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Comparison of Recovery Characteristics From Spinal Anaesthesia Between 1% 2 Chloroprocaine and 0.5% Bupivacaine Heavy in Elective LSCS

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Abstract

Neuraxial anaesthesia is the favored approach for caesarean sections, often employing local anaesthetics such as Bupivacaine, Chloroprocaine and Ropivacaine. However, there's limited data comparing 2-Chloroprocaine to Bupivacaine specifically in patients undergoing LSCS. An optimal spinal anaesthetic for brief surgeries should offer swift onset and offset while ensuring effective postoperative pain management." Aim of our study is to compare the recovery characteristics of spinal anaesthesia between 1% 2-Chloroprocaine and 0.5% Bupivacaine heavy in elective LSCS. In this comparative study, 30 pregnant females aged 18-35 years with ASA ≤2 status posted for elective LSCS under Subarachnoid block were randomly divided into 2 groups of 15 each. Bupivacaine group was administered with 2ml (10mg) of 0.5% Bupivacaine heavy while Chloroprocaine group was administered with 2.5ml (25mg) of 1% 2 Chloroprocaine , characteristics of sensory, motor block and hemodynamic characteristics were recorded. It was found that there were no significant variation between the groups with respect to age, height, weight, BMI and duration of surgery and hemodynamic parameters. The duration of postoperative analgesia and time of 2 segment regression were significantly faster in Chloroprocaine group (70.58±21.15min) and (45±6.9min) compared to Bupivacaine group (168.41±17.94min) and (128±27.82min). Similarly, Duration of motor blockade was far more in Bupivacaine group (127.45min±16.32min) compared to Chloroprocaine group (59.75min±9.97min). Hypotension and bardycardia occurred more frequently in Bupivacaine group when compared to Chloroprocaine group but these were in acceptable range and not statistically significant. Spinal anaesthesia with 1% 2 Chloroprocaine for LSCS in comparison to 0.5% Bupivacaine Heavy produces adequate sensory and motor block without unnecessary prolonged postoperative stay and serious hemodynamic changes.

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Key Words

1% 2-chloroprocaine, 0.5% bupivacaine heavy, subarachnoid block, elective LSCS

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INTRODUCTION

Neuraxial anaesthesia is the preferred technique in caesarean section as general anaesthesia is associated with airway-related outcomes, aspiration risk, intra operative awareness and increased uterine atony leading to higher blood loss[1]. Regional anaesthesia is a safer technique for caesarean section for both the mother and baby, Among regional anaesthetic 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 anaesthesia, less neonatal depression, fewer complications and low failure rate.

As doctors and patients prefer early recovery from anaesthesia; so short acting local anaesthetic would be preferred for short duration lower abdominal procedures like uncomplicated elective caesarean sections[2-4]. An ideal spinal anaesthetic for short-duration surgeries should have a rapid onset and faster offset with predictable duration, adequate postoperative pain control, low neurotoxicity potential and systemic side effects. LSCS require anaesthesia up to the level of T6 for a comfortable and co-operative patient. Spinal blocks to T6 usually require conventional doses of spinal anesthetics such as Ropivacaine 15mg or Bupivacaine 10-12.5mg with the attendant risk of hypotension, prolonged recovery and post-operative stay in the post-anesthesia care unit[5,6]. Even though shorter acting agents such as Lignocaine have been found to provide an acceptable profile for outpatient spinal anesthesia when used in conventional doses, but the use of Lignocaine has declined due to concerns about the risk of transient neurological symptoms (TNS)[7,8] and most anesthesiologists have therefore abandoned its use[7,8]. Similarly, Mepivacaine has been associated with transient neurological symptoms[8].

2-Chloroprocaine (2-CP) is an amino-ester local anaesthetic (LA) available as preservative-free LA. It was used widely for almost three decades (1952-82), after that reports of neurotoxicity were reported following the use of large doses of 2-chloroprocaine for epidermal anaesthesia., subsequently, it was withdrawn from commercial use[9,10]. A preservative free formulation was reintroduced into clinical use in 2005 and has been safely used for spinal anaesthesia in healthy volunteers and in patients without complications. It has a rapid onset, effective sensory and motor block, a short recovery time and few side effects. Intrathecal LA with adjuvant drugs increases the quality and duration of the spinal blockade and extends postoperative analgesia. By using an adjuvant, it is possible to lower the amount of LA and, consequently, the occurrence of negative effects. In parturient undergoing elective LSCS, Bupivacaine is the most commonly used local anaesthetic for spinal anaesthesia. Bupivacaine is a long-acting amide local anaesthetic that provides effective pain relief without having a significant effect on motor fibres[11,12]. Bupivacaine is popularly used due to a longer duration of action and good quality of motor block compared to tetracaine and has been associated with dose-dependent cardiac toxicity.

Local anaesthetics like Bupivacaine, LevoBupivacaine have been used for Caesarean section. Though these are widely used but there is little information regarding short acting 2-chloroprocaine compared with Bupivacaine in patients undergoing LSCS.In this study we are comparing recovery characteristics from spinal anaesthesia between 1% 2-Chloroprocaine and 0.5% Bupivacaine heavy in elective LSCS.

Aims and Objectives: To compare the recovery characteristics of spinal anesthesia between 1% 2-chloroprocaine and 0.5% Bupivacaine heavy in elective LSCS

MATERIALS AND METHODS

It is a prospective randomized single blinded comparative study. This study was conducted on 30 parturients scheduled for elective LSCS under spinal anaesthesia in the Department of Anaesthesiology at General Hospital, Doddaballapura, from April to May 2023, after obtaining clearance from hospital ethics committee and taking informed consent. Sample size was calculated according to n Master 2.0 software. Pregnant women in the age group of 18-35 years of age with ASA ≤2 status posted for elective LSCS under SAB were included in the study. Women with height less than 145cm and BMI >30 kg/m2, the requirement of emergency caesarean section, Pre-eclampsia, gestational diabetes, coagulopathy, local infection, severe spinal deformity and other known contraindications for spinal anesthesia, known hypersensitivity to any of the study medications, were excluded from the study. All patients fulfilling the inclusion and exclusion criteria were screened and included in the study after their consent of participating and willingness to undergo required investigations and management as a part of the study. Medical history was noted for all patients prior to surgery along with general physical and systemic examination. Any laboratory investigations like CBC, BT, CT, LFT and RFT were performed. Preoperatively, patients were kept nil per oral for 6 hours. A total of 30 samples were considered for the present study and were randomly grouped into group A and group B of 15 each. Group A received 2ml (10mg) of 0.5% Bupivacaine heavy and Group B received 2.5ml (25mg) of 1% 2-chloroprocaine. All the procedures were explained once the patient entered the operation theatre, 18 gauge intravenous cannula was secured and patient's were preloaded with 500ml of Ringer

Lactate over a period of 20-30 minutes .Standard ASA monitors were attached and patient's vitals were recorded. Monitoring consisted of frequent recording of ECG, HR, NIBP, SPO2, MAP throughout the procedure until the patient went out of the postoperative room. Under strict aseptic precautions all patient's were subjected to spinal anaesthesia in lateral position at the level of L3-L4 or L4-L5 interstate through the midline approach by using 25 G Quincke's spinal needle. Patients were randomly grouped. Patient's in group A received intrathecal 2ml (10mg) of 0.5% Bupivacaine heavy and patients in group B received intrathecal 2.5ml (25mg) of 1% 2-chloroprocaine. After spinal anaesthesia, the patients were placed in the supine position with left lateral tilt [15 degree]. The surgery was started once adequate level of sensory block (upto T6 level) was achieved. The sensory and motor blockade were evaluated every minute for first 10 minutes then every 5 minutes till the completion of the surgery. VAS was recorded 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 $\geq$4. Time of onset of sensory block was recorded as interval from the time of injection into the subarachnoid space and development of loss of sensation to pin prick while motor blockade was assessed using modified Bromage scale.

Bromage Scale:

- scale 0-no motor movement, complete motor block
- scale 1-unable to flex knee, able to flex ankle
- scale 2-unable to straight leg raise, able to flex knee
- scale 3-no block, full straight leg raise possible

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 $\geq$2 to time to complete recovery of motor power. All the patients were observed intra-operatively for complications like hypotension, bradycardia, nausea, vomiting, shivering and were treated accordingly if anything occurred. Patient's were followed up for next 24 hours to look for complaints such as nausea, backache, headache, urinary retention, any symptom or signs of TNS (TNS was defined as pain/dysaesthesia of light to severe intensity originating in the gluteal region and radiating to the lower extremity, commencing within 24 hours of spinal administration).

Statistical Analysis: Data was collected and statistical analyses were performed using SPSS 20 version software for determining statistical significance. Results were presented as mean standard deviation. $p<0.05$ was considered as statistically significant which was ruled out by the Chi-square test.

RESULTS AND DISCUSSIONS

- It was found that there were no significant variation between the groups with respect to age, height, weight, BMI and duration of surgery (Table 1) and hemodynamic parameters (Table 2)
- The duration of postoperative analgesia and time of 2 segment regression were significantly faster in chloroprocaine group (70.58±21.15min) and (45±6.9min) compared to Bupivacaine group (168.41±17.94min) and (128±27.82 min) (Table 3)
- Similarly, Duration of motor blockade was far more in Bupivacaine group (127.45min±16.32min) compared to Chloroprocaine group (59.75min±9.97min) (Table 4).
- Hypotension and bradycardia occured more frequently in Bupivacaine group when compared to Chloroprocaine group but these were in acceptable range and not statistically significant (Table 5). None of the patient's reported TNS during the period of follow up

No significant variation with respect to demographic details and duration of surgery.
No significant variation with respect to haemodynamic parameters.

Duration of Analgesia and time of 2 segment regression is found to be statistically significant, with $p<0.05$ which is ruled out by the Chi-square test
Duration of motor blockade is found to be statistically significant with $p<0.05$ which is ruled out by Chi-square test .

Hypotension and bradycardia occured more frequently in Bupivacaine group when compared to Chloroprocaine group but these were in acceptable range and not statistically significant.

- In day to day practice interest for short duration spinal anaesthetic agent is increasing.
- Spinal anaesthesia is preferred over epidural anaesthesia for elective caesarean and emergency caesarean procedures, due to the relative ease of administration, reduced systemic toxicity, faster onset of action and start of the operation[13]
- The choice of the correct local anaesthetic for spinal anaesthesia is crucial, the ideal anaesthetic should allow rapid onset and offset of its own effect with minimal side effects
- Spinal anaesthesia is the mainstay in Caesarean section as it avoids problems associated with general anaesthesia, However it is better to use local anaesthetics like Chloroprocaine which do not have prolonged duration of motor block and hemodynamic changes
- Because of its limited protein binding and quick metabolism by pseudo-cholinesterase, 2-CP has a

Table 1: Demographic details and the duration of surgery

Parameters	Group A	Group B	p-value
Age year	25.3±3.4	24.7±2.3	0.54
Height (cm)	160±5.3	161±2.4	0.87
Weight (kg)	64±2.3	66±3.5	0.12
BMI (kg/m2)	27.4±2.1	28.2±2.9	0.32
Duration of surgery (min)	38.42±4.2	39.7±3.4	0.78

Table 2: Haemodynamic parameters

Characteristic	Group A	Group B	p-value
Mean Heart Rate (bpm)	97	96	0.918
Mean SBP (mmhg)	131	124	0.765
Mean DBP (mmhg)	90	87	0.712

Table 3: Characteristics of sensory block

Variables (minutes)	Group A	Group B	p-value
Onset of analgesia	3.37±0.18	2.45±0.45	0.06
Time to reach maximum height	T6 at 6.91±0.71	T6 at 4.27±0.69	0.21
Time of 2 segment regression	128±27.82	45±6.9	0.005
Recovery of sensation at T12	158±16.2	105±11.6	0.23
Duration of postop analgesia	168.41±17.94	70.58±21.15	0.002

Table 4: Characteristics of motor block

Variable (minutes)	Group A	Group B	p-value
The onset of motor blockade	6.77±0.44	4.12±0.93	0.13
Duration of motor blockade	127.45±16.32	59.75±9.97	0.003

Table 5: Number of patients with complications

Characteristics	Group A	Group B	p-value
Hypotension	12	7	0.56
Bardycardia	9	4	0.06
Nausea	2	3	0.39
Vomiting	1	3	0.48

shorter duration of action.

- Several older studies have highlighted the issues of safety and potential neurotoxicity with preservative of 2-CP[14,15]. The acidic solution and the preservative bisulfite were associated with a higher incidence of complications[15]. However, use of preservative-free 2-CP has shown good results without complications[12,16]. Rapid onset of sensory block (3-5 min) and complete resolution of the sensory block in 70-150min after intrathecal 2-CP makes it an attractive option for SAB in day care surgeries[18,16,17]. Use of 2-CP in low-risk caesarean section in healthy parturients has been found to reduce the length of stay in the post-anaesthesia care unit (PACU), benefit early breast feeding initiation, improve maternal satisfaction due to better and early mother-baby bonding and help in the maintenance of the new born's temperature[19]
- Andrea Fanelli et *al*.[20] studied 2 Chloroprocaine for ultra short outpatient surgical procedure and found it extremely suitable in view of low risk of urinary retention and Transient Neurological Symptoms compared to Bupivacaine and Lidocaine
- The total duration of spinal analgesia in Group B was shorter significantly (70.58±21.15min) when compared to Group A (168.41±17.94min) with ($p<0.05$). The improved operating environment would result from a faster onset time of the motor block, which would be especially beneficial for parturients receiving LSCS who need a quicker induction of anaesthesia. 2-chloroprocaine (2-CP) showed faster offset times to the end of anaesthetic, supported early ambulation and hospital discharge as compared to Bupivacaine. These findings suggest that 2-CP could be a viable alternative to low-dose long-acting local anaesthetics in ambulatory surgery[17]
- In the evaluation of newer alternative Chloroprocaine has received attention by many researchers like Camponovo *et al*.[18] noted Chloroprocaine group showed faster resolution of sensory (105min vs. 225min) and motor (100min vs. 210min) blocks. In our study also in comparison with Bupivacaine, Chloroprocaine showed early resolution of sensory (70.58±21.15min vs 168.41±17.94min) and motor (59.75±9.97min vs 127.45±16.32min) blocks and quicker discharge from the hospital
- The shorter duration of motor block using 1% 2-Chloroprocaine helps in early ambulation avoiding the risks associated with immobilisation due to prolonged post operative stay
- Hypotension with n = 12 (80%) and bardycardia with n = 9 (60%) occured more frequently in Bupivacaine group when compared to Chloroprocaine group but these were in acceptable range and not statistically significant. In a similar study by Ashwini *et al*.[21], they noted higher incidence of hypotension as 53 % in Bupivacaine group and 30 % in chloroprocaine group
- Lacasse *et al*.[5] compared hyperbaric Bupivacaine to 2 chloroprocaine in 106 patients. In comparison with Bupivacaine, CP showed faster offset times to end of anaesthesia, unassisted ambulation and

quicker discharge from hospital and these findings suggest that chloroprocaine may be a suitable alternative to low doses of long-acting local anaesthetics in ambulatory surgery. Contrary to this our study was small in 30 patients

- Maes *et al*.[19] noted that 2-Chloroprocaine can be used for low risk Caesarean section in healthy pregnant women
- Thus 1% 2-Chloroprocaine can be rendered as safe and effective alternative compared to 0.5% Bupivacaine heavy especially for short duration uncomplicated and elective LSCS

CONCLUSION

Spinal anaesthesia with 1% 2 Chloroprocaine for LSCS in comparision to 0.5% Bupivacaine H produces adequate sensory and motor block without unnecessary prolonged postoperative stay and serious hemodynamic changes.

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