Original Research Article

Comparison of Intrathecal 2-Chloroprocaine With Bupivacaine in Short Surgical Procedures

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Abstract

Background: In the post-Lidocaine spinal era, which went into oblivion owing to TNS, there is a need to substitute its alternative, Bupivacaine, in short surgeries to overcome its limitations. 2-Chloroprocaine is a recent introduction with claims of fast onset and recovery as spinal anaesthetic. The aim of the study is to compare the effect of spinal anaesthesia in short surgical procedures (surgeries lasting <60 minutes) between 0.5 % Bupivacaine (Hyperbaric, 7.5 mg) and 1% Chloroprocaine (40mg).

Method: A prospective, randomized controlled study was undertaken with 90 patients of ASA physical status I or II undergoing short surgeries consisting of GROUP C(n=45) who received 4 ml 1% 2-Chloroprocaine (40 mg), and GROUP B(n=45) who received 1.5 ml 0.5% Hyperbaric Bupivacaine, (7.5 mg). Patients were observed for hemodynamic stability, degree and adequacy of sensory / motor block, duration of analgesia and adverse effects. For continuous variables, the summary statistics of mean± standard deviation (SD) were used. Chi-square (χ^2) test was used for association between two categorical variables.

Results: Mean time of onset of sensory block (Group C-1.6 ± 0.7 min, Group B-2.6 ± 0.8 min) and motor block (Group C-2.7 ± 1.0 min, Group B-3.3 ± 1.0 min) were comparable. Duration of sensory block was 113.9±13.3min (Group C), 168.0±13.1min (Group B) ($p<0.001$); duration of motor block was 92.7±11.2 min (Group C), 140.1±12.2 min (Group B) ($p<0.001$); duration of analgesia before any rescue dose was 132.5±12.2 min (Group C), 194.1±12.7 min (Group B) ($p<0.001$). No statistical significant differences were noted in the hemodynamic parameters between two groups at different intervals.

Conclusion: Chloroprocaine has comparable onset of sensory and motor block but faster recovery, making it near ideal spinal anaesthetic agent for short surgical procedures.

Keywords: Chloroprocaine, Bupivacaine, spinal, short surgeries.

Introduction

In recent years, ambulatory surgery is expanding as a speciality wherein a large number of procedures are being done as day care cases and patients do not need overnight hospital stay. Some of the major limitations of spinal anaesthesia in day care surgery include prolonged stay in post-anaesthesia care unit, prolonged leg immobility, urinary retention and occasionally hemodynamic disturbances [1]. Lidocaine is a short acting local anaesthetic which has a rapid onset and also a fast recovery. It is an ideal agent for ambulatory surgery; however it may be associated with Transient Neurological Symptoms (TNS), thus leading to its fall from favour [2,3]. Bupivacaine produces prolonged block effect and a delayed recovery of motor block (240-380 min) when used in conventional doses leading to prolonged time to eligibility for discharge criteria [4]. Preservative free 2- Chloroprocaine which is an amino-ester containing local anaesthetic was introduced in 2004 for spinal anaesthesia. Volunteer studies have indicated that doses of 30 and 60 mg of 2-Chloroprocaine could be useful in an outpatient setting [5]. In the background of above limitations posed by Lidocaine and Bupivacaine, we would like to investigate whether clinical profile of 2- Chloroprocaine is beneficial in short surgical procedures (surgeries lasting <60 minutes) performed on an ambulatory basis.

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Materials and methods

This prospective randomized control study data was collected from patients after ethical committee clearance at ESIC Medical College Hospital & PGIMSR, Bangalore for a time period of one and half years. For continuous variables, the summary statistics of mean± standard deviation (SD) were used. Chi-square (χ^2) test was used for association between two categorical variables. If the p-value was < 0.05, then the results were considered to be statistically significant and data were analyzed using SPSS software v.23.0. Our study included patients willing to give written informed consent, American Society of Anesthesiologists (ASA) physical status I or II, Age 20-60 years of either sex, Short surgical procedures (less than 60 min). Patients with ASA physical status- III and IV or absolute contraindications for lumbar puncture, known allergic disorders to local anaesthetics were excluded. Patients fulfilling the required essential criteria were selected and 45 patients were randomly allocated to each of the 2 Groups by computer generated numbers. Group C received 2-Chloroprocaine (40 mg) 1% 4.0 ml and Group B: Hyperbaric Bupivacaine (7.5 mg) 0.5% 1.5 ml. Patients were kept nil per oral 8 hours before the procedure. Vital parameters like Pulse rate, Blood Pressure, Respiratory rate and Saturation were recorded 10 min prior. Intravenous line was secured using iv cannula (18G). No preloading done and patient was maintained on maintenance infusion of Ringer's Lactate.

Under aseptic conditions lumbar puncture was performed in sitting position at L_{3-4} interspace using a midline approach with a 25-G Quincke spinal needle. The spinal anaesthetic was injected and patient

was immediately placed in supine position. In all cases monitoring of Heart Rate, Blood pressure, ECG, Saturation was done at regular intervals intra-operatively and continued the same for 2 hours. The assessment of sensory block, motor block and post operative analgesia is made as shown under.

At 10 min after spinal injection, the inability to reach a sensory block at T12 and a Bromage Score of 0 will be considered as a block failure and excluded from further study. In case of intra-operative discomfort or pain, they will be administered appropriate anaesthesia based on the patients physical status and will be excluded from the study. Parameters such as characterstics of sensory and motor block, hemodynamic indices, time of request of first analgesic and adverse outcomes, if any, were studied.

Results

Anthropometric parameters (Mean age, height, weight and BMI) of subjects in Group C and B showed no statistically significant difference. There was no statistical significant difference in the vital hemodynamic parameters between the two groups.

The mean time of onset of sensory block was 1.7 minutes in Group C and 2.6 minutes in Group B with a standard deviation of 0.7 and 0.8. It was statistically significant with a P value of < 0.001.

Table 1: Time of onset of Sensory Block

	Group C		Group B		p value
	Mean	±SD	Mean	±SD	
Time of Onset of Sensory Block (min)	1.7	0.7	2.6	0.8	<0.001

The mean time taken to attain highest sensory blockade was 5.6 ± 1.0 min in Group C compared with 8.0 ± 0.6 min which was significant with a p value of <0.001.

Table 2: Time taken to attain Highest Sensory Level

	Group C		Group B		p value
	Mean	±SD	Mean	±SD	
Time to reach Highest Sensory Block (min)	5.6	1.0	8.0	0.6	<0.001

The extent of sensory block is depicted among the Groups. 1 patient in Group C developed a sensory block up to T4. 17 Patients (Group C) and 14 Patients (Group B) had sensory block upto T10.

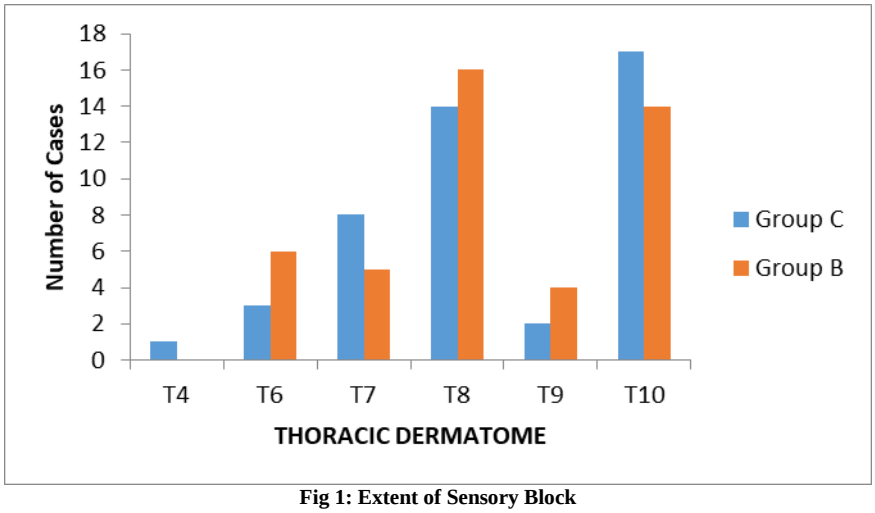

Fig 1: Extent of Sensory Block

Two segment regression time in Group B was (69.3 ± 12.3 min) compared to Group C (45.8 ± 9.3 min). Values were observed to be statistically significant with p <0.001.

Table 3: Time for Two Segment Regression

	Group C		Group B		p value
	Mean	±SD	Mean	±SD	
Two segment regression (min)	45.8	9.3	69.3	12.3	<0.001

The total duration of sensory block was 114.2 ±13.3 minutes in Group C and 168.0 ± 13.1 minutes in Group B with a standard deviation of 13.3 and 13.1 respectively. The difference was statistically significant with a P value of < 0.001.

Table 4: Total duration of sensory block (min)

	Group C		Group B		p value
	Mean	±SD	Mean	±SD	
Total Duration of Sensory Block(min)	114.2	13.3	168.0	13.1	<0.001

The total duration of motor block was 92.7 ± 11.2 minutes in Group C and 140.1 ± 12.2 minutes in Group B and was statistically significant with a P value of < 0.001.

Table 5: Total duration of motor block (min)

	Group C		Group B		p value
	Mean	±SD	Mean	±SD	
Total Duration of Motor Block (min)	92.7	11.2	140.1	12.2	<0.001

The time needed before administering rescue dose at VAS 4 was taken as duration of analgesia. In Group C it was 132.5 ± 12.2 minutes and in Group B 194.1 ± 12.7 minutes (p value < 0.001).

Table 6: Duration of Analgesia (min)

Duration	Group C		Group B		p value
	Mean	±SD	Mean	±SD	
Time for VAS 4 (min)	132.5	12.2	194.1	12.7	<0.001

One case (2.2%) in Group C failed to achieve sensory level of T10 and had been excluded from study. None of the cases failed in Group B.

Discussion

Many surgical procedures, of late, are increasingly coming under the ambit of elective ambulatory surgery and last under or around an hour.

In our study, demographic profiles with respect to age, sex, weight, height and duration of surgery were comparable between both the Groups. Our study showed comparable hemodynamic parameters between groups and they were not statistically significant.

Breebart et al [8] found the onset time of sensory block at T12 to be 6 min with 40 mg Chloroprocaine intrathecally. In our series, the mean time of onset of sensory block (L1) was 1.7 ± 0.7 minutes in Group C (Chloroprocaine group) and 2.6 ± 0.8 minutes in Group B (Bupivacaine group) and was statistically significant with a P value of < 0.001. This finding is in agreement with the other workers who have confirmed the faster onset of action with 2-Chloroprocaine compared to Bupivacaine. Kararmaz et al [13] demonstrated Time to peak sensory level (T10) as 7.3 ± 1.9 min with 7.5 mg Bupivacaine intrathecally. In our series, we found a mean time to highest sensory block of 5.6 ± 1.0 minutes in Group C and 8.0 ± 0.6 minutes in Group B (p value <0.001).

Kouri and Kopacz et al. [6] reported peak height attained as T8 (T5-T11) with 40 mg intrathecal Chloroprocaine. Prajapati et al [7] showed a peak level of T10 with 7.5 mg Bupivacaine in TURP surgeries. In our series, the median highest dermatome reached was similar in both groups, the level being T8 and the range was also similar (T6-T10). The probable explanation for this similarity maybe that the larger volume (4 ml) of Chloroprocaine containing 40 mg had to be given as the predetermined minimal effective dose, causing as much analgesic spread as a smaller volume (1.5 ml) of Bupivacaine whose dose was also fixed at 7.5 mg in the study.

Lacasse et al [9] found Two segment regression time of 50 min (Bupivacaine 7.5mg) and 75 min (Chloroprocaine 40mg). We have also noticed more rapid regression (p<0.001) in group C (45.8 ± 9.3 min compared to 69.3 ± 12.3 min in group B). Our findings are similar to above studies and shows that 2 Chloroprocaine produces fast resolution of block.

Yoos and Kopacz [10] found duration of sensory block of 113 ± 14 min (Chloroprocaine 40mg) and 191 ± 30 minutes (Bupivacaine 7.5 mg). Total duration of sensory block in our study was 114.2 ±13.3 minutes in Group C and 168.0 ± 13.1 minutes in Group B. Our findings are in agreement with the above studies suggesting prolonged duration of action with Bupivacaine.

Lacasse et al[9] complete motor regression times with spinal 40 mg Chloroprocaine and 7.5 mg Bupivacaine were 76 minutes and 119 minutes respectively. We observed similar rapid recovery of motor function with Chloroprocaine group; the total duration of motor block was 92.7 ± 11.2 minutes in Group C and 140.1 ± 12.2 minutes in Group B and was statistically significant with a P value of < 0.001.

Pradipta Kumar et al found the duration of analgesia with 40 mg Chloroprocaine spinal as 122 ± 10.56 min. The time needed before administering rescue dose at VAS 4 was taken as duration of analgesia. In Group C it was 132.5 ± 12.2 minutes and in Group B 194.1 ± 12.7 minutes (p value < 0.001).

Overall Spinal block failure is reported to be 3.1 % in the literature [11]. We had 2.2% failure rate in Chloroprocaine group and none in Group B. Studies in over 4000 patients report 'zero' incidence of TNS (Transient Neurological Symptoms) with spinal 2-Chloroprocaine [12]. We did not come across any patients having TNS in our series.

Conclusion

Comparing Chloroprocaine 40 mg 1% and Bupivacaine 7.5 mg 0.5% as spinal anaesthetics in day-care surgeries, it is concluded that, Chloroprocaine has faster ascent and resolution of sensory and motor block. Duration of sensory, motor block and analgesia were markedly longer with Bupivacaine. In the dosage used, either drug did not produce significant peri-operative adverse effects. Chloroprocaine is preferred over low-dose Bupivacaine for spinal anaesthesia in ambulatory surgeries lasting around 2 hours.

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