A Randomized Comparative Study of Intrathecal 1% Chloroprocaine (plain) with 0.5% Bupivacaine (isobaric) in Lower Limb Surgeries.

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Abstract :

Introduction- Spinal anaesthesia is a popular technique of the modern anaesthesia practice because of its proven success, predictability and low complication rate. For daycare surgery, the ideal anaesthetic drug should allow rapid onset and offset of its own effect for early patient discharge with minimal side effects.

Methods- A randomized, double blind controlled study was carried out on 60 patients who had undergone lower limb surgeries, fulfilling inclusion and exclusion criteria, divided in two groups: Group C (Study group) 1% Plain Chloroprocaine 30mg and Group B (Control group) 0.5% Isobaric Bupivacaine) 15mg.

Results- Onset of sensory block (4.78 ± 0.49 min) vs (3.75 ± 0.88 min) P- 0.0001, peak block height T10 (L1-T10) vs T8 [L1-T6] P-0.0034, times until the resolution of sensory blockade (108.9±9.16 min vs 210±6.15 min) P 0.001, duration of motor block (80.1±8.86 min) vs (190.0±6.69 min), time to stand unassisted (115 ±28.19 min vs 225 ± 28.79 min; P 0.007), and first void of urine (125 ±19.83 min versus 235 ±26.23 min; P 0.016) in case of Chloroprocaine (Group C) vs Bupivacaine (Group B) respectively.

Conclusions- 30mg of Chloroprocaine resulted in slower onset of sensory and motor block compared to 15 mg of isobaric Bupivacaine. Peak sensory level achieved was higher in Bupivacaine group. Total duration of sensory and motor blocks was significantly shorter in Chloroprocaine group as compared to Bupivacaine group. Time to stand unassisted and time to void were significantly shorter in Chloroprocaine group.

Key words : day care surgery, Choroprocaine, lower limb surgery.

Background:

Spinal anaesthesia is a popular technique of the modern anaesthesia practice because of its proven success, predictability and low complication rate [1]. It is a reliable as well as a safe technique for procedures of lower limbs. Use of spinal anaesthesia is gradually increasing in the ambulatory setting as it is a simple procedure, has quick turnover of patients and provides quality surgical anaesthesia. In the postoperative recovery room, patients are generally more alert and nausea and vomiting [PONV] is less [2].

For spinal anaesthesia, Hyperbaric Bupivacaine is commonly used. A higher dose of Bupivacaine produces long duration sensory and motor block, delaying discharge of patient whereas a small dose is associated with a large variability in block duration. The choice of appropriate local anaesthetic drug for spinal anaesthesia is therefore crucial. The ideal anaesthetic drug should allow rapid onset and offset of its own effect for early patient discharge with minimal side effects. Chloroprocaine is an ester type local anaesthetic agent and has the shortest duration of action amongst all the established local anaesthetics [3]. Traditionally, we have been using Bupivacaine for spinal anaesthesia. Since Chloroprocaine is newly introduced here in India, this study was undertaken to compare it with Bupivacaine with the objectives to evaluate the characteristics of spinal anaesthesia block in terms of onset, peak block height, duration of sensory and motor block and time to stand unassisted and time for first void of urine.

Methods:

Study design

This study is a randomized double-blind trial comparing intrathecal plain (1%) Chloroprocaine with isobaric (0.5%) Bupivacaine for spinal anaesthesia in lower limb surgeries. The present research work was carried out after Institutional Ethics Committee approval and obtaining informed consent from patients undergoing lower limb surgeries at Tertiary Care Hospital attached to Medical College over a period of two years. Sample size of 60 was calculated based on the study by Lacasse et al [3] with total duration of sensory block as the outcome with effect size of 25 min, α error of 5% and power of 90%.

Randomization

Randomization was done with the help of computer-generated randomization table. Group allocation was concealed with sealed opaque envelopes. Such sealed envelopes were handed over to person preparing the drugs. For blinding, the study medication was prepared by a consultant staff member of the Department of Anaesthesiology who was not further involved in the perioperative care of the respective patients or in data gathering and study visits. Patient and investigator were blinded to drug administered.

Inclusion/exclusion criteria

Patients of both male and female gender with age between 18 and 65 years weighing 40 kg to 70 kg belonging to ASA class I and II presenting for elective lower limb surgeries under spinal anaesthesia were included. Patients with psychiatric disorder, with history suggestive of allergy to study medications and those unwilling to participate were excluded from the study.

Outcome measures

Preoperative evaluation was carried out in all patients. ASA fasting guidelines were followed. Standard monitoring in the form of ECG, non-invasive blood pressure and pulse oximetry were attached and baseline parameters were noted. On securing intravenous access, Ringers Lactate co-loading was started. On lumbar puncture under aseptic precautions, LA drug was administered according to group allocation and assessments were made.

Onset of block was defined as loss of sensation at L1 to light pin prick. Onset of motor block was judged when Bromage score reached 1. Both sensory and motor blocks were assessed every one minute for first 5 minutes followed by every five minutes till 15 minutes. Sensory block thereafter was assessed every ten minutes till the end of surgery and motor block was assessed at the end of surgery. Peak sensory level was judged when three consecutive assessments revealed the same dermatomal block. Time to reach peak sensory level was noted. Time to reach Bromage grade 3 was noted. Surgeon was allowed to start the procedure when sensory block reached T10 level.

Hemodynamic parameters were assessed at similar intervals. Hypotension (MAP<25% from the baseline or systolic pressure <90 mm of hg) was treated with Inj Ephedrine 6mg IV. Bradycardia (pulse rate <25% from the baseline or pulse rate <50 beats /min) was treated with Inj Atropine 0.6mg IV. Side effects like nausea, vomiting, itching, urinary retention was noted as yes or no survey.

After surgery patient was transferred to PACU. Similar assessment was continued in PACU every 15 min till block resolved completely. Hemodynamic parameters were assessed at similar time points. Duration of sensory block defined as the time of injection to the time of regression of sensory block to S2 dermatome was calculated. Duration of motor block defined as the interval between time of injection of drug and time to reach Modified Bromage Score 0 was calculated.

Post-operative analgesia was offered with Inj Diclofenac Na 75mg by IV on patient demand or VAS score >3 whichever was earlier. After complete resolution of block, patients were made to stand unassisted, and time was noted. Time to void urine for the first time was recorded. Data was coded and entered in MS Excel worksheet and

analysed in statistical software, Stata, version 10.1, 2011. Measures like Mean and Standard Deviation were used for describing Continuous Variables (e.g. SBP, DBP, MAP, SpO2, patient age) and analysed using student t test. Percentages were used for describing Categorical Variables. Difference between two proportions was analysed using chi square or Fisher exact test. All the analysis was 2 tailed and the significance level was set at 0.05. Two patients in group B and two patients in group B had failed in achieving subarachnoid block, hence exluded.

Results:

The mean time to onset of sensory block was higher in group C i.e 4.78 ± 0.49 minutes when compared to the group B i.e 3.75 ± 0.88 minutes, with the significant difference between the groups denoted by p-value of 0.0001. (Table 1)

Mean time to reach peak level of sensory block in group B was found to be 13.56±2.24 minutes whereas in group C it was 11.78± 2.31 minutes with p-value 0.032< 0.05, therefore there is significant difference between mean time to reach peak level for group B and C. (Table 1)

Mean time of total duration of sensory block was found to be 210±6.15 minutes in group B and 108.9±9.16 minutes in group C with significant difference denoted by p-value of 0.0001. (Table 1)

The mean time of onset of motor block was found to be 3.21± 0.95 minutes in group B and in group C it was found to be 4.35±0.82 minutes with significant difference between the groups with p value of 0.0001. (Table 1)

The mean time to achieve highest grade of motor block in group B was 10.17±0.94 minutes and in group C it was 10 minutes with no significant difference between the groups denoted by p value of 0.3218. (Table 1)

The mean of total duration of motor block in group B was 190.0±6.69minutes and in group C it was found to be 80.1±8.86 minutes with significant difference between the groups with p value of 0.00041. (Table 1)

The mean value of time to stand unassisted in group B was 225 ± 28.79 minutes and in group C it was 115 ±28.19 minutes with significant difference between the groups with p value of 0.007. (Table 1)

The mean time to void in group B was 235 ±26.23 minutes and in group C it was 125 ±19.83 minutes with significant difference between the groups with p value of 0.016. (Table 1)

Table 1

Variables	Group B (N-29)		Group C (N-29)		p-value*
	Mean	SD	Mean	SD	
Onset of sensory block	3.75	0.88	4.78	0.49	0.0001
Mean timeto reach peak level	13.56	2.24	11.78	2.31	0.032
Total duration of sensory block	210	6.15	108.9	9.16	0.001
Onset of motor block	3.21	0.95	4.35	0.82	0.0001
Highest grade of motor block	10.17	0.94	10	0	0.3218
Total duration of motor block	190.0	6.69	80.1	8.86	0.0041
Time to stand unassisted	225	28.79	115	28.19	0.007
Time to void	235	26.23	125	19.83	0.016

P-value estimated using t-test for independent samples

(*2 patients in group B and 2 patients in group B had failure.)

The peak block height was found to be T8 (L1-T6) for group B whereas for group C it was found to be T10(L1-T10) with significant difference between the groups denoted by p value of 0.0034. (Table 2)

Table 2

	Group B (N-29)	Group C (N- 29)	P value
Peak block height	T8(L1-T6)	T10(L1-T10)	0.0034

P-value estimated using t-test for independent samples

(*2 patients in group B and 2 patients in group B had failure.)

Discussion:

In the literature various studies have quoted the dose of Chloroprocaine to be between 10 mg and 60 mg. Smith K N et al [4] have inferred from their dose response study that preservative and antioxidant free 2-CP can be used effectively for spinal anesthesia in doses of 30–60 mg. Gebhardt et al [5] in a dose finding study for low dose spinal anaesthesia in ambulatory perianal surgery have recommended 20 mg as optimal dose. Yoos et al [6] in a dose finding study advocated use of 40 mg and 60 mg. They further commented that 20 mg and 30 mg Chloroprocaine resulted in less motor block and some sacral sparing should be anticipated.10 mg is not satisfactory for spinal anaesthesia.

A pilot study with 10 patients was conducted to arrive at a suitable dose of Chloroprocaine which was found to be 30 mg. Since Chloroprocaine is available in 1% concentration, 30mg makes volume to be 3ml. To match volume of both the drugs, Bupivacaine was used in volume of 3 ml (15mg).

Chloroprocaine is available as a plain drug. Hence Isobaric form of bupivacaine was used for comparison. Although no dextrose is added, studies in the literature have quoted that plain Chloroprocaine (20mg/ml) behaves slightly hyperbaric to CSF (density of 1.00123g/ml at 37 °C) [7].

Onset of sensory block has been variously assessed at L1 or T12 or T10 levels by various studies. Camponovo et al [8] and Agrawal et al [9] have reported onset at T10. Anarase YS et al [10] have assessed onset at L1 similar to present study. Onset of sensory block was faster with Bupivacaine compared to Chloroprocaine in this study, however, Camponovo et al [8] and Anarase et al [10] have reported comparable onset of sensory block between Bupivacaine and Chloroprocaine.

Onset of motor block was similarly faster in Bupivacaine group in present study. Camponovo et al [8] reported faster onset of motor block with Chloroprocaine whereas Anarase et al [10] have reported comparable onset times between groups.
Height of block achieved is affected by dose and volume of drug in general. Hyperbaric drugs demonstrate predictable spread compared to isobaric solutions. Peak block height achieved was higher with Bupivacaine than Chloroprocaine in present study. Using 40mg of Chloroprocaine and 7.5mg of Hyperbaric Bupivacaine, Lacasse et al [3] and Yoos et al [2] have reported peak block height comparable between groups. Camponovo et al [8] again have reported comparable peak sensory level for Chloroprocaine (50mg) versus plain Bupivacaine (10mg).

Time to reach peak level of sensory block was significantly lesser with Chloroprocaine compared to Bupivacaine. Time to achieve highest grade of motor block, however, was comparable between the groups. Yoos et al [6] (40 mg Chloroprocaine and 7.5 mg Bupivacaine) and Agarwal et al [9] (40mg Chloroprocaine and 12.5 mg hyperbaric Bupivacaine) reported comparable time to reach peak sensory block level between groups.

Duration of spinal block is generally seen to co-relate with the dose of the drug administered. The duration of sensory and motor block is significantly less in Chloroprocaine group in present study. Similar results are reported by Camponovo et al [8], Agarwal et al [9] and Anarase et al [10]. Bupivacaine is a long-acting local

anaesthetic and Chloroprocaine is short acting. To allow early recovery from sensory and motor blocks, particularly important in ambulatory anaesthesia, Bupivacaine is used in smaller dose. The studies conducted by Lacasse et al [3], Yoos et al [2] and Teunkens et al [11] have used dose of Bupivacaine as low as 7.5mg. In these studies also, Chloroprocaine has shown significantly shorter duration of sensory block. With 30 mg of Chloroprocaine, Casati et al [12] have reported spinal block resolution in 60 (41-98) min. Davis et al [13] have compared Chloroprocaine 30 mg alone and with Clonidine. In the group of Chloroprocaine alone, complete resolution of sensory block is reported to be 99± 18 min. Result of present study showed 108.9± 9.16 min. as duration of sensory blockade.

In this study, there was significant difference in the time to stand unassisted as well as time to first voiding of urine between the groups and these results are in line with Teunkens et al [11], Lacasse et al [3] and Yoos et al [2]. Using 30mg of Chloroprocaine, Gonter et al [14] have reported time to stand unassisted to be 103±12 minutes and our results are close by with a value of 115 ±28.19 minutes. In their study comparing doses 30mg, 40mg, 50mg of Chloroprocaine, Casati et al [12] have reported time to micturition to be 182(120-267) minutes in 30mg group whereas it is 125 ±19.83 minutes in present study.

None of our patient had any side-effects and comparision of haemodynamic parameters were comparable between the groups. All patients were clinically stable.

Limitations:

We have not analysed postoperative pain in this study. This may be a limitation as time to stand unassisted may be affected by pain score as well.

Conclusion :

considering ambulatory anaesthesia, cholorprocaine is a better local anaesthetic with respect to short duration of action, lesser time to stand unassisted and time to void postoperatively as compared to Bupivacaine. However, Bupivacaine has faster onset of action and is better in achieving peak sensory and motor dermatomal levels when compared with choloroprocaine.

Competing interest: Nil

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