

A Prospective Study of Effect Of Caudal Morphine And Fentanyl Addition To Ropivacaine In Paediatric Infraumbilical Surgery

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ABSTRACT

INTRODUCTION: caudal epidural analgesia is commonly practiced regional block technique in children undergoing infraumbilical surgeries but has a short duration of action after single shot local anaesthetic injection. The aim of this study was to determine effect of caudal morphine and fentanyl addition to ropivacaine in pediatric infraumbilical surgery.

MATERIALS AND METHODS: 80 pediatric patients undergoing various elective lower abdominal surgeries like circumcision, orchidopexy, herniotomies, etc. And belonging to ASA Grade I and II were selected for this study for convenience. This study was conducted in Department of Anesthesia, Mahatma Gandhi Memorial Medical College, Jamshedpur, Eastsingbhum, Jharkhand from January 2016 to February 2017.

RESULTS: The mean duration of analgesia was 10.30(0.89) hour in MR group compared to 5.68(0.87) hour in FR group (P, 0.0001). Subjects in MR group remained more sedated than FR group. Vomiting was observed in 12% and 9% in MR and FR group respectively. Itching was 14% and 6% in MR and FR group respectively. No hypotension, bradycardia or respiratory depression was observed in any subject.

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

KEYWORDS: Postoperative Analgesia, Ropivacaine, Morphine, Fentanyl,

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I. Introduction

Caudal block is one of the most popular and commonly used regional anaesthetic procedures in paediatric patients for most surgeries below the umbilicus. The block can be practised by a single-shot injection or as a continuous infusion through a caudal epidural catheter. For continuous infusion, use of a caudal catheter is usually not preferred due to high risk of catheter contamination from faecal soiling [1]. To extend the duration of post-operative analgesia provided by the 'single shot' caudal technique, various additives, such as tramadol, ketamine, ephedrine, morphine, fentanyl and clonidine with local anaesthetics, have been investigated. Tramadol, a synthetic 4-phenyl-piperidine analogue of codeine, is a racemic mixture of two enantiomers, both of which contribute to the analgesic activity through different mechanisms enhancing inhibitory effects on pain transmission in the spinal cord. The (+) enantiomer has moderate affinity for the opioid μ -receptor, which is greater than that of the (-) enantiomer. In addition, the (+) enantiomer stimulates the pre-synaptic release of serotonin and inhibits serotonin reuptake, and the (-) enantiomer is a norepinephrine reuptake inhibitor [2]. The complementary and synergistic actions of the two enantiomers improve the analgesic efficacy and tolerability profile of the two. Tramadol has a striking lack of respiratory depressant effect despite having analgesic potency approximately equal to that of pethidine [3, 4]. Tramadol is a centrally acting analgesic effect via opioid receptors [5]. The main site of action of epidurally administered fentanyl is the substantia gelatinosa on the dorsal horn of spinal cord [6]. We evaluated the duration of postoperative analgesia, intraoperative hemodynamic changes, the requirement of inhalational agent and any side effect while using caudal block bupivacaine with tramadol versus fentanyl in pediatric patients undergoing infraumbilical surgery.

II. Materials And Methods:

This prospective and randomized controlled, single-blind study were conducted in the pediatric surgical ward between January 2016 to February 2017, and total 80 children of either sex scheduled for elective infraumbilical surgeries under general anesthesia.

Inclusion criteria: American Society of Anesthesiologist (ASA) physical status I and II, aged 1-12 years, weighing 5-30 kg.

Exclusion criteria: Patients are having a local infection at the caudal site, neurological disorder, the history of allergic reaction to local anesthetics, sacral/vertebral abnormalities, and bleeding diathesis.

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 (0.04mg/kg) and Inj. Fentanyl 1µg/kg. General anaesthesia was induced with sevoflurane in oxygen/propofol (2µg/kg) depending on the presence of IV cannula. Appropriate size of Proseal LMA was given after giving Injection atracurium 0.5mg/kg. A suction catheter was kept for nasogastric aspiration. Depth of anaesthesia was maintained with isoflurane, atracurium, 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 23G needle. Placement of needle was confirmed by characteristic pop of sacrococcygeal ligament penetration followed by whoosh test with 0.5mL air.⁽⁸⁾ after negative aspiration, patients in the group MR received Morphine 20µg/kg with ropivacaine 0.2% 1mL/kg, whereas patients in the group FR received fentanyl 2µg/kg with ropivacaine 0.2% 1mL/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 40mg/kg was given as rescue analgesia. Score 1 means alert and aware, score 2 means Asleep, arousable by verbal contact, score 3 means Asleep, arousable by physical contact score 4 means Sleep not arousable.

III. Results:

80 pediatric patients, 40 in group I and 40 in group II were studied. Both the groups were comparable with regard to mean age, weight, gender, duration of general anaesthesia, duration of surgery, time from caudal block to incision, and time to removal of LMA after discontinuation of volatile anesthetic agent.

Parameter	Group MR (N=40)	Group FR (N=40)	P Value
Age (years)	3.75±2.61	3.67±1.73	0.336
Sex(male/female)	29/11	26/14	-----
Weight (kg)	13.65±2.67	14.65±2.67	0.086
Surgical procedures			
Inguinal hernia	29	28	0.791
Hypospadias repair	6	8	0.380
Orchidopexy	5	3	0.353
Orchidectomy	0	1	0.465
Duration of surgery (min)	35±7.3	37±8.7	0.476
Caudal block characteristic and sedation (min)			
Duration of analgesia	643.76±74.65	649±25.89	0.0001
Duration of motor block	421.34±56.46	466.13±32.67	0.007
Duration of sedation	423.98±76.23	498.45±65.31	0.001

Table 1: Patient demographic characteristics

Parameter	Group MR (N=40)	Group FR (N=40)
Duration of analgesia (min)	10.96±0.72	5.62±0.67
Duration of sedation(hrs)	3.36±0.41	1.260±0.28
Vomiting	4(16%)	2(10%)
Itching	3 (15%)	2(10%)
Bradycardia	0	0
Hypotension	0	0
Respiratory depression (spo2<95%)	0	0

Table 2: 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.

IV. 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. $P \leq 0.05$ was considered to be statistically significant.

V. 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% (2mg/mL) for caudal block provide satisfactory postoperative pain relief after inguinal surgery in 4-12 years' children. It also showed ropivacaine 1mg/mL had less efficacy, while use of 3mg/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 2mg/mL (1mL/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 (0.03mg/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 0.03-0.04mg/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 2µg/kg and morphine 20µg/kg added to 0.2% ropivacaine (1mL/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 (0.03mg/kg) was 12-26hrs with a mean duration of (20.8±3-4hrs). 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⁾

VI. 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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