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A comparison of Ropivacaine alone and in combination with Fentanyl for caudal analgesia in pediatric patients

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Abstract: *Caudal analgesia is a very popular route to provide intraoperative and postoperative analgesia in children because of its simple technique, predictable level of blockade, high success rate and smooth recovery. It can be used mainly for perineal and sub umbilical procedures. Ropivacaine, the S-enantiomer of the amide local anesthetic, produces differential neural blockade, with lesser motor blockade; less cardiovascular and neurological toxicity than bupivacaine, making it suitable for day-care surgery in children. The addition of an adjuvant prolongs and intensifies the sensory blockade caused by local anaesthetic and also reduces the dose of local anaesthetic required to provide desired analgesia. Fentanyl is one of the most commonly used adjuvant with local anesthetics in caudal blocks. The aim of our study was to compare the efficacy of ropivacaine alone and in combination with fentanyl via caudal route for postoperative analgesia in children. The primary end point was duration of sensory and motor blockade. Study Design: Double blind, prospective, randomized .The subjects were 40 children aged 1 – 10 years undergoing perineal and sub umbilical procedures. They were randomly divided in two groups of 20 each using chit in box method. Group R received inj ropivacaine 0.2%, 0.5 ml/kg and Group RF received inj ropivacaine 0.2%,0.5 ml/kg in combination with inj fentanyl 0.5mcg/kg via caudal route just after intubation. GA was induced in the standard manner using propofol. Our study showed that patients in group RF required rescue analgesic 16 – 20 hrs later than patients in group R and the pain scores of group RF were better in the postoperative period. There was no significant motor blockade in both the groups. There was also no significant hemodynamic variation and postoperative complications observed in either group. Thus, addition of fentanyl to ropivacaine as caudal analgesic provides prolonged and more intense postoperative analgesia in children.*

Keywords: *Caudal analgesia, fentanyl, postoperative analgesia, rescue analgesia, ropivacaine*

I. Introduction

Caudal analgesia is a very popular route to provide intraoperative and postoperative analgesia in children because of its simple technique, predictable level of blockade, high success rate and smooth recovery. It can be used mainly for perineal and subumblical procedures [1]. It reduces analgesic requirements and facilitates early discharge.

Bupivacaine was a popular drug in regional anaesthesia for years until toxic reactions were reported. Ropivacaine, the S-enantiomer of the amide local anaesthetic, produces differential neural blockade, with less motor blockade; less cardiovascular and neurological toxicity, making it suitable for day-care surgery in children [2, 3, 4, 5]. The addition of an adjuvant prolongs and intensifies the sensory blockade caused by local anaesthetic and also reduces the dose of local anaesthetic required to provide desired analgesia. Epidural fentanyl acts on the substantia gelatinosa in the dorsal horn of spinal cord blocking fibres carrying nociceptive impulses both pre and post synaptically[6].

The aim of our study was to compare the efficacy of ropivacaine alone and in combination with fentanyl via caudal route for postoperative analgesia in children. The primary end point was duration of sensory and motor blockade. Study Design: Double blind, prospective, randomized.

II. Materials And Methods

The subjects were 40 children ASA grade I/II, aged 1 - 10 years weighing between 5 and 25 kg, undergoing perineal and sub umbilical procedures. After having obtained the written informed consent of the parents, we randomly divided the children in two groups of 20 each using chit in box method.

Group R received inj ropivacaine 0.2%, 0.5 ml/kg and Group RF received inj ropivacaine 0.2%, 0.5 ml/kg in combination with inj fentanyl 0.5mcg/kg via caudal route just after intubation. General anaesthesia was induced in the standard manner using propofol. The patients were premedicated with inj. glycopyrrolate 0.04 mg/kg, inj midazolam 0.05 mg/kg and inj fentanyl 1 mcg/kg IV. Induction was done with inj propofol 1- 2 mg/kg and intubated with inj succinylcholine 2-2.5mg/kg . Maintenance was with inj. Vecuronium bromide, N2O:O2: Isoflurane technique.

After intubation, caudal block was attained as per the study groups. The duration of postoperative analgesia was assessed as the time to first administration of supplemental analgesia (based on a Childrens Postoperative Pain Scale score of ≥4 through an observation using Objective Pain Scale. The degree of immediate postoperative motor blockade was determined by use of a modified Bromage scale.

TABLE 1. Demographic Data

PARAMETER	GROUP R	GROUP RF	P VALUE
AGE (years) (Mean±SD)	6.51 ± 3.23	5. 88 ± 4.09	0.58
WEIGHT (KGS.) (Mean±SD)	18.01 ± 6.2	15.13 ± 7.2	0.16
M:F RATIO	13:7	12:8	
TYPE OF SURGERY (n=no. of patients)			
- Hernia repair	3	4	
- Hypospadias	5	4	
- Orchidopexy	9	8	
- Urethroplasty	3	4	
DURATION OF GA (MIN) (Mean+-SD)	102.01 ± 6.70.	103.10 ± 5.12	0.62
DURATIONOFSURGERY(MIN) (Mean+-SD)	46.62 ±5.11	47.22 ± 6.10	0.77

TABLE 2 Hemodynamic Variables

PARAMETERS	GROUP R (Mean+-SD)	GROUP RF (Mean+-SD)	P VALUE
HEART RATE (beats / min)			
- before induction	117.11 ±11.68	115 ±12.25	0.55
- intra - operatively	97.42 ± 7.01	96.22 ± 6.81	0.63
- post - operatively	109.22 ± 6.92	107.42 ± 8.22	0.52
MEAN ARTERIAL PRESSURE (mmHg)			
- before induction	73.25 ± 10.26	72.90 ± 12.65	0.93
- intra - operatively	68.24 ± 10.21	67.14 ±9.68	0.76
- post - operatively	69.84 ±11.26	68.72 ± 11.22	0.78
SpO2 (%)			
- before induction	98 ±2.0	98 ±1.5	1
- intra - operatively	98 ±1.24	98 ± 1.26	1
- post - operatively	98 ± 1.76	98 ± 1.02	1

TABLE.3 Postoperative Pain Scores

POST – OP TIME IN HOURS	GROUP R (Mean±SD)	GROUP RF (Mean±SD)	P VALUE
0	0.24 ± 0.2	0.022 ± 0.5	0.12
1	0.90 ± 0.7	0.80 ±0.7	0.69
2	1.08 ± 0.2	1.01 ±0.2	0.34
3	1.36 ± 0.2	1.10 ± 0.4	0.01
4	1.40 ± 0.4	1.22 ±0.4	0.22
8	1.42 ± 0.6	1.28 ± 0.02	0.37
12	2.22 ± 0.04	1.30 ± 0.6	0.0001
16	3.60 ± 0.6	1.50 ±0.2	0.0001
20	4.02 ± 0.8	1.72 ± 0.4	0.0001
24	4.40 ± 0.6	2.00 ± 0.6	0.0001
28		2.60 ± 0.8	
32		3.10 ± 0.1	
36		3.80 ± 0.4	
40		4.40 ± 0.6	

Note: Patients in group R needed rescue analgesia after 20-24 hours in postoperative period hence pain scores not relevant after 24 hrs.

TABLE4. Residual Motor Blockade

Parameter	Group R	Group RF	P value
RESIDUAL MOTOR BLOCKADE **(n=no.ofpatients)**	2	1	
TIME TO COMPLETE REGRESSION OF RESIDUAL MOTOR BLOCKADE (Mean+-SD)(min)	210 ± 30	215 ± 30	0.6516

TABLE 5. Complications

COMPLICATIONS/SIDE EFFECTS	GROUP R n=no.ofpatients	GROUP RF n=no.ofpatients
NAUSEA / VOMITING	1	4
RESP. DEPRESSION (SpO2 < 95%)	0	0
BRADYCARDIA	0	0
HYPOTENSION	0	0

III. Results

Both study groups were demographically identical.(TABLE.1). Our study showed that patients in group RF required rescue analgesic 16 – 20 hrs later than patients in group R (p-0.0001) and the pain scores of group RF were better in the postoperative period (TABLE.3). There was no significant motor blockade in both the groups.(TABLE.4) There was also no significant hemodynamic instability(TABLE.2) and postoperative complications observed in either group.(TABLE5)

IV. Conclusions

Thus we concluded that addition of fentanyl to ropivacaine as caudal analgesic provides prolonged and more intense postoperative analgesia in children. The limitation of our study is that type of surgical procedure is varied in the study. The intensity of postoperative pain may vary depending on the type of surgical procedure. Moreover the study population was aged from 1-10 years; age may have effect on the behaviour and response to pain.

V. Discussion

Caudal analgesia is frequently used for intra and postoperative pain relief in children undergoing operative procedures in subumblical region. It is desirable that the local anaesthetic agent used should not cause persistent motor block postoperatively. Ropivacaine in various concentrations have been used for the purpose. Addition of adjuvant analgesic agents allows use of lower concentration of local anaesthetic agents and also improved analgesia. Various drugs have been used as adjuvants viz. Clonidine, dexmedetomidine, midazolam, ketamine, opioids etc [7]. Fentanyl is one of the most commonly used adjuvants with local anaesthetics in caudal blocks [8].

We found that adding fentanyl 0.5 mcg / kg to ropivacaine 0.2% 0.5 ml/kg for a single shot caudal analgesia increased the mean time to first analgesic and better postoperative pain scores. This is in accordance with the study by Tarlika P et al[9]and Shukla et al.[10] In contrast ,another study by Y. Kawaraguchi et al depicted that there is no advantage of adding fentanyl to ropivacaine [11].

It has also been reported that ropivacaine is less cardiotoxic and has lesser motor effects than bupivacaine [2,3,4,5]. Therefore, ropivacaine is increasingly used for caudal blocks in children. In addition, it has been reported that ropivacaine produces vasoconstriction in contrast to vasodilation produced by bupivacaine [12]. Thus, we hypothesized that addictives to ropivacaine can improve analgesia. In a study, it was concluded that ropivacaine 0.2%provided satisfactory postoperative analgesia, 0.1%was less efficacious, whereas 0.3% was associated with a more frequent incidence of motor block with Minimal improvement in postoperative pain Relief [13]. Thus, we chose ropivacaine 0.2% in the present study.

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