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INTRATHECAL HYPERBARIC BUPIVACAINE 0.5% WITH PRESERVATIVE FREE KETAMINE AND HYPERBARIC BUPIVACAINE 0.5% IN LOWER ABDOMINAL SURGERIES - A COMPARATIVE STUDY

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ABSTRACT

In the present study practice of spinal anaesthesia, bupivacaine is the most commonly used drug for spinal anaesthesia. To improve the quality of analgesia many adjuvants have been used. Intrathecal ketamine, which is a NMDA receptor blocker, has analgesic effect at the spinal cord which is due to inhibition of dorsal horn. Thus, intrathecal ketamine has shown to effectively intensify spinal anaesthesia. This study was done to evaluate the efficacy of spinal anaesthesia with ketamine added to hyperbaric bupivacaine in lower abdominal and lower limb surgeries. 100 ASA grade I and II aged between 18-60years undergoing elective lower abdominal, urological, lower limb surgeries were selected and divided into 2 groups of 50 each. Bupivacaine group B received intrathecally 2.5ml of heavy bupivacaine 0.5% and 0.5 ml of normal saline. Whereas ketamine group BK received intrathecally 2.5ml of heavy bupivacaine 0.5% with 25mg of preservative free ketamine (total 3.0ml). We summarize that the duration of sensory block and analgesia was significantly prolonged in Bupivacaine with Ketamine group and hemodynamically stable in this group.

Keywords: Bupivacaine, Ketamine

1.INTRODUCTION

Spinal anaesthesia is used extensively for lower abdominal and lower extremity surgeries because it has distinct advantages over general anaesthesia viz, minimum physiological disturbance resulting in minimum stress response, optimal operative conditions, minimal intra operative blood loss and less chance of post-operative morbidity.

Lignocaine and Bupivacaine are the commonly used local anaesthetic agents for spinal anaesthesia. Lignocaine produces good motor blockade but duration of action is lesser than that of bupivacaine.[1]Whereas bupivacaine has been found to have less effective motor blockade but as lower onset of action.[2]

Ketamine, a phencyclidine derivative has recently been found to be effective by epidural and intrathecal routes. It possesses some definite advantages over the conventional local anaesthetic agents as it stimulates cardiovascular system[3,4]and respiratory system.[5] The onset of anaesthesia (sensory block) and motor paralysis is found to be earlier than the conventional local anaesthetics.[4]Intensity of sensory block is 100% as it is described to be due to potent analgesic effect of ketamine.[6]

Addition of adrenaline 0.1 mg and 5% dextrose to ketamine improves the degree of motor block and prolongs the duration of motor paralysis.[4,7]

Postoperative analgesia persists for a longer period of at least 2-3 hours. Incidence of nausea and vomiting, disturbance of micturition etc. are also less with this agent.[4]Postoperative neurological squeal is not reported with preservative free ketamine which is a problem with the conventional local anaesthetics. Intrathecally administered ketamine has central sedative effect and so the patient does not suffer from hallucination and irritability.[7]

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Since intrathecal ketamine has the above mentioned beneficial effects on cardio respiratory functions, and has good analgesic and local anaesthetic effects, this study was therefore undertaken to assess the intrathecal effectiveness of mixture of ketamine, dextrose and adrenaline as compared to bupivacaine.

2.MATERIALS AND METHODS:

100 ASA grade I and II aged between 18-60years undergoing elective lower abdominal, urological, lower limb surgeries were selected and divided into 2 groups of 50 each. Bupivacaine group B received intrathecally 2.5ml of heavy bupivacaine 0.5% and 0.5 ml of normal saline whereas ketamine group BK received intrathecally 2.5ml of heavy bupivacaine 0.5% with 25mg of preservative free ketamine (total 3.0ml). During the pre-operative visit detailed history of every patient was noted and a routine examination was done. The procedure of spinal anaesthesia was explained to each patient and the informed consent of the patient was obtained. Routine laboratory investigations i.e. haemogram, blood sugar, urea and creatinine chest X-ray and ECG were also done. All the patients were given Tab. Diazepam 5 mg orally on the previous right and also on the morning, about an hour before surgery. Hundred patients were divided randomly into two groups of fifty each. In all of them preloading was done with 500 ml of Ringer's lactate solution and spinal anaesthesia was administered by standard technique.

GROUP B – received 2.5ml of hyperbaric bupivacaine 0.5% + 0.5ml of normal saline. GROUP BK – received 2.5ml of 0.5% of hyperbaric bupivacaine + 0.5ml of preservative free ketamine(25mg). Spinal anaesthesia was carried out under strict aseptic precautions in all the patients using 25 G Quincke spinal needle through L3-4 inter space in lateral positionand patients were immediately placed in supine position. Supplementation of oxygen 3 Lmin-1 was given to allpatients through a facemask. Arterial blood pressure, pulse and respiratory rates were measured every 5 minutes for the first thirty minutes and every 15 minutes till sensation returned to normal.

1. Sensory and motorblockade-onset, duration, highest level of sensory blockade.
2. Recovery parameters-time for 2 segment regression, time for complete sensory and motor recovery.
3. Analgesia–time to first pain medication, quality of analgesia.
4. Side effects.

3.RESULTS:

A total of 100 patients belonging to ASA grade I and II posted for lower abdominal surgeries were randomly selected. The patients were divided into 2 groups of 50each.

Bupivacaine group B received intrathecally 2.5ml of heavy bupivacaine 0.5% and 0.5 ml of normal saline whereas ketamine group BK received intrathecally 2.5ml of heavy bupivacaine 0.5% with 25mg of preservative free ketamine (total 3.0ml).

DEMOGRAPHICPROFILE:

TABLE–1: AGEDISTRIBUTION

Age (Years)	Bupivacaine		Ketamine	
	No.	%	No.	%
18-29	24	48	12	24
30-39	11	22	22	44
40-49	12	24	12	24
50-60	3	6	4	8
TOTAL	50	100	50	100
Mean+/-SD	33.3+/-9.5		35.6+/-8.1	
P* Value, sig	0.207 NS			

* Student's unpairedt test

TABLE-2: SEXDISTRIBUTION

SEX	Bupivacaine		Ketamine	
	No.	%	No.	%
Male	29	58	23	46
Female	21	42	27	54

X^2=1.4442; P = 0.230 NS

TABLE–3: HEIGHT AND WEIGHTDISTRIBUTION

Parameter	Bupivacaine		Ketamine		Mean Difference	P* Value, sig
	Mean	SD	Mean	SD		
Height(cms)	160.4	5.4	160.1	6.9	0.30	0.8 NS
Weight(kgs)	53.9	6.1	55.3	5.9	1.48	0.22 NS

The mean value of age in group BK is 35.6± 8.1 whereas in group B it is 33.3 ± 9.5. In group BK there were23 malesand 27females whereasin group B there were 29males and 21females. The mean value of height in group BK is 160.1 ± 6.9 whereas in group B it 160.4 ± 5.4. The mean age in group BK was 55.3 ± 5.9 whereas in group B it was 53.9 ± 6.1. There was no statistical difference between the 2 groups with regards to age, sex, height and weight (p>0.05).

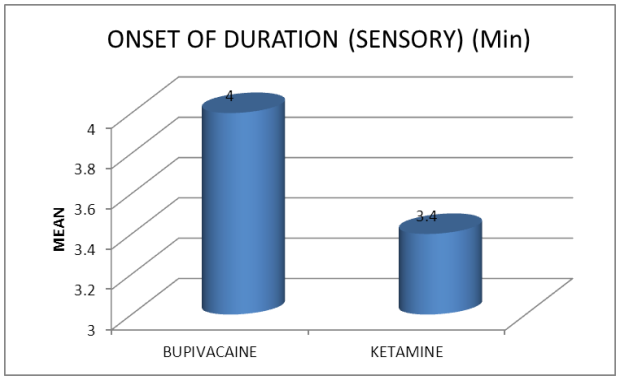
TABLE–4: ONSETOF SENSORY AND MOTOR BLOCKADE

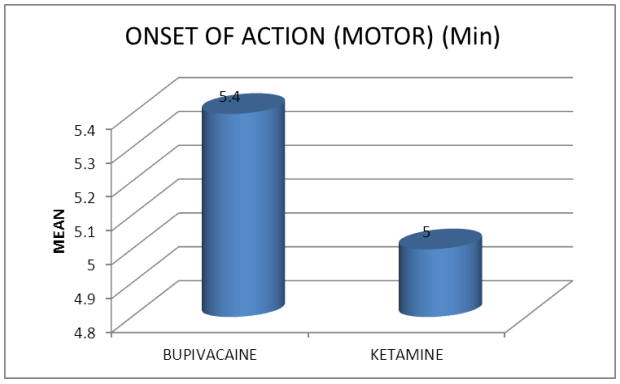
Parameter	Bupivacaine		Ketamine		MeanDifference	P* Value, sig
	Mean	SD	Mean	SD		
Onset ofaction (Sensory) (Min)	4.0	0.2	3.4	0.7	0.67	<0.001 HS
Onset ofaction (Motor) (Min)	5.4.0	5.3	5.0	0.3	0.42	0.57 NS

* Student's unpaired t test

The mean time of onset for sensory block in group BK was 3.4±0.7min whereas, in group B it was 4.0 ± 0.2 min. The onset of sensory block in group BK was faster compared to group B and significant with p < 0.001.

The mean time for onset motor block in group BK was 5.0 min whereas in group B it was 5.4 min (p>0.05). Though motor blockade was clinically faster it was not statistically significant.



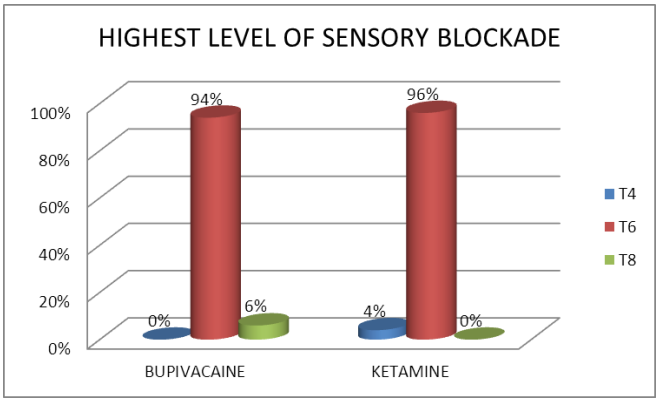


TABLE–5:HIGHEST LEVEL OF SENSORY BLOCKADE

Highest Level of sensory blockade	Bupivacaine		Ketamine	
	No.	%	No.	%
T4	0	0	2	4
T6	47	94	48	96
T8	3	6	0	0

X^2=5.0 P=0.08 NS

With regard to the highest level of sensory blockade in group BK 96% achieved a level of T6 whereas 4% achieved level of T4. In group B 94% achieved a level of T6 whereas 3% achieved level of T8.



TABLE–6:RECOVERYPARAMETERS

Parameter	Bupivacaine		Ketamine		Mean Difference	P*Value, sig
	Mean	SD	Mean	SD		
Two Segment Regression Time	58.7	14.7	62.5	10.1	3.760	0.13 NS
Time for full	157.0	13.6	160.7	7.7	3.680	0.1 NS
Time for full sensory recovery	212.4		306.8	28.8	94.380	<0.001 HS

* Student's unpaired t test

The time for 2 segment regression in group BK was 62.5 min whereas in group B it was 58.7 minutes. There was no statistical significance in the 2 segment regression time (p>0.05). The mean duration of motor blockade in group BK was 160.7 min and in group B it was 157.0 minutes (p>0.05). There was no statistical difference between the motor recovery parameters.

The mean duration of sensory blockade in group BK was 306.8 min whereas in group B it was 212.4 minutes (p<0.001). There was highly significant statistical difference between both the groups.

TABLE-7: DURATION OF ANALGESIA

Parameter	Bupivacaine		Ketamine		Mean Difference	P* Value, Sig
	Mean	SD	Mean	SD		
Time to first pain	222.7	15.6	322.8	29.4	100.12	<0.001 HS

* Student's unpaired t test

Time to first pain medication in group BK was 322.8 min. whereas in group B it was 222.7 minutes. This was statistically significant (p<0.001).

TABLE–8: QUALITY OF INTRA OPERATIVE ANALGESIA

Quality of Intra operative analgesia	Bupivacaine		Ketamine	
	No.	%	No.	%
0	39	78	50	100
1	11	22	0	0

All the patients in group BK had no pain during the surgery whereas 79% in group B had no pain during the surgery. 22% of patients in group B had mild discomfort during surgery.

TABLE–9: QUALITY OF POST OPERATIVE ANALGESIA

Quality of post op Analgesia	Bupivacaine		Ketamine		Mean Difference	P* Value, sig
	Mean	SD	Mean	SD		
3	2.4	0.9	0.6	0.7	1.80	<0.001 HS
6	3.4	1.1	1.8	1.6	1.62	<0.001 HS
12	4.2	1.5	4.18	1.2	0.060	0.8 NS

* Mann Whitney U test

VAS at the end of 3 hours was 0.7 in group BK whereas in group B it was 2.4. At the end of 6 hours VAS in group BK was 1.6 whereas in group B it was 3.4. VAS at the end of 12 hours in group BK was 4.18 whereas in group B it was 4.2.

VAS was statistically significant at the end of 3 and 6 hours (p<0.001) but it was insignificant at the end of 12 hours (p>0.05).

TABLE–10: HEART RATE

Heart rate (min)	Bupivacaine		Ketamine		Mean Difference	P*Value	
	Mean	SD	Mean	SD			
0	82.2	11.7	80.0	12.1	2.2	0.357	NS
1	84.6	12.2	81.4	12.7	3.2	0.196	NS
3	86.7	13.2	82.5	12.5	4.2	0.108	NS
5	90.1	13.7	84.0	12.9	6.1	0.023	S
10	91.1	12.8	84.9	13.1	6.3	0.018	S
15	89.1	17.2	85.1	13.2	3.9	0.203	NS
20	89.0	17.6	84.3	12.6	4.6	0.133	NS
25	88.9	14.1	83.8	11.9	5.1	0.053	NS
30	85.6	14.6	82.9	12.0	2.7	0.319	NS
45	83.4	12.4	82.7	11.9	0.7	0.767	NS
60	81.7	11.4	81.7	11.5	0.0	0.986	NS
120	81.4	9.8	82.0	11.2	0.6	0.791	NS
180	82.5	8.8	82.2	10.7	0.4	0.855	NS

* Student's unpaired t test

The groups did not differ significantly with respect to heart rate at any Interval ($p>0.05$) except at 5 and 10 minutes where it is slightly significant $p<0.05$.

The fluctuation in the heart rate was less in group BK patients than when compared to group B only.

TABLE–11: SYSTOLIC BLOOD PRESSURE

SBP (mm/Hg)	Bupivacaine		Ketamine		Mean Difference	P*Value	
	Mean	SD	Mean	SD			
0	119.7	10.5	119.7	14.3	0.0	0.994	NS
1	116.5	9.2	120.9	12.2	4.4	0.043	S
3	110.7	8.2	120.9	11.8	10.2	<0.001	HS
5	104.6	15.4	118.1	18.8	13.6	<0.001	HS
10	101.0	14.2	119.2	13.2	18.2	<0.001	HS
15	102.4	8.3	117.4	13.9	15.0	<0.001	HS
20	101.9	9.7	114.2	13.2	12.4	<0.001	HS
25	104.0	8.0	112.9	12.5	8.9	<0.001	HS
30	106.2	7.1	111.6	11.1	5.4	0.004	S
45	107.3	14.9	110.4	9.4	3.1	0.217	NS
60	111.0	7.1	111.6	9.1	0.7	0.686	NS
120	114.5	7.3	115.8	8.5	1.4	0.391	NS
180	116.6	7.3	118.2	9.1	1.5	0.358	NS

* Student's unpaired t test

The SBP in group B from decreased from the base line of 120 mm Hg to 101 mm Hg at 10 min, and 20 min. It then increased to 106 mm Hg at 30 min. At the end of 2 hours it was 114 mm Hg. The SBP in group BK at the start of Procedure was 120 mm Hg, it remained almost same at 10 mins which was 119 mm Hg. Its lightly decreased to 114 mm Hg at the end of 20 minute and 111 mm Hg at the end of 30 minutes. The SBP at the end of 2 hours was 115 mm Hg.

TABLE–11: SYSTOLIC BLOOD PRESSURE

SBP (mm/Hg)	Bupivacaine		Ketamine		Mean Difference	P*Value	
	Mean	SD	Mean	SD			
0	119.7	10.5	119.7	14.3	0.0	0.994	NS
1	116.5	9.2	120.9	12.2	4.4	0.043	S
3	110.7	8.2	120.9	11.8	10.2	<0.001	HS
5	104.6	15.4	118.1	18.8	13.6	<0.001	HS
10	101.0	14.2	119.2	13.2	18.2	<0.001	HS
15	102.4	8.3	117.4	13.9	15.0	<0.001	HS
20	101.9	9.7	114.2	13.2	12.4	<0.001	HS
25	104.0	8.0	112.9	12.5	8.9	<0.001	HS
30	106.2	7.1	111.6	11.1	5.4	0.004	S
45	107.3	14.9	110.4	9.4	3.1	0.217	NS
60	111.0	7.1	111.6	9.1	0.7	0.686	NS
120	114.5	7.3	115.8	8.5	1.4	0.391	NS
180	116.6	7.3	118.2	9.1	1.5	0.358	NS

* Student's unpaired t test

The SBP in group B from decreased from the base line of 120 mm Hg to 101 mm Hg at 10 min, and 20 min. It then increased to 106 mm Hg at 30 min. At the end of 2 hours it was 114 mm Hg. The SBP in group BK at the start of Procedure was120 mm Hg, it remained almost same at 10 mins which was 119 mm Hg. Its lightly decreased to 114mm Hg at the end of 20 minute and 111 mm Hg at the end of 30 minutes. The SBP at the end of 2 hours was 115 mm Hg.

TABLE–12: DIASTOLIC BLOOD PRESSURE

DBP (mm/Hg)	Bupivacaine		Ketamine		Mean Difference	P* Value	
	Mean	SD	Mean	SD			
0	69.5	6.6	71.5	8.0	1.9	0.191	NS
1	67.2	7.0	70.2	8.2	3.1	0.046	S
3	62.8	6.8	70.4	8.5	7.6	<0.001	HS
5	59.1	6.1	69.4	9.7	10.3	<0.001	HS
10	56.3	6.7	68.3	11.0	12.0	<0.001	HS
15	55.2	6.8	66.6	11.0	11.5	<0.001	HS
20	55.1	7.5	64.7	12.1	9.6	<0.001	HS
25	56.5	6.9	63.8	11.0	7.4	<0.001	HS
30	58.7	6.4	62.6	11.0	4.0	0.029	S
45	61.2	6.2	62.3	9.8	1.1	0.489	NS
60	63.2	6.1	64.0	8.9	0.8	0.603	NS
120	65.9	5.9	65.5	7.9	0.4	0.763	NS
180	67.8	5.9	67.2	7.4	0.6	0.676	NS

* Student's unpaired t test

The DBP in group B from decreased from the base line of 69.5 mm Hg to 56.3 mm Hg at 10 min and at 20 min it was 55.1 min. It then increased to 58.7 mm Hg at 30 min. At the end of 2 hours it was 65.9 mm Hg. The DBP in group BK at the start of procedure was 71.5 mm Hg, it slightly decreased to 68.3 mm Hg at 10 mins. It then decreased to 64.7 mm Hg at the end of 20 minute and 62.6 mm Hg at the end of 30 minutes. The DBP at the end of 2 hours was 65.5 mm Hg.

TABLE-13 : SIDE EFFECTS

Side effect	Group B	Group BK
Nausea / Vomiting	2(4%)	6(12%)
Nystagmus	0(0%)	0(0%)
Emergence delirium	0(0%)	2(4%)
Urinary retention	2(4%)	0(0%)
Hypotension	6(12%)	0(0%)

4.CONCLUSIONS

This study titled "comparative study of 0.5% hyperbaric bupivacaine with ketamine 25 mg and 0.5 % hyperbaric bupivacaine for spinal anaesthsia" was done to evaluate the effects of adding ketamine to hyperbaric bupivacaine with regard to onset and duration of sensory and motor blockade, duration, quality of analgesia and side effects. 100 patients aged 18-60 years belonging to ASA I and II undergoing elective lower limb, urological and lower abdominal surgeries were randomly allocated for the study into two group.

Bupivacine group B received intrathecally 2.5ml of heavy bupivacaine 0.5% and 0.5 ml of normal saline whereas ketamine group BK received intrathecally 2.5ml of heavy bupivacaine 0.5% with 25mg of preservative free ketamine (total 3.0ml).

Demographic profile – both the groups were comparable with regard to age, sex, height, and ASA grading. The common surgeries they underwent were hysterectomies, appendiectomies, herniorraphy, urologic and lower limb surgeries.

Sensory and motor blockade – we found that there was statistically significant variation with regard to the onset of sensory block between the 2 groups. The motor block was comparable in both group. Also highest level of sensory blockade was similar with both the groups.

Recovery parameters – Time for full sensory recovery was significantly prolonged in group BK which was 306 min than group B which was 212 min.

Time for full motor recovery in both groups was comparable.

Analgesia – we found that the time for first pain medication was considering delayed in group BK than group B (322 min Vs 222 min) thereby reducing the requirement of analgesics in the early post operative period. The quality of analgesia was better in the early recovery period was better as the VAS score was lower in group BK than group B.

Haemodynamic parameter – patients were comparatively more stable in group BK than group B. Side effects – there were no major side effects.

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