

Original article

COMPARISON OF TWO DOSES OF CHLOROPROCAINE (20 mg v/s. 30 mg) FOR SPINAL ANAESTHESIA IN PERIANAL SURGERY. A PROSPECTIVE OBSERVATIONAL STUDY. (Running title: Chloroprocaine for spinal anaesthesia)

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Abstract

Introduction: The favourable pharmacokinetic properties of 2-chloroprocaine has regained popularity recently as spinal anaesthetic agent because of rapid onset and quick recovery time. The aim of this study was to determine the optimal dose of chloroprocaine for perianal surgeries. **Methods:** This prospective observational study recruited 30 subjects in each group (group A 20 mg of 1% chloroprocaine and group B 30 mg of 1% chloroprocaine) who underwent elective ambulatory perianal surgeries. Time of unassisted ambulation was considered as primary outcome variable expressed in min. For normally distributed quantitative parameters the mean values were compared between the study groups using independent sample t-test. Categorical outcomes were compared between study groups using Chi square test. **Results:** Time of unassisted ambulation was 100.50 ± 4.02 min for 20 mg group and 123.17 ± 5.33 min for 30 mg group ($p < 0.001$). Duration of sensory blockade for 20 mg group was 46.50 ± 5.11 min and for 30 mg group was 76.00 ± 8.14 min ($p < 0.001$). Duration of motor blockade for 20 mg group was 75.17 ± 7.01 min and for 30 mg group was 99.83 ± 4.25 min ($p < 0.001$). **Conclusion:** Chloroprocaine can be used successfully in perianal surgeries. Among the two doses, duration of motor blockade is increased in 30 mg compared to 20 mg, also adequate intraoperative anaesthesia was obtained with 20 mg. Isobaric chloroprocaine 1%, 20 mg is sufficient to achieve adequate intraoperative anaesthesia and leads to earlier discharge.

Keywords: ambulatory surgery; anesthesia; 2-chloroprocaine; spinal anesthesia; motor blockade

Introduction

Ambulatory surgery places high demands on anesthetic technique¹. Rapid onset and offset of anesthesia, fast recovery of protective reflexes, mobility and micturition, and reasonable control of postoperative pain and nausea are required for the ambulatory setting². Spinal anaesthesia is a well-known modality for lower limb, urological, abdominal, perianal, and gynecological surgeries. Lack of ideal spinal anesthetic drugs for ambulatory surgery made general anaesthesia preferred in the past^{3,4}.

Historically, the drug preferred in this setting was lidocaine, which provided a dense block and fast recovery. Still, it has been excluded from use nowadays due to the high incidence of transient neurologic symptoms (TNS)⁵. The favorable pharmacokinetic properties of 2-chloroprocaine have

regained popularity recently. During the 1980s, 2-chloroprocaine was removed from the market due to concerns about neurotoxicity. It was again introduced into clinical practice in 2004 as a new preservative-free formulation. Rapid onset (5–10 min) and a quick recovery time (70–150 min) are characteristics of 2-chloroprocaine^{6,7}.

Plain 2-chloroprocaine 1% was approved by the US Food and Drug Administration (FDA) in 2017. It has been found that the criteria of an ideal intrathecal agent for ambulatory surgery are fulfilled by this short-acting drug, thereby expanding the choices of both anaesthetist and patient on performing spinal anaesthesia for ambulatory procedures. 2-chloroprocaine does not necessarily require any adjuvant like intrathecal opioids when used for spinal anaesthesia and is associated with the reduced requirement of postoperative analgesics, lower

postoperative nausea and vomiting (PONV), and faster recovery for discharge^{8,9}. Studies have reported that in doses ranging from 30 to 60 mg, the spinal block profile of 2-chloroprocaine is similar to that of lidocaine and has a significantly lower incidence of TNS but longer recovery time and motor regression. Doses less than 30 mg also showed adequate sensory and limited motor blockade resulting in good recovery times. However, the literature on the impact of time on motor block regression during patient discharge remains unclear^{10,11,12}. Thus, this study aimed to determine the optimal dose of chloroprocaine for perianal surgeries. The objectives were to compare both groups' time taken for unassisted ambulation and sensory and motor blockade duration. (20 mg v/s 30 mg of chloroprocaine).

Methods

In this prospective observational study, the participants were patients undergoing elective perianal surgeries in Govt Mohan Kumaramangalam Medical College Hospital, Salem, from July 2019 to September 2019. The patients included were aged 18-60 years and of ASA grade I & II. The exclusion criteria were abnormal coagulation profile, trauma or infection at the procedure site, documented allergies to local anaesthetic drugs, and systemic disorders.

The sample size was calculated assuming the expected mean and standard deviation of the onset of motor block in group A as π, σ_1 (5.45, 1.4) and in the group B as π, σ_0 (4.53, 1.05), as per the previous study by Sugandarajappa SG et al¹³. The other parameters considered for sample size calculation included were 80% power of the study and 5% two-sided alpha error. The required sample size as per the calculation was 29 in each group. To account for a non-participation rate/loss to follow-up rate of about 5%, one subject will be added to the sample size. Hence the final required sample size would be 30 subjects in each group. Subjects were recruited in each group conveniently till the sample size is obtained. The study was approved by institutional review board and the hospital's ethics committee, and informed consent was obtained from the patients.

Demographic data including age, sex, and American Society of Anaesthesiologists (ASA) score

were collected. The day before surgery, pre-anaesthetic evaluation of the patient was done, including history, complete systemic examination, and all routine blood investigation, coagulation profile, electrocardiogram and x-ray chest. All patients were kept nil per oral for solid for 6 hours and liquid for 2 hours before the surgical procedure. After the patient's arrival in the operation theatre, an intravenous cannula 20 G was inserted and crystalloid infusion was started. All routine monitors such as electrocardiography, non-invasive blood pressure, and pulse oximetry were connected and baseline hemodynamic parameters were recorded.

Spinal anaesthesia was performed in patients sitting at L3-L4 intervertebral space using a 26 gauge Quincke Babcock needle. According to their study groups, patients received either 20 mg of 1% chloroprocaine (Group A) or 30 mg of 1% chloroprocaine (Group B). No adjuvant medication was added to local anaesthetic. The independent blinded observer evaluated the sensory and motor blocks every minute for 10 min, then every five minutes for 20 min and then every 10 min for the next 30 min, and finally every 15 min until the sensory block had regressed S2 dermatome. Sensory block was assessed in dermatomal areas of T6 to S1, S2 with a blunt 23 G hypodermic needle using the following scaling system 0 = normal sensation, 1 = loss of prick sensation (analgesia), 2 = loss of touch sensation (anaesthesia). The onset of sensory block was the time from intrathecal injection to the time taken to achieve T10 dermatome level.

We noted the duration of sensory block (the time taken to regress sensory block up to S1 dermatome in the heel). Motor block was assessed using Modified Bromage Scale. The onset of motor block and duration of motor block were recorded.

Statistical Methods

Time of unassisted ambulation was considered as primary outcome variable. Duration and onset of sensory blockade (min), duration and onset of motor blockade (min), and duration of surgery (in min) were considered as secondary outcome variables. The study group (Group A v/s Group B) was considered as a primary explanatory variable.

For normally distributed quantitative parameters the mean values were compared between the study groups using an independent sample t-test (Group A v/s Group B)

Categorical outcomes were compared between study groups using Chi-square test. P value < 0.05 was considered statistically significant. Data were analyzed by using coGuide software, V.1.03¹⁴.

Results

A total of 60 subjects were included in the final analysis. The difference in age between the study groups was found to be insignificant with a P-value of 0.169, with majority of 15 (50%) participants were aged 41 years and above in Group A. Ten participants (33.33%) were aged between 31 to 40 years and were in Group B. The difference in gender between the study group was found to be insignificant with a P-value of 0.347, with the majority of male (83.33%) participants were in group B. (Table 1)

outcome parameters like the onset of sensory blockade (min) and onset of motor blockade (min) (P > 0.05). (Table 3)

Discussion

Spinal anaesthesia is an attractive choice for ambulatory surgery, and preservative-free 2-chloroprocaine has re-emerged with minimal side effects. In this study, two doses (20 mg v/s 30 mg) of chloroprocaine for perianal surgeries was compared. We found that spinal anesthesia with 20 mg of 1% chloroprocaine (group A) can also provide satisfactory surgical block while permitting earlier discharge from hospital without any side-effects.

Time for unassisted ambulation was significantly earlier in group A (100.50 ± 4.02 min) than group B 123.17 ± 5.33 min. Many authors found that

Table 1: Comparison of demographic parameters

Parameter	Study groups		P-value
	Group A (20 mg) (N = 30)	Group B(30 mg) (N = 30)	
Age group			
Upto 30 years	9 (30%)	12 (40%)	0.169 ^a
31 to 40 years	6 (20%)	10 (33.33%)	
41 and above	15 (50%)	8 (26.67%)	
Gender			
Male	22 (73.33%)	25 (83.33%)	0.347 ^a
Female	8 (26.67%)	5 (16.67%)	

^a Chi square test

The difference in ASA grade between the study group was found to be insignificant with a P-value of 0.243, with majority (80%) of ASA grade I participants were in group B. There was no statistically significant difference between two groups in duration of surgery (min) (P > 0.05) (Table 2).

There was a statistically significant difference between the two groups in outcome parameters like time of unassisted ambulation, duration of sensory blockade (min), and duration of motor blockade (min) (P < 0.05). There was no statistically significant difference between the two groups in

there was earlier ambulation in chloroprocaine group when compared to bupivacaine^{15,16}. There was no difference in the onset of sensory and motor blockade among groups in the present study, similar to another study¹³. The onset of action of spinal anesthesia can be attributed to the baricity of the solution injected. Baricity of chloroprocaine can be increased by adding a small amount (0.8–1.1%) of dextrose to spinal given local anesthetic, thereby producing faster onset of block and a reduction in the variability of peak block level^{17,18}. In a study by Zhang Y et al. the experimental results showed

Table 2: Comparison of ASA grade and duration of surgery

Parameter	Study groups		P- value
	Group A (20 mg) (N = 30)	Group B(30 mg) (N = 30)	
ASA grade			
I	20 (66.67%)	24 (80%)	0.243 ^a
II	10 (33.33%)	6 (20%)	
Duration of surgery (min) (Mean \pm SD)	34.87 \pm 8.16	32.20 \pm 8.21	0.212 ^b

^a Chi square test; ^bIndependent sample t-test

Table 3: Comparison of outcome parameter

Outcome Parameter (Mean \pm SD)	Study groups		P value
	Group A (20 mg) (N = 30)	Group B(30 mg) (N = 30)	
Time of unassisted ambulation (min)	100.50 \pm 4.02	123.17 \pm 5.33	< 0.001 ^b
Onset of sensory block (min)	1.9 \pm 0.3	1.8 \pm 0.4	< 0.277 ^b
Duration of sensory blockade (min)	46.50 \pm 5.11	76 \pm 8.14	< 0.001 ^b
Onset of motor block (min)	4.1 \pm 0.6	3.9 \pm 0.4	0.134 ^b
Duration of motor blockade (min)	75.17 \pm 7.01	99.83 \pm 4.25	< 0.001 ^b

^bIndependent sample t-test

that the same concentration of different doses of chloroprocaine had different anaesthetic effect in saddle anaesthesia. The authors used 0.5% (w/v) chloroprocaine dissolved in 0.6–1.0 mL 10% (w/v) glucose solution¹⁹. The baricity of chloroprocaine was less compared to other local anaesthetics like bupivacaine, ropivacaine, and lignocaine and this accounted for the delayed onset of action with chloroprocaine¹⁷.

In this study, the total duration of sensory block was more in group B (76 \pm 8.14 min) compared to group A (46.50 \pm 5.11 min), similar to other studies¹³. In the dose-ranging study, it was reported that the time taken to regress to the level of L1 in chloroprocaine 20 mg was 40 minutes and chloroprocaine 30 mg was 42 minutes¹⁷.

The total duration of motor blockade was longer in group B (99.83 \pm 4.25 min) compared to group A (75.17 \pm 7.01 minutes). Similar findings were seen in Sugandarajappa SG et al. study¹³. It was reported that that 10 mg of 2-chloroprocaine has no effect, whereas 20 mg and 30 mg produced

sensory anaesthesia adequate for surgical procedures¹⁷. Kopacz DJ et al. also concluded that there was less motor block and there was sacral sparing in 20 mg and 30 mg doses compared to 40mg and 60 mg doses¹⁷. The present study differed slightly in terms of onset of action for sensory block, motor block, and total block duration compared to previous studies. This can be due to difference in doses and concentration of chloroprocaine used^{11,18–20}.

As an observational study, confounding variables might have affected the results; and groups were naturally unbalanced. In the present study there is an increased number of male patients, which can affect the BMI and consequently the pharmacokinetics and pharmacodynamics of the drug. This study involves a single-center investigation, which might affect external validity.

Conclusion

Chloroprocaine can be used successfully in perianal surgeries. Among the two doses, duration of motor blockade is increased in 30 mg compared to 20 mg, also adequate intraoperative anesthesia was obtained in 20 mg itself. We concluded that 20 mg of 1% isobaric chloroprocaine is sufficient to achieve adequate intraoperative anaesthesia and leads to earlier discharge.

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