Section: Anaesthesiology and Critical care

Research

A RANDOMIZED STUDY TO COMPARE THE EFFECT OF 0.5% HYPERBARIC BUPIVACAINE AND 1% 2-CHLOROPROCAINE IN SPINAL ANAESTHESIA IN ELECTIVE SHORT SURGICAL PROCEDURES

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Abstract

Background: The aim of this comparative study is to compare the effect of 0.5% hyperbaric bupivacaine and 1% 2-chloroprocaine in spinal anaesthesia.
Materials and method: This study was conducted over a period of 18 months in which 12 months for study and 6 months for statistical analysis. The study population has been calculated by using G-power software with 80% of the power and 5% of the significance level. A total of 60 patients were taken as sample size for the study. Group A: Patients were given intrathecal 4ml of preservative free 1% 2-chloroprocaine (1ml = 10mg) and Group B: Patients were given intrathecal 1.5ml of 0.5% hyperbaric bupivacaine (1ml = 5mg).
Results: The mean Onset of sensory block (min), Onset of motor block (min), Duration of motor blockade (min), Total time taken for two segment sensory regression (min), Total duration of sensory blockade (min)/ Duration of Analgesia and Time to ambulation (min) was significantly more among Group B compared to Group A.
Conclusion: Chloroprocaine has the shortest time to complete recovery of sensory and motor block otherwise it was comparable and same in all the other characteristics of anaesthesia with 0.5% bupivacaine. 1% 2-chloroprocaine showed faster recovery from anaesthesia and thus prompter eligibility for home discharge than the control, suggesting its suitability for the ambulatory setting.

INTRODUCTION

Ambulatory surgery places high demands on anaesthetic technique. Rapid onset and reversal of anaesthesia, rapid recovery of protective reflexes, movement, and micturition, and effective postoperative pain and nausea management are necessary in this situation.[1] Regional anaesthetic techniques are advantageous over general anaesthesia due to reduced chances of aspiration of gastric contents, uncompromised airway and extension of analgesia into postoperative period.[2]
Local anaesthetics administered in the subarachnoid space block sensory, autonomic, and motor impulses as the anterior and posterior nerve roots pass through the CSF. Blockade of neural transmission in the posterior nerve root fibers interrupts somatic and visceral sensation, whereas blockade of anterior nerve root fibres prevents efferent motor and autonomic outflow.[3,4]
Subarachnoid block (SAB) is a popular and common anaesthetic procedure practices worldwide. It was first performed by August Bier more than a century ago by injecting cocaine into cerebrospinal fluid (CSF) of a patient.[2,5] Spinal anaesthesia is advantageous because it uses a small dose of the anaesthetic, is simple to perform and offers a rapid onset of action, reliable surgical analgesia and good muscle relaxation is achieved. Though, some of its characteristics may limit its use that is delayed ambulation, risk of urinary retention, and pain after block regression.[6]
Unfortunately, no local anaesthetic can provide a block with rapid onset, predictable duration, good effectiveness and reliability, fast recovery, and lack of side effects. For many years, spinal lidocaine has been local anaesthetic of choice for short surgery

procedures because of its profile of fast onset and short duration but is often associated with transient neurologic symptoms (TNS) in 27-30%.[7]

Local anaesthetics such as bupivacaine, ropivacaine, levobupivacaine, chloroprocaine, lidocaine, and tetracaine have been used for caesarean operations, in combination usually with opioids such as fentanyl or its derivatives, or morphine.[8]

Bupivacaine is widely used for surgical procedures in lower extremities. Bupivacaine provides the prolonged postoperative analgesia and low incidence of TNS. However long duration of action 240-280 minutes may delay recovery of motor function and cause urinary retention and may lead to delayed discharge from the hospital.[9,10]

The current availability of short acting local anaesthetics has renewed interest for this technique in context to short surgical procedures. Chloroprocaine is an amino-ester local anaesthetic with a very short half-life. Introduced into clinical practice more than 50 years ago, Chloroprocaine quickly gained widespread popularity as an epidural drug, particularly in obstetrics, where its rapid hydrolysis by pseudo cholinesterase virtually eliminated concern for systemic toxicity and fetal exposure. It was introduced and successfully used for spinal anaesthesia since 1952.[11,12,13]

The most widely recognised experiments were conducted by Gissen et al in which exposure of isolated rabbit vagus nerve to the commercial solution of 3% chloroprocaine (containing 0.2% sodium bisulfite, PH 3) produced irreversible block, but exposure to the same solution buffered to pH 7.3 resulted in complete recovery.[13,14]

Clinical research with spinal 2-CP has been limited mainly to dose comparisons and evaluation of block characteristics in patients undergoing short procedures.[15,16,17,18,19,20] Yoos et al.[21] concluded that spinal 2-CP provides adequate duration and density of block for ambulatory surgical procedures, and it has a significantly faster resolution of block and return to ambulation compared with bupivacaine.

In comparison with bupivacaine, 2 CP showed favorable characteristics in terms of faster resolution of the motor block with early ambulation and discharge from hospital and may be a suitable alternative to low doses of long acting LAs in ambulatory surgery. 2 CP could also be a better alternative for intrathecal short or intermediate acting LAs, such as lidocaine and bupivacaine, as lidocaine may cause transient neurological symptoms (TNS) while bupivacaine may lead to prolongation of the motor block with delayed ambulation.[7,22]

There is a need for additional data collection under umbrella of institutional approval and informed consent for effect of spinal chloroprocaine in clinical practice and to compare its effects with 7.5 mg bupivacaine.

MATERIALS AND METHODS

This prospective randomized clinical study was conducted after clearance from Board of Studies and Ethical committee in the Department of Anesthesiology, Muzaffarnagar Medical College & Hospital associated to Chaudhary Charan Singh University, Meerut (U.P.). This study was conducted over a period of 18 months in which 12 months for study and 6 months for statistical analysis.

Sample Size

The study population has been calculated by using G-power software with 80% of the power and 5% of the significance level. After reviewing a pilot study it is seen that to obtain a 60- minutes reduction in mean time to eligibility for discharge a minimum of 27 patients are required in a group with an alpha error of 0.05 and power of 90% keeping to % dropout rate a total of 60 patients were taken as sample size for the study.

Study Design

Patients were allocated into two following groups, according to computer generated random number table.

Group A: Patients were given intrathecal 4ml of preservative free 1% 2-chloroprocaine (1ml = 10mg)

Group B: Patients were given intrathecal 1.5ml of 0.5% hyperbaric bupivacaine (1ml = 5mg)

Inclusion and Exclusion criteria

The study subjects were chosen as per the inclusion and exclusion criteria:

Inclusion Criteria

- Patients aged between 18 to 58 years, weighing 55-85 kg and of height 150-165 cm scheduled for elective short infraumbilical surgical procedures.
- Patients of American Society of Anesthesiologists (ASA) grade I & II either gender,
- Urologic surgeries: cystoscopy, circumcision, anorectal surgeries like fissure in ano fistula and haemorrhoids, varicocelectomy and hydrocelectomy
- General surgeries: Haemorrhoidectomy, rectal biopsy, or any short anorectal surgery & gynaecology surgeries (Vulvar or vaginal biopsy, cystocele repair, dilatation and curettage), were included in this comparative study.

Exclusion Criteria

Patients with contraindication to spinal anaesthesia that is

- Unwilling patients,
- Emergency surgeries,
- Patients with physical status of ASA III or greater,
- Age more than 58 years and less than 18 years,
- Poorly controlled hypertension,
- Morbidly obese patients,

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- Having cardiovascular diseases.
- With a known history of hypersensitivity to study drugs
- Infection at site of lumbar puncture,
- With bleeding diasthesis
- With hepatic or renal dysfunction
- Endocrinal or metabolic disorders,
- Using any drug that modifies pain perception,
- With psychiatric illness,
- With chronic headache and back ache in the past,
- Patient on anticoagulant therapy with INR>1.3, Platelets <75,000)
- With neurologic disease (Multiple sclerosis, symptomatic lumbar herniated disc, spinal stenosis), neuromuscular disease Refusal to technique or enrolment for study,
- Un-cooperative patients was also be excluded from the study.

Study Procedure

After approval from the Institutional Ethical committee all patients were selected as per inclusion and exclusion criteria. A detailed history, complete physical examination and routine & appropriate investigations were done for all patients.

Anaesthetic Technique

All patients enrolled for this study were undergo the pre-anaesthetic check-up,which was include a detailed medical and surgical history with any previous anaesthetic exposure and its outcomes. General physical examination was done and the systemic examination were performed to rule out any cardiovascular, respiratory, and neurological or any other systemic illness. The routine and relevant investigations were done.

Standard monitors for heart rate (HR), electrocardiogram (ECG), pulse oximetry (SpO2) and non-invasive arterial blood pressure (NIBP) were attached for monitoring of vital parameters. The observations for these parameters were cycled at three-minute interval.

The subarachnoid block was given under all strict aseptic precaution.

Assessment of Sensory and motor block characteristics

The sensory and motor block characteristics were assessed after the intrathecal injection of study drug solution at 2 minutes interval till the surgical anaesthesia is achieved. The segmental level of sensory block was assessed by pin prick test. The Motor block of the lower extremities were evaluated bilaterally by modified Bromage Scale (0-3).

The onset times of both sensory blockade (by pin prick test) and motor blockade (Bromage scale of 3), and regression times of both sensory blockade (time taken for two segment regression to S1) and motor blockade (time taken till patient was able to move his ankle) were recorded. Duration of analgesia were taken from onset of spinal anaesthesia to time of administration of first rescue analgesic on demand. (Inj. Tramadol 2mg/kg i.v. i.e. when VAS≥ 4). Side effect of nausea, vomiting, sedation, itching and shivering was also be noted and were managed accordingly.

Hemodynamic Parameters

After institution of subarachnoid block, the hemodynamic parameters of systemic systolic blood pressure, diastolic blood pressure, heart rate, pulse oximetry and electrocardiography were monitored at every 3 minutes interval till 30 minutes then at 5 minutes interval till end of surgery and followed by at every 30 minutes interval postoperatively till complete recovery from block.

Duration of Post-Operative Analgesia

The duration of Post-Operative Analgesia was calculated from the time surgery were end. The patients were followed up till requirement of 1st rescue analgesia. They were asked to point out the intensity of their pain on the linear visual pain scale.

Statistical Analysis

SPSS version 21.0 was used to analyze the Microsoft Excel data. Quantitative variables (numerical) were mean and SD, while qualitative variables (categorical) were frequency and percentage. The student t-test was used to compare mean values, whereas the chi-square test compared frequency. p-values less than 0.05 were deemed significant.

RESULTS

The mean age was compared between Group A and Group B using the unpaired t-test. There was no significant difference in mean age between Group A and Group B. There was no significant difference in distribution of gender and ASA grade between Group A and Group B.

Table 1: Distribution of study population according to

	Group A	Group B	p-value
Age	37.00±14.20	38.77±12.49	0.611
Male	21	21	1.000
	70.0%	70.0%	
Female	9	9	
	30.0%	30.0%	
ASA grade I	17	16	0.828
	56.7%	53.3%	
ASA grade II	13	14	
	43.3%	46.7%	

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Table 2: Distribution of study population according to

	Group A		Group B			
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**	**t-test value**	**p-value**
Onset of sensory block (min)	3.40	0.77	5.00	0.87	-7.538	0.001*
Onset of motor block (min)	3.27	0.94	5.57	0.82	-10.087	0.001*
Duration of motor blockade (min)	62.03	8.50	183.73	6.44	-62.518	0.001*
Total time taken for two segment sensory regression (min)	55.13	7.48	165.23	8.90	-51.889	0.001*
Total duration of sensory blockade (min)/ Duration of Analgesia	73.07	9.76	225.80	10.98	-56.945	0.001*
Time to ambulation (min)	96.07	7.33	261.50	8.14	-82.677	0.001*

The mean Onset of sensory block (min), Onset of motor block (min), Duration of motor blockade (min), Total time taken for two segment sensory regression (min), Total duration of sensory blockade (min)/ Duration of Analgesia and Time to ambulation (min) was compared between Group A and Group B using the unpaired t-test. The mean Onset of sensory block (min), Onset of motor block (min), Duration of motor blockade (min), Total time taken for two segment sensory regression (min), Total duration of sensory blockade (min)/ Duration of Analgesia and Time to ambulation (min) was significantly more among Group B compared to Group A.

Table 3: Distribution of study population according to Heart Rate (beats/ min)

Heart Rate (beats/min)	**Group A**		**Group B**		**t-test value**	**p-value**
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**		
Baseline	84.67	6.58	82.10	6.97	1.610	0.062
After SA block	83.30	6.62	77.53	7.68	3.114	0.003*
5 min	85.60	7.06	77.23	7.24	4.532	0.001*
10 min	84.63	7.20	76.10	6.79	4.722	0.001*
15 min	82.53	9.97	74.77	6.83	3.519	0.001*
20 min	82.27	8.75	73.67	6.63	4.291	0.001*
30 min	81.63	7.78	73.27	5.04	4.943	0.001*
40 min	82.14	7.02	72.83	6.44	4.689	0.001*
50 min	85.08	6.80	72.93	5.09	5.312	0.001*
Post-op 30 min	85.37	7.15	77.00	10.22	3.674	0.001*
Post-op 60 min	85.97	7.18	75.37	10.23	4.646	0.001*
Post-op 90 min	85.13	8.57	75.53	10.71	3.833	0.001*
Post-op 120 min	85.40	9.75	75.43	10.26	3.857	0.001*

The mean Heart Rate (beats/min) at Baseline, after SA block, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, Post-op 30 min, Post-op 60 min, Post-op 90 min, Post-op 120 min was compared between Group A and Group B using the unpaired t-test. The mean Heart Rate (beats/min) at Baseline, after SA block, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, Post-op 30 min, Post-op 60 min, Post-op 90 min, Post-op 120 min was significantly more among Group A compared to Group B.

Table 4: Distribution of study population according to Systolic Blood Pressure (mmHg)

Systolic Blood Pressure (mmHg)	**Group A**		**Group B**		**t-test value**	**p-value**
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**		
Baseline	124.53	10.12	124.60	10.25	-0.025	0.980
After SA block	118.20	8.26	111.40	10.77	2.745	0.008*
5 min	118.33	9.53	108.67	10.36	3.761	0.001*
10 min	116.87	10.39	107.87	11.70	3.150	0.003*
15 min	120.07	9.58	107.60	10.61	4.776	0.001*
20 min	121.40	8.12	108.53	10.07	5.446	0.001*
30 min	121.20	7.04	108.67	9.83	5.678	0.001*
40 min	123.18	7.27	112.42	8.30	4.662	0.001*
50 min	125.83	8.02	114.00	7.01	4.089	0.001*
Post-op 30 min	121.20	7.75	112.13	7.41	4.633	0.001*
Post-op 60 min	120.60	8.55	113.67	7.56	3.327	0.002*
Post-op 90 min	120.93	7.00	113.40	7.72	3.958	0.001*
Post-op 120 min	120.13	8.88	115.87	5.30	2.259	0.028*

The mean Systolic Blood Pressure (mmHg) (beats/min) at Baseline, after SA block, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, Post-op 30 min, Post-op 60 min, Post-op 90 min, Post-op 120 min was compared between Group A and Group B using the unpaired t-test. The mean Systolic Blood Pressure (mmHg) (beats/min) at Baseline, after SA block, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, Post-op 30 min, Post-op 60 min, Post-op 90 min, Post-op 120 min was significantly more among Group A compared to Group B.

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Table 5: Distribution of study population according to Diastolic Blood Pressure (mmHg)

Diastolic Blood Pressure (mmHg)	Group A		Group B		t-test value	p-value
	Mean	Std. Deviation	Mean	Std. Deviation		
Baseline	81.53	12.03	82.27	10.55	-0.251	0.803
After SA block	79.80	11.58	73.27	10.90	2.250	0.028*
5 min	79.80	10.68	71.40	11.39	2.947	0.005*
10 min	79.53	9.20	69.33	12.31	3.636	0.001*
15 min	81.00	11.46	68.93	12.30	3.931	0.001*
20 min	81.33	9.25	70.40	12.63	3.825	0.001*
30 min	81.87	8.65	69.73	12.50	4.372	0.001*
40 min	83.00	8.90	71.42	11.62	3.769	0.001*
50 min	84.83	9.93	69.87	9.61	3.964	0.001*
Post-op 30 min	81.20	9.93	72.53	10.40	3.301	0.002*
Post-op 60 min	81.93	9.65	73.87	10.21	3.145	0.003*
Post-op 90 min	80.67	9.15	73.47	8.96	3.080	0.003*
Post-op 120 min	80.40	10.18	74.87	8.22	2.317	0.024*

The mean Diastolic Blood Pressure (mmHg) (beats/min) at Baseline, after SA block, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, Post-op 30 min, Post-op 60 min, Post-op 90 min, Post-op 120 min was compared between Group A and Group B using the unpaired t-test. The mean Diastolic Blood Pressure (mmHg) (beats/min) at Baseline, after SA block, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, Post-op 30 min, Post-op 60 min, Post-op 90 min, Post-op 120 min was significantly more among Group A compared to Group B.

Table 6: Distribution of study population according to Mean Arterial Pressure (mmHg)

Mean Arterial Pressure (mmHg)	Group A		Group B		t-test value	p-value
	Mean	Std. Deviation	Mean	Std. Deviation		
Baseline	95.87	10.95	96.38	9.88	-0.190	0.850
After SA block	92.60	10.01	85.98	10.02	2.560	0.013*
5 min	92.64	9.89	83.82	10.17	3.407	0.001*
10 min	91.98	9.15	82.18	11.40	3.672	0.001*
15 min	94.02	9.94	81.82	11.00	4.508	0.001*
20 min	94.69	7.65	83.11	10.89	4.766	0.001*
30 min	94.98	7.05	82.71	10.83	5.198	0.001*
40 min	96.39	7.66	85.08	9.76	4.344	0.001*
50 min	98.50	7.67	84.58	8.31	4.475	0.001*
Post-op 30 min	94.53	8.25	85.73	8.85	3.983	0.001*
Post-op 60 min	94.82	8.59	87.13	8.56	3.473	0.001*
Post-op 90 min	94.09	7.46	86.78	7.80	3.710	0.001*
Post-op 120 min	93.64	8.73	88.53	6.72	2.541	0.014*

The mean Mean Arterial Pressure (mmHg) (beats/min) at Baseline, after SA block, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, Post-op 30 min, Post-op 60 min, Post-op 90 min, Post-op 120 min was compared between Group A and Group B using the unpaired t-test. The mean Mean Arterial Pressure (mmHg) (beats/min) at Baseline, after SA block, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, Post-op 30 min, Post-op 60 min, Post-op 90 min, Post-op 120 min was significantly more among Group A compared to Group B.

Table 7: Distribution of study population according to

Maximal cephalic dermatome level (min)	Groups		Total
	Group A	Group B	
T6	1	6	7
	3.3%	20.0%	11.7%
T7	2	0	2
	6.7%	0.0%	3.3%
T8	5	9	14
	16.7%	30.0%	23.3%
T9	2	2	4
	6.7%	6.7%	6.7%
T10	20	13	33
	66.7%	43.3%	55.0%
□2 value = 8.199, p-value = 0.048*			

The distribution of Maximal cephalic dermatome level (min) was compared between Group A and Group B using the chi-square test. Maximal cephalic dermatome level (min) T10 was significantly more among Group A.

Table 8: Distribution of study population according to

		Groups		
		Group A	Group B	p-value
Hypotension	No	27	26	0.688

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		90.0%	86.7%	
	Yes	3	4	
		10.0%	13.3%	
Bradycardia	No	27	26	0.688
		90.0%	86.7%	
	Yes	3	4	
		10.0%	13.3%	
Nausea & Vomiting	No	29	27	
		96.7%	90.0%	
	Yes	1	3	
		3.3%	10.0%	

The distribution of Hypotension, Bradycardia and Nausea & Vomiting was compared between Group A and Group B using the chi-square test. There was no significant difference in distribution of Hypotension, Bradycardia and Nausea & Vomiting between Group A and Group B.

Table 9: Distribution of study population according to

		Groups		
		Group A	**Group B**	**p-value**
Treatment given (Inj. Mephentermine in mg)	12mg	0	2	0.314
		0.0%	6.7%	
	6mg	3	4	
		10.0%	13.3%	
	Nil	27	24	
		90.0%	80.0%	
Treatment given (Inj. Atropine in mg)	0.6 mg	3	4	0.688
		10.0%	13.3%	
	Nil	27	26	
		90.0%	86.7%	
Treatment given (Inj. Emset in mg)	4mg	1	3	0.301
		3.3%	10.0%	
	Nil	29	27	
		96.7%	90.0%	

The distribution of Treatment given (Inj. Mephentermine in mg) was compared between Group A and Group B using the chi-square test. There was no significant difference in distribution of Treatment given (Inj. Mephentermine in mg) between Group A and Group B. There was no significant difference in distribution of Treatment given (Inj. Atropine in mg) between Group A and Group B. There was no significant difference in distribution of Treatment given (Inj. Emset in mg) between Group A and Group B.

DISCUSSION

Chloroprocaine (CP) is used for spinal anesthesia, and recently published double-blind randomised controlled trials have added to the body of information. An equal onset and recovery without TNS were seen in a randomised experiment comparing CP with low-dose lidocaine. With CP spinal anesthesia, an earlier release might result in lower medical expenses without lowering the standard of treatment.[22]

Sensory and Motor Block

In our study, the mean Onset of sensory block (min), Onset of motor block (min), Duration of motor blockade (min), Total time taken for two segment sensory regression (min), Total duration of sensory blockade (min)/ Duration of Analgesia and Time to ambulation (min) was significantly more among 0.5% hyperbaric bupivacaine compared to 2-chloroprocaine.

M et al.[23] reported that the onset time of sensory and motor blockade was significantly lower in group C as compared to group B. The duration of sensory and motor blockade was significantly less in group C as compared to group B. The time for unaided voiding and ambulation was less in group C as compared to group B.

The time to achieve maximum sensory block level was significantly faster in 2-CP group than group B. The difference was statistically significant in both groups. Duration of motor block was shorter in group CP. This was in agreement with other studies as well by Lee et al and Förster et al.[24,25]

Ghisi et al,[26] stated that 1% or 2% chloroprocaine is an alternative for short and ultra-short procedures, and when compared to spinal bupivacaine, it resulted in a significantly faster offset of sensory and motor blocks with similar onset time. Teunkens et al,[27] found that 40 mg chloroprocaine intrathecally had the shortest recovery time from sensory and motor blockade compared to 40 mg lidocaine and 7.5 mg bupivacaine, and had shorter voiding, ambulation, and discharge times compared to bupivacaine.

Bojaraj et al,[28] found that the onset of sensory block was comparable in both groups. But 1% 2-Chloroprocaine showed faster onset of motor block and fast regression of sensory and motor block. Time for first mobilisation and voiding were also significantly low among 1% 2-Chloroprocaine.

Camponovo et al,[29] If the highest level of sensory block is taken into account, the mean time to onset of motor block with 50 mg of 1% chloroprocaine is

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1 minute less than that obtained with 10 mg of 0.5% bupivacaine.

Baldini et al,[15] found that average time for full sensory block regression were all shorter in the chloroprocaine group (150 vs. 325 min), (105 vs. 225 min) and (142.5 vs. 290.5) respectively.

Casati et al,[17] reported that mean time to sensory block resolution was significantly lesser among Chloroprocaine group, Khare et al.30 showed that the onset of sensory block was 1.8 ± 0.3 min versus 3.2 ± 0.4 min in 2-chloroprocaine and hyperbaric bupivacaine groups respectively and Teunkens et al,[27] patients in the chloroprocaine group had a significantly shorter time until recovery from sensory block (median, 2.6 hours) than patients in the lidocaine group (3.1 hours) and in the bupivacaine group (6.1 hours; IQR vs 5.5 hours to undefined hours).[30]

In the study by Gys et al,[31] a significantly faster regression of sensory block was seen for intrathecal 40mg of 2-chloroprocaine (2-CP) as compared to 60mg of prilocaine, both with 2.0µg of added sufentanil. Yoos et al,[21] demonstrated a 1.7 times faster regression of the sensory block with 2-CP (a difference of 78 minutes). They utilized loss of sensation to pinprick with a dermatome tester. Although the same nerve fibres transmit pain and cold information, there is a subtle distinction. Pinprick sensation is conducted by the A delta fibres, while cold sensation is transmitted by both the A delta fibres and the C fibres.

Lee et al,[24] found no difference in time to motor block resolution between groups was observed, the time to sensory block resolution and time to meet recovery room discharge criteria were both significantly shorter among patients who received chloroprocaine than patients who received bupivacaine.

Our results also coincide with the study by Khare et al,[30] the onset time of motor block was 3.7±0.6 min versus 4.1 ± 0.6 min in 2-chloroprocaine and hyperbaric bupivacaine groups respectively with significant p-value < 0.001 showing that the onset was significantly earlier in Chloroprocaine group, Bojaraaj et al,[28] (motor onset time was 5.85 ±1.46 minutes and 7.35±1.27 minutes respectively, p=0.04). Our study was also similar with respect to the duration of motor block which was 71.16 ± 12.3 min versus 160.7 ± 14.8 min in 2-chloroprocaine and hyperbaric bupivacaine groups respectively with significant p value < 0. 001 and Teunkens et al.,27 Chloroprocaine was associated with a significantly faster recovery from motor block than lidocaine and bupivacaine.

Casati et al,[17] time to motor block resolution was significantly lesser among Chloroprocaine group. Campigilo et al,[32] in their retrospective review of 672 patients, chloroprocaine has a motor block lasting for 40 minutes, a rapid onset time of 3-5 minutes (9.6 min ± 7.3 min at 40 mg dose; 7.9 min ± 6.0 min at 50 mg dose) and a time to ambulation of 90 minutes.

Gys et al,[31] showed that in their study time to complete motor regression (Bromage 0) was significantly lesser among 2-chloroprocaine (1.8 minutes) compared to Bupivacaine group (3.1 minutes). Agarwal et al,[33] showed that considering the motor blockade, the duration was 73 minutes with chloroprocaine and 124 minutes with bupivacaine. Comparing motor blockade, the time to onset of motor blockade as gauged by a Bromage of 2 was 1 minute longer with bupivacaine.

Haemodynamic Parameters

In current study, the mean Heart Rate (beats/min) at Baseline, after SA block, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, Post-op 30 min, Post-op 60 min, Post-op 90 min, Post-op 120 min was significantly more among 2-chloroprocaine compared to 0.5% hyperbaric bupivacaine. The mean Systolic blood pressure, Diastolic blood pressure and MAP at Baseline, after SA block, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min, Post-op 30 min, Post-op 60 min, Post-op 90 min, Post-op 120 min was significantly more among 2-chloroprocaine compared to 0.5% hyperbaric bupivacaine.

Agrawal et al,[33] observed that among group Bupivacaine, 10% of patients exhibited hypotension that required pharmacological treatment, while 8.3% of patients had bradycardia. Contrarily, 1.1% and 3% patients in the group chlorprocaine experienced bradycardia and hypotension.

Khare et al,[30] in their study demonstrated that there was decrease in mean blood pressure at baseline (0 minute), 1 minutes, 3 minutes and 5 minutes in both 1% 2-chloroprocaine and 0.5% hyperbaric bupivacaine which was not significant but at 10 min pattern of decrease in mean blood pressure was significant with more fall in Bupivacaine group.

Maximal Cephalic Dermatome Level

Our study showed that Maximal cephalic dermatome level (min) T10 was significantly more among 2-chloroprocaine. In the study by Lacasse et al,[34] no significant difference was seen in the peak block height. Dahlgren et al,[35] recorded a comparable sensory peak block height (T4 versus T3) when using 12.5mg of bupivacaine with 2.5µg of sufentanil in patients undergoing C-section.

Complications

In present study, there was no significant difference in distribution of Bradycardia and Nausea & Vomiting between 2-chloroprocaine and 0.5% hyperbaric bupivacaine.

Ashwini and Kumara,[36] reported higher incidences of hypotension in the bupivacaine group compared to chloroprocaine group (53.33% Vs 30%). Lacasse et al. found to have equal incidences of complications like hypotension, headache, between the groups. Vaghadia et al,[37] and Maes et al,[38] discovered that prophylactic supplementation with colloids and phenylephrine did not always prevent hypotension in their trial, despite equal incidences of hypotension, the need for vasopressors, and duration of hypotension always less than 5 minutes.

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In the study by Khare et al,30 hypotension and bradycardia were more observed in bupivacaine than 2-chloroprocaine. Postdural puncture headache and transient neurological symptoms were not observed in any patients as follow-up of the patients was done telephonically for the first 24 hours after recovery from uneventful spinal anesthesia and Agarwal et al,33 in terms of intraoperative hemodynamic perturbations, in Bupivacaine, 8.3% of patients experienced bradycardia and 10% of patients developed hypotension requiring pharmacological intervention. In contrast, in 2-chloroprocaine group 1.1% developed bradycardia and 3% patients developed clinically significant hypotension.

A study by Casati et al,[17] compared spinal anaesthetics using either 50 mg of 10 mg/ml CP or 50 mg of 10 mg/ml lidocaine in a randomised, double- blinded fashion in 30 patients undergoing knee arthroscopy. Hypotension necessitating vasopressor administration was reported in two patients, one in each group. In the study by Lacasse et al,46 the incidence of hypotension was similar between the two groups intraoperatively and in the PACU which was different from our study.

The limitations of this study are non-randomization and small sample size in each group and this study was not perfectly double-blinded. Efforts should be made to standardise the protocol and evaluation as much as possible.

CONCLUSION

2-chloroprocaine proved to be comparable with 12.5 mg of 0.5% hyperbaric bupivacaine in terms of onset of sensory block to T10 in patients undergoing spinal anaesthesia for short procedures. It can be concluded from this study that 2- Chloroprocaine has the shortest time to complete recovery of sensory and motor block otherwise it was comparable and same in all the other characteristics of anaesthesia with 0.5% bupivacaine.

REFERENCES

1. Rattenberry W, Hertling A, Erskine R. Spinal anaesthesia for ambulatory surgery. BJA Educ. 2019;19(10):321-328.
2. Kuusniemi KS, Pihlajamäki KK, Irjala JK, Jaakkola PW, Pitkänen MT, Korkeila JE. Restricted spinal anaesthesia for ambulatory surgery: a pilot study. Eur J Anaesthesiol. 1999;16(1):2-6. doi: 10.1046/j.1365-2346.1999.00414.x.
3. Martin-Flores M. Epidural and Spinal Anesthesia. Vet Clin North Am Small Anim Pract. 2019;49(6):1095-1108. doi: 10.1016/j.cvsm.2019.07.007.
4. Swain A, Nag DS, Sahu S, Samaddar DP. Adjuvants to local anesthetics: Current understanding and future trends. World J Clin Cases. 2017;5(8):307-323. doi: 10.12998/wjcc.v5.i8.307.
5. Gorelick PB, Zych D. James Leonard Corning and the early history of spinal puncture. Neurology. 1987;37(4):672-4. doi: 10.1212/wnl.37.4.672.
6. Smith KN, Kopacz DJ, McDonald SB. Spinal 2-chloroprocaine: a dose-ranging study and the effect of added epinephrine. Anesth Analg. 2004;98(1):81-88. doi: 10.1213/01.ANE.0000093361.48458.6E.
7. Pollock JE. Transient neurologic symptoms: etiology, risk factors, and management. Reg Anesth Pain Med. 2002;27(6):581-6. doi: 10.1053/rapm.2002.36457.
8. Rollins M, Lucero J. Overview of anesthetic considerations for Cesarean delivery. Br Med Bull. 2012;101:105-25. doi: 10.1093/bmb/ldr050.
9. 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(3):309-13. doi: 10.1093/bja/aeg078.
10. Kamphuis ET, Ionescu TI, Kuipers PW, de Gier J, van Venrooij GE, Boon TA. Recovery of storage and emptying functions of the urinary bladder after spinal anesthesia with lidocaine and with bupivacaine in men. Anesthesiology. 1998;88(2):310-6. doi: 10.1097/00000542-199802000-00007.
11. Barsa J, Batra M, Fink BR, Sumi SM. A comparative in vivo study of local neurotoxicity of lidocaine, bupivacaine, 2-chloroprocaine, and a mixture of 2-chloroprocaine and bupivacaine. Anesth Analg. 1982;61(12):961-7.
12. Kouri ME, Kopacz DJ. Spinal 2-chloroprocaine: a comparison with lidocaine in volunteers. Anesth Analg. 2004;98(1):75-80. doi: 10.1213/01.ANE.0000093228.61443.EE.
13. Gissen A. Toxicity of local anesthetics in obstetrics: II. Chloroprocaine: Research and clinical aspects. Clin Anesthesiol. 1986;4:101-8.
14. Gissen A, Datta S, Lambert D. The chloroprocaine controversy: II. Is chloroprocaine neurotoxic? Reg Anesth. 1984;9:135-44.
15. Baldini G, Bagry H, Aprikian A, Carli F. Postoperative urinary retention: anesthetic and perioperative considerations. Anesthesiology. 2009;110(5):1139-57. doi: 10.1097/ALN.0b013e31819f7aea.
16. Casati A, Danelli G, Berti M, Fioro A, Fanelli A, Benassi C, et al. Intrathecal 2-chloroprocaine for lower limb outpatient surgery: a prospective, randomized, double-blind, clinical evaluation. Anesth Analg. 2006;103(1):234-8, table of contents. doi: 10.1213/01.ane.0000221441.44387.82.
17. 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. doi: 10.1213/01.ane.0000258766.73612.d8.
18. Sell A, Tein T, Pitkänen M. Spinal 2-chloroprocaine: effective dose for ambulatory surgery. Acta Anaesthesiol Scand. 2008;52(5):695-9. doi: 10.1111/j.1399-6576.2008.01639.x.
19. Fu RQ, Tian YK, Fang WR. Combined spinal and epidural anaesthesia with chloroprocaine for hysterectomy. Clin Exp Pharmacol Physiol. 2008; 35: 60-3.
20. Palas TA. Four years' experience with 1% chloroprocaine for spinal anesthesia in ambulatory anesthesia. Reg Anesth Pain Med. 2005; 30(Suppl 1):13.
21. Yoos JR, Kopacz DJ. Spinal 2-chloroprocaine: a comparison with small-dose bupivacaine in volunteers. Anesth Analg. 2005;100(2):566-572. doi: 10.1213/01.ANE.0000143356.17013.A1.
22. Hejtmanek MR, Pollock JE. Chloroprocaine for spinal anesthesia: a retrospective analysis. Acta Anaesthesiol Scand. 2011;55(3):267-72. doi: 10.1111/j.1399-6576.2010.02371.x.
23. Sugumar M, Singh AK, Rath A, Reena, Jayanthi A. A Comparative Study of Isobaric 1% Chloroprocaine With 0.5% Isobaric Bupivacaine for Ureteroscopic Lithotripsy Under Spinal Anaesthesia: A Prospective Randomised Study. Cureus. 2022;14(4):e24633. doi: 10.7759/cureus.24633.
24. Lee A, Shatil B, Landau R, Menon P, Smiley R. Intrathecal 2-Chloroprocaine 3% Versus Hyperbaric Bupivacaine 0.75% for Cervical Cerclage: A Double-Blind Randomized Controlled Trial. Anesth Analg. 2022;134(3):624-632. doi: 10.1213/ANE.0000000000005653.
25. Förster JG, Rosenberg PH. Revival of old local anesthetics for spinal anesthesia in ambulatory surgery. Curr Opin

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Anaesthesiol. 2011;24(6):633-7. doi: 10.1097/ACO.0b013e32834aca1b.
26. Ghisi D, Bonarelli S. Ambulatory surgery with chloroprocaine spinal anesthesia: a review. Ambulatory Anesth. 2015;2:111–120.
27. 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. doi: 10.1007/s12630-010-9450-x.
28. Bojaraaj K, Lalitha M. Spinal anaesthesia for perineal surgeries: A comparison of 1% 2-chloroprocaine with 0.5% bupivacaine. ISSN. 2017;7(11):272-273.
29. Camponovo C, Wulf H, Ghisi D, Fanelli A, Riva T, Cristina D, et al. 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. doi: 10.1111/aas.12291.
30. 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 anaesthesia for infra-umbilical surgeries. Anaesth Pain Intensive care. 2019;23(2):162-7.
31. Gys B, Lafullarde T, Gys T, Janssen L. Intrathecal prilocaine, 2-chloroprocaine and bupivacaine for ambulatory abdominal wall herniorrhaphy: a prospective observational study. Ambulatory Surg. 2017:8-12.
32. Campiglio GL, Bufo S, De Sisto L, Garassino E, Gibelli PL, Gilardino P, et al; Associazione Lombarda di Chirurgia Plastica Ambulatoriale. Guidelines for the safe outpatient practice of aesthetic surgery. Minerva Chir. 2010;65:145-52.
33. 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 Pharm Res. 2019;05(04):4153-6.
34. 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. doi: 10.1007/s12630-010-9450-x.
35. Dahlgren G, Hultstrand C, Jakobsson J, Norman M, Eriksson EW, Martin H. Intrathecal sufentanil, fentanyl, or placebo added to bupivacaine for cesarean section. Anesth Analg. 1997;85(6):1288-93. doi: 10.1097/00000539-199712000-00020.
36. Ashwini S, Kumara A. Comparison of 2-chloroprocaine 1% versus hyperbaric bupivacaine 0.5% for subarachnoid block in pregnant females posted for elective caesarean section. Indian J Clin Anaesth. 2019;6(4):532–537
37. Vaghadia H, Neilson G, Lennox PH. Selective spinal anesthesia for outpatient transurethral prostatectomy (TURP): randomized controlled comparison of chloroprocaine with lidocaine. Acta Anaesthesiol Scand. 2012;56(2):217-23. doi: 10.1111/j.1399-6576.2011.02599.x.
38. Maes S, Laubach M, Poelaert J. Randomised controlled trial of spinal anaesthesia with bupivacaine or 2-chloroprocaine during caesarean section. Acta Anaesthesiol Scand. 2016;60(5):642-9. doi: 10.1111/aas.12665.

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