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Original Research Article

Randomized Double-Blind Comparative Assessment of Analgesic Efficacy of Intrathecal 1% 2-Chloroprocaine with or Without Fentanyl in Elective Caesarean Section

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Abstract:

Aim: To investigate the effect of intrathecal fentanyl as an adjuvant to 1% 2-chloroprocaine (2-CP) in parturients undergoing elective lower segment caesarean section (LSCS).

Material & Methods: This prospective, double-blind, randomized, comparative study was conducted in Department of Anesthesiology, Jan Nayak Karpoori Thakur Medical College and Hospital, Madhepura, Bihar, India for 1 year. 120 parturients with term pregnancy (≥36 weeks) aged between 18 and 35 years, scheduled to undergo low-risk elective caesarean section under SAB, over a period of one year were enrolled in the study.

Results: The difference in HR, BP and SpO2 was not statistically significant in both the groups throughout the perioperative period. The mean duration of sensory block was prolonged in group CF in comparison to group CS, with the difference being statistically significant (101.2±14.50 min versus 72.24±10.63 min, $P < 0.0001$). There was no statistical difference in the Apgar score of newborns in both the groups.

Conclusion: The addition of fentanyl to 1% 2-chloroprocaine intrathecally prolonged the duration of sensory block and postoperative analgesia in patients undergoing LSCS.

Key words: 2-chloroprocaine, caesarean section, fentanyl, spinal anesthesia

Introduction

Spinal anesthesia is a reliable and safe technique for perianal surgeries. Nevertheless, some of its characteristics may limit its use for ambulatory surgery, including delayed ambulation, risk of urinary retention, and pain after block regression. [1] The changing trend of surgical practice from an inpatient to outpatient convention has urged us to modify our anesthetic drug to suit the ambulatory setting. The primary goal of ambulatory anesthesia is rapid recovery leading to early patient discharge with minimal side effects.

Although low doses of long-acting local anesthetics such as bupivacaine, ropivacaine, and levobupivacaine are usually administered intrathecally, they are

associated with significant delays in hospital discharge and less reliability of block efficacy, onset, and spread. [2]

In recent times, post-operative outcome is considered to be positive only when it is associated with a shortened length of hospital stay. Recovery from anesthesia is much faster with chloroprocaine as compared to other short acting local anesthetics. Lacasse et al. showed that the unassisted ambulation time and the time of patient's hospital discharge eligibility were significantly shorter when using chloroprocaine compared to bupivacaine [3]. Adjuvants like opioids are commonly added to intrathecal local anesthetics for improving quality and duration of spinal blockade and prolonging post-operative analgesia [4]. Among opioids, fentanyl is the most extensively used opioid in sub-arachnoid block [5].

The short duration of action and poor quality of postoperative analgesia limits its use in caesarean sections. Adding adjuvant drugs to intrathecal LA improves the quality and duration of the spinal blockade and prolongs postoperative analgesia. With the addition of an adjuvant, it is possible to reduce the amount of LA and thus the incidence of side-effects. The opioids continue to be the most commonly used adjuvants in clinical practice. [6] Among opioids, fentanyl is the most extensively used opioid in SAB, because of its potency, rapid onset, short duration of action with a reduced need for analgesia after the operation. [7-8]

The present study aimed to compare the analgesic efficacy and safety of intrathecal fentanyl (25 µg) as an adjuvant to low dose 1% 2-CP (30 mg) in parturients undergoing caesarean section.

Material & Methods:

This prospective, double-blind, randomized, comparative study was conducted in Department of Anesthesiology, Jan Nayak Karpoori Thakur Medical College and Hospital, Madhepura, Bihar, India for 1 year. The clinical research was done following the ethical principles for medical research involving human subjects in accordance with the Helsinki Declaration 2013. 120 parturients with term pregnancy (≥36 weeks) aged between 18 and 35 years, scheduled to undergo low-risk elective caesarean section under SAB, over a period of one year were enrolled in the study.

Written informed consent was obtained from each parturients. The parturients who refused to participate, having known hypersensitivity to LA, infection at the site of injection, history of bleeding disorders, parturients with pregnancy induced hypertension, body mass index (BMI) >35 kg/m2, parturients with cardiac or renal disease, pre-existing peripheral neuropathy or neurological deficit were excluded from the study. All parturients were randomized to one of the two groups (60 each) by using a computer-generated random number table and group allocation was done with the sealed envelope method by an anesthesiologist who was not involved in data collection.

After arrival in the operation theatre, an 18-gauge (G) intravenous cannula was secured in the non-dominant hand and the parturients was preloaded with a 10 ml/kg ringer lactate solution over 15 min. Non-invasive blood pressure (NIBP), pulse oximeter, and electrocardiogram (ECG) were applied and baseline blood pressure (BP), heart rate (HR) and oxygen saturation (SpO2) were recorded.

Spinal anesthesia was administered in lateral position at the level of L3-4 or L4-5 interspace by using 25 G Quincke spinal needle under aseptic precaution. Parturients in group CS received intrathecal 1% preservative free 2-CP 3 ml + 0.5 ml normal saline (NS) and parturients in group CF received intrathecal 1% preservative-free 2-CP 3 ml + 0.5 mlfentanyl (25 µg). The study drugs were prepared by an anesthesiologist, who was not a part of the study. The anesthesiologist administering

the study drug and the patients were blinded to the group allocation. After spinal anesthesia, the parturients were placed in the supine position with a wedge under the right buttock. The sensory and motor blockade were evaluated each minute for the first 15 min, than every 5 min till completion of the surgery.

The sensory block was assessed by pinprick sensation using hypodermic needle and pin-prick sensation over the clavicle was taken as reference point, whereas the motor block was assessed by the modified Bromage scale (0 = no paralysis, able to flex hips/knees/ankles, 1 = able to move knees, unable to raise extended legs, 2 = able to flex ankles, unable to flex knees, 3 = unable to move any part of the lower limb) at every min till adequate sensory and motor blockade for surgery was achieved. The onset of sensory block was defined as time from intrathecal drug administration to loss of pin prick sensation at T10 level, while onset of motor blockade considered from intrathecal drug administration to Bromage scores ≥2. The surgery was commenced after achieving a sensory block height of T6 level or above. Apgar score was recorded at 1, 5, 10 min after birth for all newborns. The anaesthesiologists who administered spinal anesthesia recorded NIBP, HR, SpO2 and VAS every 10 min in post-operative period till patient requested for first analgesic agent. The duration of analgesia was considered from the time of subarachnoid injection of drug to the time up till visual analogue scale (VAS) for pain assessment score ≥4. The duration of sensory block was from the onset of sensory block till sensation was felt at the level of S2 dermatome, while duration of motor block was from time to achieve Bromage scores ≥2 to time to complete recovery of motor power. The adverse events like hypotension, bradycardia, nausea, vomiting, and pruritus were recorded for first 24 h. Paracetamol 100 ml (1 gm) i.v. was administered when VAS ≥4. The occurrence of transient neurological sequelae (TNS) was assessed at days 1, 3, 7, 1 month and 6 months after surgery. This was done by an observer anesthesiologist by making a telephone call and asking the patients about the presence of back pain radiating to buttocks, thigh, hip and calf, inability to void, or presence of residual paresthesia/dysaesthesia in lower limbs and buttocks.

The primary outcome of the study was the duration of analgesia, while secondary outcomes were onset of sensory block (time to achieve at T10 dermatomal level), onset of motor block, duration of sensory block, duration of motor block, time to achieve T6 and T10 dermatomal level, maximum cephalad spread, time for two-segment regression, Apgar score and any adverse effects.

Numerical data like age, height, weight, BMI, duration of surgery along with spinal block characteristics were summarized as mean ± SD. Data on complications reported in each group were presented as numbers and percentages. Independent sample t-test was used to compare the baseline and spinal block characteristics between two groups. Fisher's exact test was used to compare number of complications reported between the two groups. $P < 0.05$ was considered statistically significant.

Results:

The parturients in both groups were similar with respect to demographic data and duration of surgery [Table 1].

Table 1: Demographic data and duration of surgery

Parameters	Group CS (n=60) mean±SD	Group CF (n= 60) mean±SD	P
Age (years)	25.8 ± 4.5	24.22 ± 4.0	0.492
Height (cm)	153.6 ± 6.4	154.8 ± 5.2	0.472
Weight (kg	65.8 ± 5.3	66.9 ± 5.1	0.220

BMI (kg/m^2)	27.9 ± 2.1	26.2 ± 2.8	0.184
Duration of surgery (min)	37.1 ± 4.6	39.1 ± 4.2	0.712

The difference in HR, BP and SpO2 was not statistically significant in both the groups throughout the perioperative period. The time to achieve block height of T10 (onset of sensory block), time to achieve block height of T6, maximum dermatomal cephalad spread, the onset of motor block and the duration of motor block were comparable in both the groups [Table 2]. The mean duration of sensory block was prolonged in group CF in comparison to group CS, with the difference being statistically significant (101.2±14.50 min versus 72.24±10.63 min, P < 0.0001). The mean duration of analgesia was prolonged in group CF compared to group CS, with the difference being statistically significant (115.6±25.28 min versus 79.68±10.71 min, P < 0.0001) [Table 2].

Table 2: Spinal block characteristics

	Group CS (n=60)	**Group CF (n=60)**	**P-value**
Mean time to achieve T10 sensory block (min)	4.39±0.82	4.24±1.20	0.382
Mean time to achieve T6 sensory block (min)	5.28±1.48	5.58±1.44	0.129
Mean time to achieve maximum cephalad spread (min)	5.28±0.82	6.69±2.10	0.118
Maximum cephalad sensory level (Median)	T6 (T4-T8)	T6 (T4-T8)	
Mean time for two segment regression (min)	57.90±6.52	57.43±8.69	0.638
Mean duration of sensory block (min)	72.24±10.63	101.2±14.50	<0.0001
Mean onset of motor block (min)	4.9±0.81	4.4±1.22	0.448
Mean duration of motor block (min)	69.2±13.78	70.5±14.67	0.271
Mean duration of analgesia (min)	79.68±10.71	115.6±25.28	<0.0001

The adverse effects namely hypotension, bradycardia, nausea, vomiting, pruritus, shivering, sedation and respiratory depression were comparable in both the groups [Table 3]. There was no statistical difference in the Apgar score of newborns in both the groups. In this study, none of the parturients reported TNS in the follow-up period.

Table 3: Comparison of complications

	Group CS (n=60)	**Group CF (n=60)**	**P**
Hypotension	5	4	0.681
Bradycardia	1	1	1.629
Nausea/vomiting	5	4	0.449
Shivering	9	6	0.104
Pruritus	0	5	0.793

Discussion:

CP has been reintroduced recently into the market after being initially withdrawn due to concerns of neurotoxicity and is being increasingly used in day care procedures. Studies have shown that intrathecal opioids can greatly enhance analgesia of sub therapeutic doses of local anesthetics. [9-10]

Fentanyl added to local anesthetic agent seems to be the most frequently used combination to enhance and increase the duration of sensory analgesia without intensifying the motor blockade or prolonging recovery from spinal anesthesia. [11]

No patients had to be excluded from the study. Similar findings were seen in study

done by Soumya. [12] Other clinical studies have found no difference in the hemodynamic profile between isobaric bupivacaine and ropivacaine. [13-14]

Fentanyl as an adjuvant to local anesthetic leads to rapid onset of the sensory block when administered intrathecally due to its lipophilic nature. Mean time for onset of sensory block was statistically shorter in patients who received chloroprocaine with fentanyl. Bhaskara et al. and Suryanarayana et al. have also shown similar results in their studies [14-15].

Rapid onset of sensory block (3–5 min) and complete resolution of the sensory block in 70–150 min after intrathecal 2-CP (30–60 mg) makes it an attractive option for SAB in day care surgeries. [16-19]

Conclusion:

The addition of fentanyl to 1% 2-chloroprocaine intrathecally prolonged the duration of sensory block and postoperative analgesia in patients undergoing LSCS.

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