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Research Article

COMPARISON OF 1% CHLOROPROCAINE IN SUB-ARACHNOID BLOCK WITH OR WITHOUT FENTANYL FOR ENHANCED RECOVERY AFTER PERIANAL SURGERIES

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ABSTRACT

Objective: Spinal anesthesia is a reliable and safe technique for procedures of lower abdomen, perianal surgeries, and lower limbs. The current availability of short acting local anesthetic agents like preservative free 1% chloroprocaine has renewed the interest for this technique in short- and ultra-short procedures. Opioids continue to be the most commonly added adjuvants in local anesthetics for potentiation of analgesic action. In this study, we investigated the effect of intrathecal fentanyl as an adjuvant to 1% chloroprocaine in patients undergoing perianal surgeries.

Methods: This prospective, randomized, and comparative study was conducted in 80 ASA Physical status I and II adult patients (age 20–80 years) undergoing perianal surgeries under spinal anesthesia. Group A patients received 1% chloroprocaine 3 ml (30 mg) and 0.4ml saline and Group B patients received 1% chloroprocaine 3 ml (30 mg) with fentanyl 0.4 ml (20 μg). Primary objectives were duration of analgesia and time to unassisted ambulation. Onset and duration of sensory and motor blockade, maximum height of sensory block, 2 segment regression, hemodynamic parameters, time to voiding, home discharge eligibility, and any side effects were also recorded.

Results: There were no significant differences in demographic characteristics and hemodynamic parameters. The duration of sensory block and duration of analgesia were statistically prolonged in Group B than Group A ($p<0.001$) without affecting recovery from motor block and time to unassisted ambulation. The adverse effects were comparable in both the groups.

Conclusion: The addition of fentanyl to 1% chloroprocaine intrathecally prolonged the duration of analgesia and sensory block in patients undergoing perianal surgeries.

Keywords: 1% chloroprocaine, Perianal surgery, Fentanyl, Spinal anesthesia.

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INTRODUCTION

Spinal anesthesia is a reliable and safe technique for procedures of lower abdomen, perianal surgeries and lower limbs [1]. It offers several advantages over general anesthesia by blunting surgical stress response, reducing intraoperative blood loss, and also by providing analgesia in the early post-operative period. However, characteristics such as delayed ambulation, risk of urinary retention, and pain after block regression may limit its use for ambulatory surgeries. This issue has been resolved through the use of short acting local anesthetics like 1% chloroprocaine. Camponovo compared spinal 1% chloroprocaine versus general anesthesia for outpatient procedures and found that with correct choice of local anesthetics, spinal anesthesia is more suitable for ultra-short outpatient procedures [2].

In recent times, post-operative outcome is considered to be positive only when it is associated with a shortened length of hospital stay. Recovery from anesthesia is much faster with chloroprocaine as compared to other short acting local anesthetics. Lacasse *et al.* showed that the unassisted ambulation time and the time of patient's hospital discharge eligibility were significantly shorter when using chloroprocaine compared to bupivacaine [3]. Adjuvants like opioids are commonly added to intrathecal local anesthetics for improving quality and duration of spinal blockade and prolonging post-operative analgesia [4]. Among opioids, fentanyl is the most extensively used opioid in sub-arachnoid block [5].

The present study is aimed at comparison of 1% chloroprocaine with or without fentanyl in subarachnoid block in perianal surgeries with primary objectives of duration of analgesia and time to unassisted ambulation. Secondary objectives were onset and duration of sensory and motor blockade, maximum height of sensory block, two-segment regression, hemodynamic parameters, time to voiding, home discharge eligibility, and any side effects.

METHODS

This prospective, double-blind, randomized, and comparative study was conducted after approval from the Institutional Ethical Committee and Clinical Trial Registry of India (CTRI/2021/02/031417). This clinical research was conducted in accordance with the Helsinki Declaration 2013 following the ethical principles for medical research involving human subjects. The study was conducted in 80 ASA Physical status I and II adult patients (age 20–80 years) undergoing perianal surgeries under spinal anesthesia. Written informed consent was obtained from each patient. Patients who refused to participate, having any spinal abnormality, known hypersensitivity to local anesthetic, infection at site of injection, any coagulation abnormality, recent myocardial infarction and heart disease, and patient on anticoagulants or with neurological disorder were excluded from the study. Patients were subjected to pre-operative evaluation and were randomly allocated into two groups using randomization table from website www.randomisation.com (Fig. 1). The patients and the observer who recruited the patients and collected the data were blinded.

Patients were advised overnight fasting. Tab Ranitidine 150 mg and tab Lorazepam 1 mg orally were given as premedication. In the operation room, electrocardiogram, NIBP, and pulse oximeter were applied. Intravenous access was secured with 18 G cannula and Ringer's lactate solution was started. Under all aseptic precautions, lumbar puncture was performed in L3–L4 or L4–L5 intervertebral space using midline approach with a 25 gauge quincke's spinal needle in sitting position

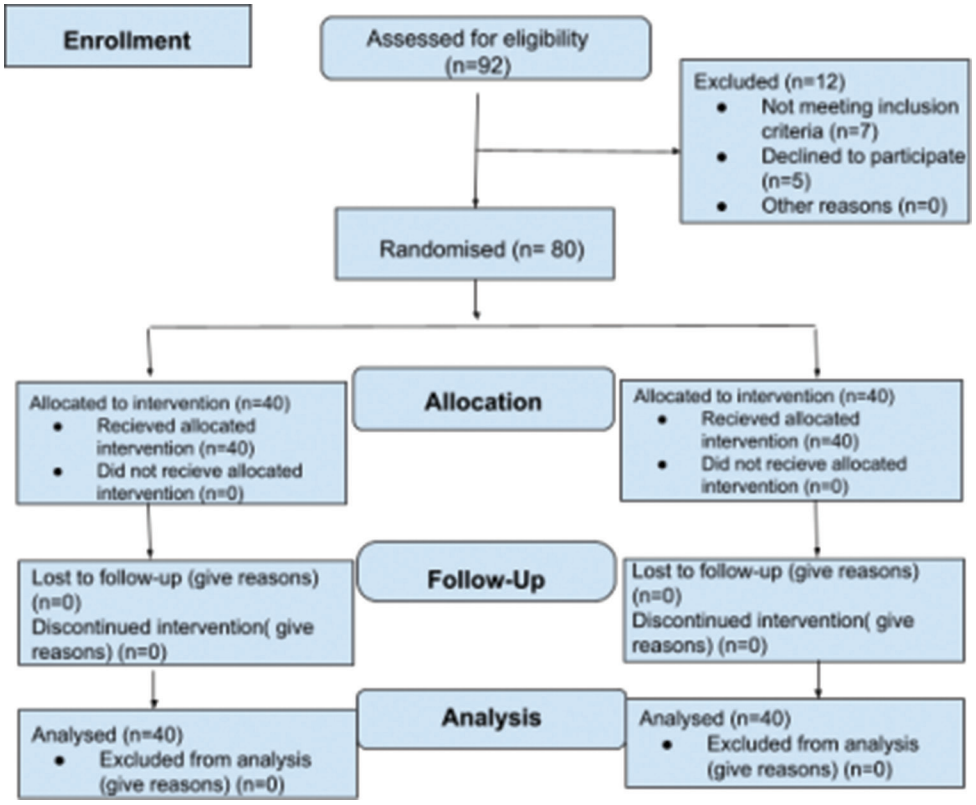

Fig. 1: Consort flow diagram

after local infiltration of skin with 2% lignocaine. Patients in Group A received 1% chloroprocaine 3 ml (30 mg) and 0.4 ml saline and Group B received 1% chloroprocaine 3 ml (30 mg) with fentanyl 0.4 ml (20 μg). Time of completion of subarachnoid injection of drug was taken as T_0 and all measurements were taken from this time. Patient was turned supine immediately and supplemental oxygen was given. Sensory blockade was assessed by loss of pinprick sensation to 23 G sterile hypodermic needle every 2 min for 10 min until the highest level (maximum sensory block) was achieved and stabilized for four consecutive tests. Onset of sensory block was taken as the time from T_0 to loss of pin prick sensation at T10 dermatome. Time for two-segment regression from maximum sensory block was noted. Duration of sensory block was taken as the time from onset of sensory block till complete recovery of S2 dermatome. Motor neural blockade was assessed using the Bromage Scale (0=no paralysis, able to flex hips/knees/ankles, 1=able to move knees, unable to raise extended legs, 2=able to flex ankles, unable to flex knees, and 3=unable to move any part of the lower limb) from T_0 every 5 min till 20 min then every 20 min till recovery from motor block. The onset of motor block was taken when Bromage Scale reached ≥2. Duration of motor block was taken as the time from onset of motor block till the recovery from motor block (defined as Bromage Scale 0).

All patients were monitored intraoperatively. Any fall in systolic blood pressure <90 mmHg or >20% of fall from baseline value was taken as hypotension and was noted. It was treated with an intravenous bolus dose of injection ephedrine 5 mg. Any pulse rate <60/min was noted and was regarded as bradycardia and treated with intravenous inj. atropine 0.6 mg.

Postoperatively, assessment of pain was done with the help of VAS score, every hour till 3 h. Duration of analgesia was taken as the time from subarachnoid injection of drug up to time when VAS was ≥4. Paracetamol 100 ml (1 g) I.V. was administered to the patient as rescue analgesia. After complete resolution of sensory and motor block, patient attempted ambulation without assistance and time was noted. Time to return, the voiding function was noted. If either ambulation or voiding was unsuccessful, then attempts were repeated at 15 min intervals until these end-points were achieved. Time period from T_0 to time when the criteria for home discharge met, even if according to hospital procedures, the patient was discharged later, was noted. Criteria for home discharge were stable vital signs, ability to ambulate without help, void spontaneously, and no nausea or pain.

Nausea, vomiting, urinary retention, headache, pruritus, respiratory depression, and TNS were observed. The occurrence of TNS was assessed 24 h and 7 days after surgery using a standardized telephonic call questionnaire, asking patients about the presence of headache, backache, and inability to void or presence of residual paresthesia or dysesthesia in the lower limbs or buttocks.

Sample size estimation was done based on the observations of the previous studies. Assuming a success rate of 95% and α margin of 5% with error of 0.05, the sample size calculated was 80 patients using Yamane (1967) formula for calculation.

Statistical analysis

Descriptive statistics were done for all data and were reported in terms of mean, S.D, and percentages. Appropriated statistical tests of comparison were applied. Categorical variables were analyzed with the help of Chi-square test and Fisher exact test. Continuous variables were analyzed with t-test and Mann-Whitney U-test where applicable. Statistical significance was taken as $p<0.05$ and $p<0.001$ were taken as highly significant. The data were analyzed using SPSS version 22 and Microsoft Excel.

RESULTS

Patients in both groups were similar with respect to demographic data and type of surgery. The difference in perioperative vitals (Heart rate, BP, respiratory rate, and SpO_2) was comparable in both the groups. The present study demonstrated that addition of fentanyl to 1% chloroprocaine intrathecally prolonged the post-operative analgesia (87.35±3.33 vs. 107.80±3.03 min, $p<0.001$), duration of sensory block

(72.85±2.86 vs. 93.05±4.68 min, p<0.001), and time to two-segment regression (47.82±1.40 vs. 52.24±2.36 min, p <0.001) in patients undergoing perianal surgeries. Chloroprocaine with fentanyl group had a faster onset of the sensory block (3.90±0.31 min) when compared to chloroprocaine alone (4.22±0.16) (p<0.001). Maximum sensory blockade (T6) and time for maximum sensory blockade (5.89±0.32 vs. 5.98±0.29 min, p=0.204) was observed to be similar in both the groups. Mean onset of motor block (4.33 ±.05 vs 4.32±.02 min, p=0.336) and duration of motor block (69.80±1.39 vs. 70.30±2.33 min, p=0.249) were also comparable in both groups. Time to unassisted ambulation (98.85±1.86 vs. 99.87±3.59 min, p=0.113), voiding (120.40±3.71 vs. 121.70±4.19 min, p=0.146), and eligibility for home discharge (180.40±3.71 min vs. 181.70±4.19 min, p=0.146) was also comparable in both groups. Overall incidence of side effects was also observed to be similar in both groups. No incidence of transient neurological symptoms was noted in our study (Tables 1-4).

DISCUSSION

Chloroprocaine is a short acting local anesthetic that allows rapid recovery from sensory and motor function. The shorter duration of action is due to very low protein binding and rapid metabolism by pseudocholinesterase [6]. There were several concerns regarding safe use of chloroprocaine and its potential neurotoxicity due to added preservatives in the past [7]. However, studies have shown that use of preservative-free chloroprocaine provides rapid and reliable sensory and motor block in doses ranging from 30–60 mg for brief surgical procedures under sub-arachnoid block without any significant complications [8]. Addition of adjuvants to intrathecal local anesthetics improves the quality and duration of spinal blockade and also prolongs the post-operative analgesia [4].

In our study, duration of analgesia and duration of sensory blockade were significantly prolonged with the addition of fentanyl (p<0.001). The literature suggests that the findings of prolongation of sensory block and post-operative analgesia are consistent with experimental as well as clinical synergistic interaction between spinal opioids and local anesthetics [9]. Our results are in concordance with the study done by Nagar *et al.* in which the duration of analgesia and time to first analgesic dose was significantly prolonged in chloroprocaine with fentanyl group (p<0.001) [10]. Our findings are also similar to those obtained with the study conducted by Madhusudhana *et al.* and Singariya *et al.* in which the time to first demand of analgesia (duration of analgesia) was significantly longer in post-operative period in the chloroprocaine with fentanyl group [11,12].

Fentanyl as an adjuvant to local anesthetic leads to rapid onset of the sensory block when administered intrathecally due to its lipophilic nature. Mean time for onset of sensory block was statistically shorter in patients who received chloroprocaine with fentanyl. Bhaskara *et al.* and Suryanarayana *et al.* have also shown similar results in their studies [13,14]. However, our findings are not consistent with the studies done by Nagar *et al.* and Singariya *et al.* [10,12] There is disparity regarding onset of sensory block which might be due to different techniques and ways of assessment of parameter and different doses of drugs used in these studies. Time taken to attain peak sensory block (T6) in our study was comparable in both groups, p=0.204. Similar results are obtained by Singariya *et al.* on comparing the anesthetic effects of intrathecal 2-chloroprocaine with or without fentanyl [12]. There was significantly prolonged mean time for two-segment regression in Group B in comparison to Group A in our study. Our findings are similar to Lacasse *et al*. who demonstrated two dermatome regression time of 50±18 min with 40 mg 2-CP on comparison with Bupivacaine for spinal anesthesia in elective ambulatory setting [13].

Table 1: Demographic profile of patients in Group A and Group B

Parameters	Group A	Group B	p value	Significance
Age (years)	38.50±12.90	39.62±12.46	0.082	NS
Gender				
Male	(29) 72.5	(30) 75.0	0.799	NS
Female	(11) 27.5	(10) 25.0		
Weight (kg)	64.75±7.25	67.57±7.11	0.083	NS

Table 2: Sensory block characteristics

Parameter	Group A	Group B	p value	Significance
Onset of sensory block (T10 dermatome) (min)	4.22±0.16	3.90±0.31	<0.001	HS
Maximum sensory block	T6	T6	-	-
Time taken to achieve maximum sensory block (min)	5.89±0.32	5.98±0.29	0.204	NS
Time for two-segment regression (min)	47.82±1.40	52.24±2.36	<0.001	HS
Duration of sensory block (min)	72.85±2.86	93.05±4.68	<0.001	HS
Duration of analgesia (min)	87.35±3.33	107.80±3.03	<0.001	HS

Table 3: Motor block characteristics and time to void and home discharge eligibility

Parameter	Group A	Group B	p value	Significance
Onset of motor block (min)	4.33±0.05	4.32±0.02	0.336	NS
Duration of motor block (min)	69.80±1.39	70.30±2.33	0.249	NS
Time to unassisted ambulation (min)	98.85±1.86	99.87±3.59	0.113	NS
Time to first voiding of urine (min)	120.40±3.71	121.70±4.19	0.146	NS
Time to eligibility for home discharge (min)	180.40±3.71	181.70±4.19	0.146	NS

Table 4: Comparison of complications

Complications	Group-A	Group-B	p value	Significance
N/V	6 (15%)	4 (10%)	0.737	NS
Hypotension	5 (12.5%)	3 (7.5%)	0.712	NS
Bradycardia	2 (5%)	2 (5%)	-	
Pruritus	0	5 (12.5%)	0.055	NS
Shivering	7 (17.5%)	6 (15%)	0.999	NS
Urinary retention	0	0	-	
Headache	0	0	-	
Respiratory depression	0	0	-	
Transient neurological symptoms	0	0	-	

In our study, the onset and duration of motor block were comparable in both the groups. The literature suggests that with addition of fentanyl, the quality and duration of sensory blockade were significantly prolonged without affecting recovery of motor block, time to unassisted ambulation, and time to void [11]. The difference in time to unassisted ambulation and voiding was statistically non-significant. Similar results have been shown by Madhusudhana *et al.* [11]. Vath *et al.* (2004) compared intrathecal injection of 40 mg 2% 2-CP with intrathecal injection of 40 mg 2% 2-CP and 20 μg fentanyl in eight healthy volunteers and demonstrated that the mean duration for ambulation in Group CF was 104±7 min and in Group CS was 95±9 min with a p value of <0.02 [5]. In a retrospective review on the discharge characteristics of spinal 2-Chloroprocaine, the time from injection to ambulation noted by Hejtmanek *et al*. in chloroprocaine group (median dose 40 mg and range 20–60 mg) was 107±24 min. The difference in time to eligibility for home discharge in both groups was also statistically non-significant. Our study results are consistent with chloroprocaine with fentanyl group of study conducted by Bhaskara *et al.* [13].

Incidence of side effects was comparable in both groups. No incidence of transient neurological symptoms was noted in our study. Although the concentration, volume of LA, and opioid intrathecally as used in our study were not similar to those used in various previous studies, but their results are similar to our findings [10-12].

The limitations of our study are that we could have compared two different doses of 1% chloroprocaine, because there is no definitive recommendation for intrathecal dose of chloroprocaine. Furthermore, we have compared only a single dose of fentanyl with chloroprocaine; hence, we cannot find out the optimum dose of fentanyl for post-operative analgesia.

CONCLUSION

Our study concluded that 1% chloroprocaine (30 mg) provides adequate surgical blockade for perianal surgeries but addition of 20 μg fentanyl to intrathecal 1% chloroprocaine has added advantage in prolonging the post-operative analgesia, speeding up the onset and increasing the duration of the sensory block without affecting the recovery of motor block, time to unassisted ambulation, voiding, eligibility of home discharge, and produce no significant hemodynamic changes. Thus, chloroprocaine with fentanyl may be a better choice in comparison to chloroprocaine alone for attaining enhanced recovery after perianal surgeries.

AUTHORS' CONTRIBUTIONS

Dr. Tripat Kaur Bindra, Dr. Davinder Chawla, Dr. Ashwani Kumar, Dr. Gurlivleen Kaur, and Dr. Amit Kaur did the literature review, acquisition of data, statistical analysis, interpretation of data, drafting, and reviewing and editing of the manuscript.

CONFLICTS OF INTEREST

There are no conflicts of interest.

AUTHORS' FUNDING

None.

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