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Original Research Article

A Retrospective Clinical Study to Investigate the Effect of Intrathecal Fentanyl as an Adjuvant to 1% 2-Chloroprocaine (2-CP) in Parturient Undergoing Elective Lower Segment Caesarean Section (LSCS)

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Abstract

Aim: The aim of the present study was to investigate the effect of intrathecal fentanyl as an adjuvant to 1% 2-chloroprocaine (2-CP) in parturient undergoing elective lower segment caesarean section (LSCS).

Methods: This retrospective study was in the Department of Anesthesiology, IGIMS, Patna, Bihar, India for 6 months. One hundred parturient (50 in each group) with term pregnancy (≥36 weeks), belonging to the American Society of Anesthesiologists (ASA) physical status II, aged between 18 and 35 years, scheduled to undergo low-risk elective caesarean section under SAB were enrolled in the study.

Results: The parturient in both groups were similar with respect to demographic data and duration of surgery. 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. The mean duration of sensory block was prolonged in group CF in comparison to group CS, with the difference being statistically significant (101.1 ± 14.61 versus 72.13 ± 10.33 min, $P < 0.0001$). The mean duration of analgesia was prolonged in group CF compared to group CS, with the difference being statistically significant (115.20 ± 25.54 min versus 79.59 ± 10.74 min, $P < 0.0001$). The adverse effects namely hypotension, bradycardia, nausea, vomiting, pruritus, shivering, sedation and respiratory depression were comparable in both the groups.

Conclusion: Our study concluded that intrathecal preservative-free 1% 2-chloroprocaine (30 mg) with fentanyl (25 μg) as an adjuvant results in a prolonged duration of sensory blockade and postoperative analgesia, with similar duration of motor blockade and incidence of complications when compared to preservative-free 1% 2-chloroprocaine (30 mg) without an adjuvant, in patients undergoing elective lower segment caesarean section.

Keywords: 2-chloroprocaine, caesarean section, fentanyl, spinal anesthesia

Introduction

Regional anesthesia is a safer technique compared to general anesthesia for caesarean section for both the mother and the baby. [1] Among regional anesthetic techniques, subarachnoid block (SAB) is the preferred one for elective caesarean section, due to its advantages like it is easy to perform, economical, rapid onset, ability to provide adequate surgical anesthesia, less neonatal depression, fewer complications and low failure rate. [2] The ideal local anesthetic agent should provide a rapid onset of action, faster offset of motor blockade with predictable duration, adequate postoperative pain control, low neurotoxicity potential and systemic side effects.

Preservative free 2-chloroprocaine (2-CP) is an amino-ester local anesthetic (LA). It has properties of faster onset, excellent sensory and motor block with quick recovery time and few adverse effects. [3] 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. [4] 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. [5,6]

The aim of the present study was to investigate the effect of intrathecal fentanyl as an adjuvant to 1% 2-chloroprocaine (2-CP) in parturient undergoing elective lower segment caesarean section (LSCS).

Materials and Methods

This retrospective study was conducted in the Department of Anesthesiology, IGIMS, Patna, Bihar, India for 6 months. The clinical research was done following the ethical principles for medical research involving human subjects in accordance with the Helsinki Declaration 2013. One hundred parturient (50 in each group) with term pregnancy (≥36 weeks), belonging to the American Society of Anesthesiologists (ASA) physical status II, aged between 18 and 35 years, scheduled to undergo low-risk elective caesarean section under SAB were enrolled in the study. Written informed consent was obtained from each parturient. The parturient who refused to participate, having known hypersensitivity to LA, infection at the site of injection, history of bleeding disorders, parturient 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 (75 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 ml fentanyl (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 anesthesiologists 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/ dysesthesia 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.

Statistical analysis was performed by using Statistical Package for Social Sciences (SPSS) version 22.0 (SPSS Inc., Chicago, IL, USA). Kolmogrov Smirnov test was used to assess normality of quantitative variables. 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

Table 1: Demographic data and duration of surgery

	Group CS	Group CF	P Value
Age (years)	24.2±3.2	24.0±3.3	0.7
Height (cm)	159.3±6.0	159.4±5.0	0.9
Weight (kg	68.1±5.7	66.6±5.0	0.1
BMI (kg/m2)	26.9±2.4	26.3±2.6	0.1
Duration of surgery (min)	38.2±4.8	39.6±4.6	0.8

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

Table 2: Spinal block characteristics

	Group CS (*n*=50)	Group CF (*n*=50)	*P* Value
Mean time to achieve T10 sensory block (min)	4.23±0.92	4.13±1.13	0.78
Mean time to achieve T6 sensory block (min)	5.16±1.05	5.39±1.34	0.15
Mean time to achieve maximum cephalad spread (min)	5.97±0.87	6.22±2.09	0.22
Maximum cephalad sensory level (Median)	T6 (T4-T8)	T6 (T4-T8)	
Mean time for two segment regression (min)	57.96±6.48	57.83±8.52	0.99
Mean duration of sensory block (min)	72.13±10.33	101.1±14.61	<0.0001
Mean onset of motor block (min)	4.5±0.74	4.4±1.12	0.55
Mean duration of motor block (min)	69.8±13.66	70.4±14.44	0.33
Mean duration of analgesia (min)	79.59±10.74	115.2±25.54	<0.0001

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. The mean duration of sensory block was prolonged in group CF in comparison to group CS, with the difference being statistically significant (101.1 ± 14.61 versus 72.13 ± 10.33 min, $P < 0.0001$). The mean duration of analgesia was prolonged in group CF compared to group CS, with the difference being statistically significant (115.20 ± 25.54 min versus 79.59 ± 10.74 min, $P < 0.0001$).

Table 3: Comparison of complications

	Group CS (*n*=50)	Group CF (*n*=50)	*P*
Hypotension	3	3	0.74
Bradycardia	1	1	1.00
Nausea/vomiting	3	2	0.74
Shivering	6	4	0.42
Pruritus	0	3	0.06

The adverse effects namely hypotension, bradycardia, nausea, vomiting, pruritus, shivering, sedation and respiratory depression were comparable in both the groups.

Discussion

Spinal anesthesia (SA) is the preferred anesthetic technique for Caesarean section (CS) due to its advantages over epidural or general anesthesia (GA). It is simple to perform, economical, and produces rapid onset of anesthesia and complete muscle relaxation. However, it can cause unwanted complications. Post dural puncture headache (PDPH) is a common problem following SA in parturients. [7] PDPH is not a life-threatening condition, but it can lead to severe limitation of daily activities. Moreover, it may cause catastrophic sequelae, such as subdural hematoma and seizures, when severe. Persistently low cerebrospinal fluid (CSF) pressure can impose traction and rupture subdural blood vessels, leading to the formation of a subdural hematoma. [8]

The parturients in both groups were similar with respect to demographic data and duration of surgery. 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. Several older studies have highlighted the issues of safety and potential neurotoxicity with preservative of 2-CP. [9,10] The acidic solution and the preservative bisulfite were associated with a higher incidence of complications. [10] However, use of preservative-free 2-CP has shown good results without complications. [11] 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. [11,12]

The mean duration of sensory block was prolonged in group CF in comparison to group CS, with the difference being statistically significant (101.1 ± 14.61 versus 72.13 ± 10.33 min, $P < 0.0001$). The mean duration of analgesia was prolonged in group CF compared to group CS, with the difference being statistically significant (115.20 ± 25.54 min versus 79.59 ± 10.74 min, $P < 0.0001$). The adverse effects namely hypotension, bradycardia, nausea, vomiting, pruritus, shivering, sedation and respiratory depression were comparable in both the groups. Literature suggests a dose ranging between 30-60 mg of 2-CP for procedures lasting 60 min or less, while 10 mg is considered as no-effect dose. [13] Different doses (30-60 mg) of 2-CP have been compared for intrathecal administration for below umbilical surgeries lasting less than 60 min. It is observed that 40 and 50 mg of 2-CP provides adequate SAB for outpatient procedures lasting 45-60 min and 30 mg produces a spinal block of insufficient duration. [12] The LSCS can be conducted under spinal anaesthesia with either a large dose of 2-CP or a small dose of the same agent with addition of fentanyl as an adjuvant. The use of a high dose of 2-CP may be associated with prolonged duration of motor blockade, which may not be desirable. [14] The addition of fentanyl to a smaller dose of 2-CP results in a shorter duration of the motor blockade and a longer duration of sensory block and analgesia. It is well documented that parturient require a smaller dosage of LA in SAB compared to non-pregnant patients because of mechanical factors such as changes in spine curvature, distension of epidural veins as a result of the aorto-caval compression by the gravid uterus and increased sensitivity of neurons to LA.14 Maes et al. used 2-CP 40 mg with and without sufentanil (1 µg) in subarachnoid block for low risk caesarean section. [15] Since, there is no recommendation regarding the appropriate intrathecal dosage of 2-CP in parturients, we selected a lower dose (30 mg) of 2-CP keeping in mind the above mentioned concerns.

Conclusion

Our study concluded that intrathecal preservative-free 1% 2-chloroprocaine (30 mg) with fentanyl (25 µg) as an adjuvant results in a prolonged duration of sensory blockade and postoperative analgesia, with similar duration of motor blockade and incidence of complications when compared to preservative-free 1% 2-chloroprocaine (30 mg) without an adjuvant, in patients undergoing elective lower segment caesarean section.

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