

COMPARATIVE STUDY OF EFFECT OF CAUDAL MORPHINE AND FENTANYL ADDED TO ROPIVACAINE IN PAEDIATRIC INFRAUMBILICAL SURGERY

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ABSTRACT

BACKGROUND

Caudal analgesia is a very popular route to provide postoperative analgesia in children because of simple technique, high success rate and smooth recovery. Various additives have been used to increase the duration provided by ropivacaine administered by a single shot caudal injection.

METHODS

A prospective, randomised double blind controlled study in 40 ASA Grade 1 children aged 1-6 years undergoing subumbilical surgery was conducted. Patients were divided into 2 groups to receive either fentanyl 2 µg/kg (FR) or morphine 20 µg/kg (MR) in ropivacaine 0.2% (1mL/kg) for caudal analgesia. The duration of analgesia (FLACC scale), sedation and side effects were observed.

RESULT

The mean duration of analgesia was 10.42 (0.89) hour in MR group compared to 5.78 (0.87) hour in FR group (P, 0.0001). Subjects in MR group remained more sedated than FR group. Vomiting was observed in 15% and 10% in MR and FR group respectively. Itching was 15% and 5% in MR and FR group respectively. No hypotension, bradycardia or respiratory depression was observed in any subject.

CONCLUSION

Caudal morphine 20 µg/kg in ropivacaine 0.2% provides longer duration of analgesia and sedation compared to caudal fentanyl 2 µg/kg in ropivacaine 0.2% (1 mL/kg) without any significant side effect in children in subumbilical surgery.

KEYWORDS

Caudal Anaesthesia, Ropivacaine, Morphine, Fentanyl, Postoperative Analgesia.

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INTRODUCTION

Caudal epidural block is one of the most common regional anaesthesia technique used for intraoperative and postoperative analgesia because of its simple technique, high success rate, smooth recovery and predictable level of block. It is used mainly in perineal and subumbilical procedures.⁽¹⁾

Caudal epidural block, however, has the disadvantage of having shorter duration of action even when long-acting local anaesthetics are used. There is an increasing concern regarding the use of caudal catheter to administer repeated doses or infusion due to risk of infection. So to improve duration of anaesthesia and quality of analgesia of a single shot caudal, various additives have been used such as opioids, clonidine, neostigmine with their associated side effects.^(2,3)

Bupivacaine was a popular drug in regional anaesthesia for years until toxic reactions were noted. Ropivacaine produces less motor blockade, less cardiovascular and neurological toxicity making it suitable for day care surgery in children.^(4,5,6,7)

We therefore designed a prospective randomised, double blind study to compare the duration of analgesia, sedation and side effects, if any of single shot caudal morphine or fentanyl in ropivacaine 0.2% in paediatric patients undergoing subumbilical procedures.

MATERIAL AND METHODS

The study was conducted from June 2015 to December 2015. After having the written informed consent from parents, the patients were randomly divided into 2 groups double blindly. All children were ASA Grade 1 between ages 1-6 years undergoing subumbilical procedures. Exclusion criteria include a history of developmental delay or mental retardation, which could make observation of pain intensity assessment outside the norm, coagulopathy, any sacral abnormality or infection at the site of block or known allergy to the study drugs.

Patients were kept fasting as per ASA guidelines (Clear liquid 2 hours, breast milk 4 hours, infant formula, non-human milk and light meal 6 hours). All routine monitors including NIBP, pulse oximetry and ECG were attached. The patients were premeditated with Glycopyrrolate (0.04 mg/kg) and Inj. Fentanyl 1 µg/kg. General anaesthesia was induced with sevoflurane in oxygen/propofol (2 µg/kg) depending on the presence of IV cannula. Appropriate size of Proseal LMA was given after giving Injection atracurium 0.5 mg/kg. A suction catheter was kept for nasogastric aspiration. Depth of anaesthesia was maintained with isoflurane, atracurium,

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N₂O:O₂(1:1). After this, patient was positioned in lateral decubitus and a single dose caudal block was performed under all aseptic conditions using 23 G needle. Placement of needle was confirmed by characteristic pop of sacrococcygeal ligament penetration followed by whoosh test with 0.5 mL air.⁽⁸⁾ after negative aspiration, patients in the group MR received Morphine 20 µg/kg with ropivacaine 0.2% 1 mL/kg, whereas patients in the group FR received fentanyl 2 µg/kg with ropivacaine 0.2% 1 mL/kg.

RL was used as maintenance fluid. Intraoperative BP, pulse, SPO₂, ETCO₂, ECG were monitored and recorded. Injection ondansetron IV 0.08mg/kg was administered before reversal with Glycopyrrolate and neostigmine. After extubation patients were shifted to PACU where they were capable of maintaining a patent airway and observation of HR, SPO₂. ECG could be done.

Using FLACC pain scale with 0-10 score range, patients' pain intensity was assessed.⁽⁹⁾ by a resident doctor (Blinded to the treatment). The sedation score was assessed by four-point scale. Pain and sedation was observed every hour. A note was made for any side effect nausea, vomiting, itching, bradycardia (HR<60/min), hypotension (BP<20% of the baseline) and respiratory depression (SPO₂ <95%). The duration of sedation was measured as the time from drug administration to a score of ≤2. The duration of analgesia was measured as the time from drug administration to a FLACC of ≥4. At this point, paracetamol suppository 40 mg/kg was given as rescue analgesia.

Score	Response of Patients
1.	Alert and aware
2.	Asleep, arousable by verbal contact
3.	Asleep, arousable by physical contact
4.	Sleep not arousable

Table 1: Sedation Score

RESULT

Forty ASA1 patients aged 1-6 years undergoing elective subumbilical surgeries were enrolled for this prospective randomised double blind study. All the subject characteristics are documented in register and Microsoft excel sheet (Table 2). All caudal blocks were regarded as clinically successful. The total duration of analgesia (For FLACC ≥4) was 10.42±0.89 hours in MR group as compared to 5.78±0.87 hours in FR group. The total duration of sedation was 3.49±0.52 hours in MR group as compared to 1.272±0.38 hours in FR group. After comparing between these two groups with the help of 't' test, it was found that there was statistically significant prolonged duration of analgesia and sedation in MR group (p≤0001). Vomiting was observed in 15% and 10% patients in MR and FR group respectively. Itching was found in 15% and 5% patients in MR and FR group respectively. No hypotension, bradycardia or respiratory depression was observed in any subject.

	Group MR (n=20)	Group FR (n=20)	P Value
Age (years)	3.17±1.35	3.03±1.32	0.74
Weight (Kg)	12.37±3.22	12.71±2.87	0.73
Duration of Surgery (hrs)	1.01±0.47	1.04±0.49	0.83
Type of Surgery			
Circumcision	5 (25%)	6 (30%)	
Orchidopexy	5 (25%)	4 (20%)	
Inguinal Herniotomy	5 (25%)	6 (30%)	
Hypospadias	5 (25%)	4 (20%)	

Table2: Subject Characteristics-Demographic and Operative Data (MR-Morphine Ropivacaine Group, FR-Fentanyl Ropivacaine Group)

Values are expressed as mean±SD. No significant differences between two groups (p>0.05). SD: Standard Deviation

	Group MR (n=20)	Group FR (n=20)	P Value
Duration of analgesia(hrs)	10.42±0.89	5.78±0.87	0.0001
Duration of sedation(hrs)	3.49±0.52	1.272±0.38	0.0001
Vomiting	3 (15%)	2 (10%)	0.64
Itching	3 (15%)	1 (5%)	0.30
Bradycardia	0	0	
Hypotension	0	0	
Respiratory depression (spo2<95%)	0	0	

Table 3: Duration of Analgesia, Sedation and Side Effects

Values are expressed as Mean±SD. No significant differences between two groups (p>0.05). SD: Standard Deviation.

STATISTICAL ANALYSIS

Data were analysed using computer statistical software system SPSS version 20. The data was expressed as mean±standard deviation as appropriate.

Patient's characteristics and duration of sedation and analgesia were compared using unpaired t-test. P≤0.05 was considered to be statistically significant.

DISCUSSION

Postoperative pain starts with surgical trauma and ends with tissue healing. Relief of pain in paediatric patients demands relatively safer techniques and drugs. Caudal epidural analgesia is a simple, frequently used technique which provides effective analgesia for both intraoperative and postoperative purposes in paediatric patients for infraumbilical surgeries.

Ropivacaine is a relatively safe local anaesthetic with a better safety margin and separation of sensory and motor effects. Bosenberg A et al. demonstrated that ropivacaine 0.2% (2 mg/mL) for caudal block provide satisfactory postoperative pain relief after inguinal surgery in 4-12 years' children. It also showed ropivacaine 1 mg/mL had less efficacy, while use of 3 mg/mL was associated with higher incidence of motor block with minimal improvement in postoperative pain relief.⁽¹⁰⁾

Use of ropivacaine in paediatric caudal blocks has been reported by G. Ivani et al. who used 0.2% ropivacaine 2 mg/mL (1 mL/kg) via caudal route for children aged 1-10 years. Addition of adjuvants allows use of lower concentration of local anaesthetic agents and also improved analgesic effect. Various agents used for adjuvant are clonidine, dexamethasone, dexmedetomidine, opioids (Fentanyl, morphine), midazolam, ketamine.⁽¹¹⁾ Fentanyl is one of the most commonly used adjuvants with local anaesthetic agents for caudal block.⁽¹²⁾ Study by Elham et al. which compared caudal fentanyl to caudal dexmedetomidine and dexamethasone when added to local anaesthesia bupivacaine concluded that caudal fentanyl had a very short duration of action with mean duration of 330.4±14.7 minutes ($P<0.001$).⁽¹³⁾ Study by Campbell et al. compared caudal fentanyl (1µ/kg)-bupivacaine (0.25%) to that of bupivacaine alone also concluded having no added advantage of improved or prolonged postoperative analgesia of adding fentanyl at dose 1µ/kg.⁽¹⁴⁾ Adding drugs to ropivacaine can prolong its analgesic efficacy.

MK Arora et al. have shown low dose morphine (0.03 mg/kg) when added to 0.25% bupivacaine significantly improved quality as well as duration of analgesia after urogenital, orthopaedic and lower abdominal general surgical procedures in children between 1-8 years.⁽¹⁵⁾ Mayhew et al. showed that low dose caudal morphine 0.03-0.04 mg/kg had relief of postoperative pain in children.⁽¹⁶⁾ Duration of analgesia was between 6-24 hours. There was no respiratory depression noted in 500 cases. Hence, a dose of fentanyl 2 µg/kg and morphine 20 µg/kg added to 0.2% ropivacaine (1 mL/kg) individually was chosen as study drug dose in FR and MR group respectively. Demographic data reveals that the two groups are comparable. It was observed that addition of morphine to ropivacaine significantly improved the quality as well as duration of analgesia when compared to fentanyl in children aged 1-6 years.

Duration of analgesia in the present study in MR group was found to be 10.42 (0.89) hrs. This correlates to study of MK Arora et al. who reported the mean duration of analgesia after caudal block using bupivacaine and morphine (0.03 mg/kg) was 12-26 hrs with a mean duration of (20.8±3-4 hrs). The duration of analgesia in our study in FR group was found to be 5.78 (0.87) hrs. This correlates to study of Campbell et al. who concluded that adding fentanyl to bupivacaine does not produce added advantage of prolonging the block. No serious side effects like respiratory depression or apnoea was seen in any of the groups. Vomiting was found 15% in MR group and 10% in FR group. This corresponds to the study of MK Arora et al. who reported nausea and vomiting after use of morphine with bupivacaine for caudal block. Constant et al. compared caudal clonidine and fentanyl, which showed adverse effect especially vomiting occurred more in fentanyl group.⁽¹⁷⁾

CONCLUSION

Addition of morphine to ropivacaine as caudal analgesia provides prolonged postoperative analgesia and sedation than fentanyl addition to ropivacaine. Vomiting and itching was little more in morphine group, but it is not statistically significant. Hemodynamically, both groups are stable.

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