed about the study and provided with a signed agreement. All of the individuals underwent a 6-hour oral fast and were premedicated 45 minutes prior to surgery with an intramuscular injection of glycopyrrolate (10 g.kg-1). The EKG, non-invasive blood pressure, and pulse oximetry were used for routine monitoring.

A computer-generated randomization table was used to randomly assign the subjects. By barring the child's parents and the person who evaluated the postoperative pain from the operating room while the block was administered, double blinding was made sure to occur. administering ketamine Before administering caudal block, 1-2 mg kg-1 intravenously were given. With a 24 gauze hypodermic needle

and aseptic conditions, the caudal block was carried out in the lateral position, and the "whoosh" test was used to validate the space's location. The medicine was then administered in the prescribed dosage.

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

Group B bupivacaine 0.25% 2 mg/kg.

The kid was flipped supine when the block was finished. Loss of the cremasteric reflex in men and loss of the patellar reflex in women signalled the beginning of anaesthesia. Skin pinching was used to gauge the level of anaesthesia every one to two minutes. By using nociceptive stimuli intended to cause withdrawal movement, motor block was assessed. By observing the moment the patient started moving their legs, the length of the motor block was calculated. If the child moved during the course of the procedure, a 0.5 mg kg-1 intraoperative dosage of intravenous ketamine was added to the block. During surgery, patients had their heart rate, systolic blood pressure, respiration rate, and SpO2 checked every five minutes. For the next ten hours after surgery, they were checked every thirty minutes. The length of caudal analgesia was measured using Hannallah's paediatric objective pain score (OPS). When the OPS was equal to 4, an intravenous injection of paracetamol (5 mg/kg) was administered. If problems such nausea, vomiting, pruritus, respiratory depression, urine retention, etc. occurred during the postoperative period, they were noted.

Microsoft Excel was used to collect and compile the data, and SPSS 23.0 was used to analyse it. Calculations for continuous variables include frequency, percentage, means, and standard deviations (SD), whereas those for categorical variables include ratios and proportions. The chi-square test or Fisher exact test was used, depending on the situation, to analyse differences between qualitative variables. A statistically significant value was defined as one with a P value less than 0.5.

Results

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

Each group in the current study received 30 patients. General characteristics including age (years), gender (male/female), weight (kg), ASA class I/II, and operation duration (min) were comparable between the two groups and statistically, the difference was not significant.

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	

In the current study, both groups underwent numerous operations, including circumcision, hernia repair, orchidopexy, and urethroplasty, however there was no statistically significant difference between the two groups.

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

The difference between the two groups' average times for the sensory block to start (in minutes) and for it to reach its peak (in minutes) was not very large. We found that in Group A compared to Group B, there was a longer duration of motor block (176.4 ± 64.4 min vs 154.5 ± 52.13 min), a longer duration of postoperative analgesia (288.3 ± 43.1 min vs 320.3 ± 41.19 min), a lower amount of rescue analgesic (73.33 ± 44.28 mg vs 85.17 ± 44.45 mg), and a later requirement for rescue

Table 4: Side effects and complication

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

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.

Discussion

It has been demonstrated that regional anaesthesia combined with local anaesthetics can reduce the stress response to surgery and can also affect the postoperative course by improving organ function[7]. The most popular localised approach for giving children analgesia both before and after surgery is caudal epidural anaesthesia, either as a continuous infusion or bolus[8]. Although it has many benefits, including early extubation, a minimal risk of infection, and

ambulation, its usage is restricted because of the analgesic's short-term effects[9].

90 children were divided into three groups at random by Ranjita A et al.[10]: group I received just bupivacaine 2 mg/kg; group II received bupivacaine 2 mg/kg with fentanyl 0.5 mcg/kg; and group III received bupivacaine 2 mg/kg with fentanyl 1 mcg/kg caudally. In comparison to groups II (7.1±0.66 hours) and I (3.2±60.59 hours), group III had postoperative analgesia for a considerably longer period of time (9.11±0.62 hours).Similar to this, group I's mean pain score was noticeably higher than that of groups II and III. When compared to bupivacaine alone, caudal fentanyl with bupivacaine prolongs and improves postoperative analgesia in children having infra-umbilical operations. However, fentanyl induces persistent postoperative analgesia at a dose of 1 g kg-1 as opposed to 0.5 g kg-1 without any negative side effects. Similar results were seen in the current investigation.

Muralidar V et al[11]. compared post-operative pain using the CHIPPS scale at 2, 4, 6, 12 and 24 hours in children receiving caudal levobupivacaine with fentanyl and levobupivacaine alone, and found that the p-values were 0.545, 0.492, 0.626, 0.166, and 0.329, respectively. The difference in the mean analgesic durations in Groups L and LF was statistically significant at 14.60 and 17.67 respectively. In children under 3 years old receiving infra umbilical procedures, the combination of fentanyl and levobupivacaine was superior to levobupivacaine alone for caudal block.

When used for caudal anaesthesia, Gaitini LA et al[12]. observed that the combination of modest dose fentanyl (1 mcg/kg) and bupivacaine 0.25% was more effective than bupivacaine 0.25% alone. Similar to this, Baris et al[13]. found that caudal block with 0.75ml/kg 0.25% bupivacaine and 50mg/kg midazolam or 1 mcg/kg fentanyl offers an extra analgesic benefit to bupivacaine alone when given to children having a unilateral inguinal hernia repaired. When compared to local anaesthetics administered alone, local anaesthetic and opioid combinations have been found to be more effective since their effects begin quickly and continue longer[14]. The management of pain effectively is a crucial component of postoperative care. This improves the patient's psychological health and lessens the stress response to surgery, which leads to a successful outcome[15].

Caudal block is renowned for its efficacy, simplicity, and safety. It expedites awakening, enables early ambulation, reduces recovery room stay, allows for pain-free rehabilitation after surgery, and offers the best possible psychological environment for the recovering kid and family. Due to the availability of secure local anaesthetics, caudal block can be utilised as a supplement to general anaesthesia for lower abdominal procedures. Through the suppression of sensory input that causes central sensitization, it limits the development of winding up[16]. A safe, dependable, and successful way to relieve postoperative pain is through caudal administration of an opioid analgesic combined with local anaesthetics.

Conclusion

When given caudally, 1µg/kg of fentanyl and 2mg/kg of 0.25% bupivacaine offer adequate surgical anaesthetic and post-operative analgesia with a longer period of analgesia without any significant postoperative problems. Fentanyl causes analgesia to start acting quickly and has fewer adverse effects including nausea and vomiting.

Conflict of Interest

None to declare

Source of funding

Nil

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