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# COMPARISION OF 1% CHLOROPROCAINE AND 0.5% (H) BUPIVACAINE FOR SUBARACHNOID BLOCK IN INFRAUMBILICAL SURGERIES

Anesthesiology

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## ABSTRACT

**Background:** Subarachnoid block is the most commonly used regional anaesthesia technique in contemporary anaesthesia practice. Commonly used agents in subarachnoid block are hyperbaric Bupivacaine, Ropivacaine and Chloroprocaine. This study was conducted with the aim to compare efficacy and safety profile of 1% Chloroprocaine with 0.5% (H) Bupivacaine for subarachnoid block in patients undergoing infraumbilical surgeries.

**Methods:** It was a prospective randomized controlled study performed on 80 patients of ASA grade I/II patients of age 18-60 years, planned for elective infraumbilical surgeries under spinal anaesthesia. Patients were randomized in two groups: Group B (Bupivacaine group) received 3 mL of 0.5% hyperbaric Bupivacaine (15mg) and Group C (Chloroprocaine group) received 4 ml of chloroprocaine (40 mg) with 40 patients in each group.

**Results:** Earlier onset of sensory block as well as faster recovery was observed in Group C as compared to Group B ($p < 0.001$). Similarly, onset was earlier and duration of motor block and duration of analgesia were also shorter in Group C as compared to Group B respectively ($p < 0.001$). Adverse effect was also more common in group B compare to group C.

**Conclusions**: Intrathecal chloroprocaine 40 mg provides spinal anaesthesia of adequate duration for infra-umbilical surgeries with the advantage of earlier onset and faster regression of spinal and motor block as compared to 0.5% hyperbaric bupivacaine 15 mg.

## KEYWORDS

Bupivacaine, Chloroprocaine, infraumbilical surgeries, sensory block

## INTRODUCTION

Surgery of the lower abdomen and lower limbs subarachnoid block is a safe and reliable technique.[1,2] Nevertheless, some of its characteristics may limit its use for ambulatory surgery, including delayed ambulation, risk of urinary retention, and pain after block regression.[3] It is therefore crucial to select correct local anaesthetic for spinal anaesthesia in the ambulatory setting: the ideal anaesthetic should allow rapid onset and offset of its own effect for faster patient discharge of the patient with minimal side effects.[4]

Commonly used agents in subarachnoid block are hyperbaric Bupivacaine, Ropivacaine and Chlorprocaine. Chlorprocaine was first introduced in 1951 and has been investigated for spinal anaesthesia in the ambulatory surgeries that may last upto 40 minutes.[5] It has a safety profile to support the growing need for day care surgery.[6] Chlorprocaine is an amino –ester local anaesthetic which has rapid onset and short duration of action and a potentially favourable profile for short procedures.[7] After spinal administration of preservative-free Chlorprocaine, a motor block may last upto 40 minutes, with onset time of 3-5 minutes and a time to ambulation of 90 minutes without complications.[8]

Concerns about its use were raised in the 1980s following the description of nine cases of neurotoxicity. Multiple studies have suggested that the combination of a low pH (<3) and the presence of sodium bisulfite, an antioxidant, may have been responsible for the neurotoxicity observed following the use of large doses of 2-CP. Subsequently, the pH of the solution has been adjusted, and a preservative-free formulation has been released. Which is now used for spinal anaesthesia in healthy volunteers without complication.[9]

Bupivacaine is a long acting amide local anaesthetic agent with a half-life of 3.5 hours[8] with duration of action between 90-150 minutes. Therefore, it has a prolonged anaesthetic recovery that may last a few hours. Bupivacaine causes frequent urinary retention, prolonged discharge time and unpredictable levels of anaesthesia dependent on dose.[10,11] The controversy exists regarding the predictability of the levels of analgesia achieved with isobaric solution when compared to hyperbaric.[12,13]

Attempts have been made to adapt hyperbaric bupivacaine, a long-acting local anaesthetic, to the ambulatory setting by using smaller doses. However, the duration of the block remains prolonged with these smaller doses, and they may provide insufficient anaesthesia.[14] Furthermore, urinary retention (or a prolonged interval to first voiding) is frequently encountered with bupivacaine, which delays the time until discharge for ambulatory patients.[15]

With a rising trend of ambulatory surgeries, a need was felt by the anaesthesiologists to have a drug with short duration of action and safety profile for ambulatory surgery. Therefore, present study was conducted to compare efficacy and safety of 2-Chloroprocaine and bupivacaine for subarachnoid block in infraumbilical surgeries to support the growing need for ambulatory surgery. It will also help to bring forward the drug that permits earlier patients' discharge from hospital.

## SUBJECTS AND METHODS

### Study design, settings and participants:

It was a Prospective, Randomized, Double blind, controlled clinical study conducted over a period of two years from 2017 to 2019 in Department of Anaesthesiology & Critical Care of a tertiary care teaching hospital in Uttarakhand, India. ASA grade I/II patients of either sex of age group 18-60 years planned for elective infraumbilical surgeries under spinal anaesthesia constituted the study population. A total of 80 cases were enrolled for the study. Patient with ASA grade III/IV, Infection at the site of injection, with coagulopathy or on anticoagulation therapy, Congenital abnormalities of lower spine and meninges, active disease of the CNS, Surgeries longer than 1 hour in duration, history of allergy to proposed/used drugs in the study were excluded from the study.

### Sampling technique:

Simple Randomization by Closed Envelope Technique was used.

### Data collection

After the approval of Institutional ethical committee, a detailed history, complete physical examination and routine & appropriate investigations was done for all patients, for PAC clearance for surgery

under anaesthesia. Informed written consent was taken from patients after PAC clearance. A total of 80 patients were randomly divided into 2 groups of 40 each by closed envelope technique.

**Group B (Bupivacaine group)-** In this group, 3mL of 0.5% hyperbaric Bupivacaine.(15mg)

**Group C (Chloroprocaine group)**- In this group, 4 ml of chloroprocaine (40 mg).

## METHODOLOGY

In the preparation room, NPO status was confirmed. An 18G intravenous line was secured. IV fluid Ringer's Lactate solution was infused at a rate of 10 ml\Kg over 30 minutes before spinal anaesthesia and then the rate was reduced to 6 ml\Kg\h. An ambient OT temperature was maintained at 22-24°C.On arrival to the operation theatre, standard ASA monitors were attached. Non-invasive blood pressure (NIBP), pulse-oximetry (SpO2), electrocardiogram (ECG), Pulse Rate(PR) and temperature were recorded as baseline value. Both patient and attending anaesthetist who observed results were blinded to the study drugs.

### The Procedure

Procedure was explained to the patient and his attendants. With the patient in the sitting position, under all aseptic precautions, subarachnoid space was entered at L3-L4 or L4-L5 intervertebral space via the midline approach using a 25G Quincke's spinal needle. After ensuring free flow of cerebrospinal fluid, patient was injected with one of the two study drugs i.e. either 40 mg isobaric 1 % Chloroprocaine (4 mL) or 15mg (0.5%) Hyperbaric Bupivacaine (3ml) without barbotage over a 1-minute period. Immediately the subjects were turned supine with their legs resting flat.

The level of sensory and motor anaesthesia was assessed in caudal to cephalad direction bilaterally every 3 minutes until readiness of surgery and then every 5 minutes for the first 30 minutes. Onset of sensory block was determined as time taken to achieve loss of sensation to pin prick at L1 level. Further assessments were performed every 15 minutes until complete resolution of sensory anaesthesia to S2 dermatome. Level of peak sensory block height attained was also checked.

Motor block level was measured when the maximum dermatomal spread is achieved according to modified Bromage scale. Onset of motor block was defined as time taken to achieve modified Bromage score 4. Readiness to surgery was defined as loss of pin prick sensation>=T10, with a Bromage score ≥2.

The time of subarachnoid injection, the onset of sensory block (block at L1 level), onset of motor block (Modified Bromage Score =4) and the readiness for surgery (block at T10 level and Bromage score >=2) were recorded. The onset time was from the end of the intrathecal injection to readiness of surgery. Motor block assessment was not done during surgery.

During the surgery, patients were closely monitored for vitals (Pulse Rate, Respiratory rate, Blood Pressure, Heart Rate). Clinically relevant hypotension (defined as a Mean Arterial Pressure MAP<=60 mmHg) was treated with 250mL crystalloid fluid boluses. If this was ineffective, 5 mg Ephedrine iv or 6 mg Mephentermine iv was administered. The occurrence of clinically relevant bradycardia (defined as heart rate reduction ≤ 50beats/minute) was treated with 0.5mg Atropine IV. The periods of desaturation (SpO2<95%) were recorded. After the surgery, the resolution of spinal block was assessed.

In the post-operative period, the patients were closely observed for any adverse effects like nausea, vomiting, hypotension, bradycardia, transient neurological symptoms (pain and /or dysesthesia in buttocks and lower extremities), urinary retention etc. All the patients were contacted telephonically after 24 hours and questioned regarding pain, headache and complaints of transient neurological symptoms (TNS) or any other complications.

### Statistical analysis

Data were analysed and statistically evaluated using SPSS software, version 17 (Chicago II, USA). Quantitative data was expressed in mean, standard deviation and difference between two groups were tested by student 't' test or Man Whitney U test, while qualitative data were expressed in percentage. Statistical differences between the proportions were tested by chi square test or Fisher's exact test. 'P' value less than 0.05 was considered statistically significant.

### Ethical issues

All participants were explained about the purpose of the study. Confidentiality was assured to them along with informed written consent. The study was approved by the Institutional Ethical Committee.

## RESULTS

Demographic profile of both the groups was comparable to each other (Table 1). The onset of block at L1 level (mins), time to readiness for surgery (mins) and time for complete sensory regression to S2 dermatome (mins) was significantly earlier in case of the group Chloroprocaine compared to Bupivacaine. So, there was an earlier onset of the sensory block as well as faster recovery in case of Chloroprocaine. (Table 2). Similarly, mean onset of motor block (mins), duration of motor block (time to Bromage = 6) (mins) and time to achieve Modified Aldrete score as 9 was significantly higher in Group B compared to Group C. So, there was an earlier onset of the motor block as well as faster recovery in case of Chloroprocaine. (Table 2).

All the adverse effects like hypotension, bradycardia, nausea/vomting were more common in group B compare to group C but no significant difference was observed between both group except in hypotension. (Table 3).

## DISCUSSION

Hyperbaric bupivacaine, a long-acting local anaesthetic, have been made to adapt to the ambulatory setting by using smaller doses. However, the duration of the block remains prolonged with these smaller doses.[16,17]

In present study, mean sensory onset of block at L1 level (min), time to readiness for surgery (min) and time for complete sensory regression to S2 dermatome (min) was significantly lesser among 1% Chloroprocaine (1.33±0.49, 3.49±0.82 and 120.58±20.38 minutes respectively) compared to 0.5% (H) Bupivacaine (2.65±1.10, 4.04±1.02 and 270.38±24.08 minutes respectively). This finding could be attributed due to higher concentration of Chloroprocaine (40 mg) used as compared to bupivacaine (15 mg). Finding of our study was similar to Camponovo et al 109 study which also reported faster onset and earlier recovery of sensory block in Chloroprocaine group. Another study by Casati A et al[18] also stated significantly lesser time to sensory block resolution among Chloroprocaine group. Similar findings were also reported by Khare et al[19] and Teunkens et al.[20]

Agarwal et al[17] showed that the regression of sensory block to S2 occurred almost 2.5 times faster with chloroprocaine (amounting to 138 minutes) when compared to bupivacaine (356 minutes). Peak sensory block was achieved in 14 minutes with chloroprocaine and 17 minutes with bupivacaine. The shorter duration leading to faster recovery from intrathecal anaesthesia displayed by chloroprocaine tends to give it a clinical advantage in ambulatory surgeries.

In our study, the mean onset of motor block (Time to achieve Bromage =3), duration of motor block (time to Bromage = 6) and time to achieve Modified Aldrete score as 9 was also significantly lesser in chloroprocaine group (6.08±2.42, 85.33±11.83 and 225.58±20.38 respectively) compared to 0.5% (H) Bupivacaine (7.70±2.34, 140.23±16.21 and 395.38±24.08 respectively) which indicated a faster onset as well as offset in the Chloroprocaine group. This was similar to the study by Camponovo et al,[21] and Lacasse et al[9]. Other studies also reported similar findings.[19,20,22]

Times to first mobilization and discharge were significantly shorter for Chloroprocaine when compared with Bupivacaine. Similarly time for complete regression of motor block to modified Bromage scale= 6 in 2-chloroprocaine group was also 2.3 times faster than hyperbaric bupivacaine group. Our results were similar to some earlier studies.[9,22]

Hypotension, nausea and/or vomiting and bradycardia was more among 0.5% (H) Bupivacaine compared to 1% Chloroprocaine. This was similar to the study by Khare et al[19] in which hypotension and bradycardia were more commonly observed in 0.5% hyperbaric Bupivacaine than 2-Chloroprocaine. Another study by Agarwal et al[17]

also reported hypotension and bradycardia more common in Bupivacaine group.

## CONCLUSION & RECOMMENDATIONS

Considering the results & discussion of the present study, it can be concluded that Intrathecal chloroprocaine 40 mg provides spinal anaesthesia of adequate duration for infra-umbilical surgeries with the advantage of earlier onset and faster regression of spinal as well as motor block as compared to 0.5% hyperbaric bupivacaine 15 mg. Chloroprocaine also had advantage of lesser side effect compare to 0.5% hyperbaric bupivacaine.

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**Table 1: Demographic profile of study subjects**

| | Group B (n=40) | Group C (n=40) | P value |
|---|---|---|---|
| **Age (in years)** | 33.98±11.27 | 40.48±12.94 | 0.55 |
| **Gender (M/F)** | 24/16 | 22/18 | 0.65 |
| **Weight (kgs)** | 55.55±4.94 | 56.58±7.42 | 0.57 |
| **ASA (I/II)** | 23/17 | 25/15 | 0.47 |

**Table 2: Sensory and motor blockade characteristics of study subjects**

| | Group B (n=40) | Group C (n=40) | P value |
|---|---|---|---|
| **Sensory blockade characteristics** | | | |
| Onset of block at L1 level (min) | 2.65±1.10 | 1.33±0.49 | <0.001 * |
| Time to readiness for surgery (min) | 4.04±1.02 | 3.49±0.82 | 0.01* |
| Time for complete sensory regression to S2 dermatome (min) | 270.38±24.08 | 120.58±20.38 | <0.01* |
| Mean Peak sensory block height | T6 | T10 | |
| **Motor blockade characteristics** | | | |
| Onset of motor block (Time to Bromage =4) (min) | 7.70±2.34 | 6.08±2.42 | 0.04* |
| Duration of motor block (time to Bromage = 6) (min) | 140.23±16.21 | 85.33±11.83 | <0.01* |
| Time to achieve modified Aldrete score = 9 (min) | 395.38±24.08 | 225.58±20.38 | <0.01* |
| **Time to first rescue analgesia (min)** | 265.38±24.08 | 115.58±20.38 | 0.02* |

***p value was statistically significant**

**Table 3: Adverse effects in both groups**

| | Group B (n=40) | Group C (n=40) | P value |
|---|---|---|---|
| **Hypotension** | 7 (17.5%) | 2 (5.0%) | 0.04* |
| **Bradycardia** | 2 (5.0%) | 1 (2.5%) | 0.89 |
| **Nausea/vomiting** | 3 (7.5%) | 1 (2.5%) | 0.61 |
| **Transient neurological symptoms (TNS)** | 0 | 0 | - |

***p value was statistically significant**

## REFERENCES

1. Förster JG. Short-acting spinal anesthesia in the ambulatory setting. Current Opinion in Anaesthesiology. 2014;27(6):597–604.
2. Alley EA, Mulory MF. Neuraxial anesthesia for outpatients. Anesthesiol Clin. 2014;32(2):357-69.
3. Mulroy MF, Salinas FV, Larkin KL, Polissar NL. Ambulatory surgery patients may be discharged before voiding after short-acting spinal and epidural anaesthesia. Anesthesiology. 2002;97(2):315-9.
4. Förster JG, Rosenberg PH. Revival of old local anesthetics for spinal anesthesia in ambulatory surgery. Curr Opin Anaesthesiol. 2011;24(6):633-7.
5. Foldes FF, McNall PG. 2-Chloroprocaine: a new local anaesthetic agent. Anaesthesiology 1952;13:287-96.
6. GhisiD, Bonarelli S. Ambulatory surgery with chloroprocaine spinal anaesthesia a review. Ambulatory Anaesthesia. 2015;2:111-20.
7. Foldes FF, McNAll PG. 2-CP: A new local anaesthetic agent. Anaesthesiology 1952;13:287-96.
8. Katzung& Trevor's Pharmacology. Examination and Board Review,10th ed Chapter 26 Local Anesthetics.
9. Lacasse MA, Roy JD, Forget J, Vandenbroucke F, Seal RF, Beaulieu D et al. Comparison of bupivacaine and 2-chloroprocaine for spinal anesthesia for outpatient surgery: a double-blind randomized trial. Can J Anaesth. 2011;58(4):384-91.
10. Le TruongJJ, Girad M, Drolet P, Grenier Y, Boucher C, Bergeron L. Spinal Anaesthesia: A comparison of procaine and lidocaine. Can J Anaesth. 2001;48:470-3.
11. Katzung & Trevor's Pharmacology: Examination and Board Review,10th ed Chapter 26 Local Anesthetics.
12. King HK, Wood L, Steffens Z, Johnson C. Spinal anesthesia for cesarean section: Isobaric versus hyperbaric solution. Acta Anaesthesiol Sin. 1999;37(2):61-4.
13. Solakovic N. Level of sensory block and baricity of bupivacaine 0.5% in spinal anesthesia. Med Arh. 2010;64(3):158-60.
14. Ben-David B, Solomon E, Levin H, Admoni H, Goldik Z. Intrathecal fentanyl with small-dose dilute bupivacaine: better anesthesia without prolonging recovery. Anesth Analg. 1997;85:560-5.
15. Breebaart MB, Vercauteren MP, Hoffmann VL, Adriaensen HA. Urinary bladder scanning after day-case arthroscopy under spinal anaesthesia: comparison between lidocaine, ropivacaine, and levobupivacaine. Br J Anaesth. 2003;90:309-13.
16. Smith KN, Kopacz DJ, McDonald S. Spinal 2-chloroprocaine: a dose-ranging study and the effect of added epinephrine. Anesth Analg. 2004;98:81-8.
17. Agarwal A, Bhatia U, Tripathi M. Comparative Evaluation Between Bupivacaine and 2-Chloroprocaine For Spinal Anaesthesia In Ambulatory Surgeries: A Randomized Controlled Trial. Int J Curr Med Pharmaceut Res. 2019;05(04):4153-6.
18. Casati A, Fanelli G, Danelli G, Berti M, Ghisi D, Brivio M et al. Spinal anesthesia with lidocaine or preservative-free 2-chlorprocaine for outpatient knee arthroscopy: a prospective, randomized, double-blind comparison. Anesth Analg. 2007;104(4):959-64.
19. Khare A, Thada B, Yadav D, Mathur V, Singh M. A randomized double blind study to compare 1% 2-chloroprocaine and 0.5% hyperbaric bupivacaine in spinal anesthesia for infra-umbilical surgeries. Anaesth pain intensive care. 2019;23(2):162-7.
20. Teunkens A, Vermeulen K, Van Gerven E, Fieuws S, Van de Velde M, Rex S. Comparison of 2-Chloroprocaine, Bupivacaine, and Lidocaine for Spinal Anesthesia in Patients Undergoing Knee Arthroscopy in an Outpatient Setting: A Double-Blind Randomized Controlled Trial. Reg Anesth Pain Med. 2016;41(5):576-83.
21. Camponovo C, Wulf H, Ghisi D, Fanelli A, Riva T, Cristina D, Vassiliou T, Leschka K, Fanelli G. Intrathecal 1% 2-chloroprocaine vs. 0.5% bupivacaine in ambulatory surgery: a prospective, observer-blinded, randomised, controlled trial. Acta Anaesthesiol Scand. 2014;58(5):560-6.
22. Bojaraaj K, Lalitha M. Spinal anaesthesia for perineal surgeries: a comparison of 1% 2-chloroprocainewith 0.5% bupivacaine. Indian J Appl Res. 2017;7(11):272-3.