Original Article

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Comparative Study of Intrathecal Bupivacaine with Buprenorphine and Bupivacaine with Tramadol

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Abstract

Aim: The aim of the study is to compare the following factors in two groups i.e., Hyperbaric bupivacaine 0.5% and Buprenorphine 60mcg (GROUP B) and Hyperbaric bupivacaine 0.5% and Tramadol 25mg (GROUP T). *Patients and Methods:* Inpatients, posted for major surgeries, below umbilical level, in Osmania general hospital and Govt. maternity Hospital, Hyderabad were choosen for the study. *Inclusion Criteria:* ASA physical status, class I and II, Age between 18-60 years of either sex. *Exclusion Criteria:* Emergency surgery, deformities of spine, hypersensitivity to any of drugs, contraindications to spinal anaesthesia, patient refusal, bleeding diathesis. *Results:* A total of 100 patients of ASA Grade 1 and 2, between the age group of 18-65 years who were undergoing lower limb and lower abdominal (Below umbilical) surgeries included in the study. They were randomized into two groups group B and group T which were given 3ml of 0.5% hyperbaric bupivacaine + 60 mcg of buprenorphine and 3ml of 0.5% hyperbaric bupivacaine + 25 mg of tramadol respectively. Preanesthetic check-up was done one day prior to the surgery. Patients were evaluated for any systemic diseases and laboratory investigations recorded. The procedure of SAB was explained to the patients and written consent was obtained. The patients were educated about the use of visual analogue scale. Preparation of patients included period of overnight fasting. Patients were premedicated with Tab.Rantac 150mg and Tab.Alprazolam0.5mgH/S. Time of onset of sensory block was tested with pin prick which was not significantly differed in both the groups but duration of sensory blockade (225.68±41.88 min) , motor block (204.58±34.45 min) and duration of analgesia (291±33.7 min) were more with buprenorphine than tramadol which were 187.32±8.31, 153.32±7.93, 169.34±10.51 respectively. Heart rate, blood pressure, respiratory rate, saturation all were comparable in both the groups throughout the intraoperative period. Intraoperatively sedation score was assessed using Modified Ramsay Sedation Scale and there was higher incidence of sedation with Buprenorphine group. Nausea and vomiting were significantly higher in group T, with p value <0.001. Hypotension and bradycardia were more in group B which is statistically insignificant. Sedation scores were higher at 30 min in group B which was statistically insignificant with p=0.04, and higher again at 60 min and 90 min which is statistically significant with p value <0.01. At 120 min sedation scores were slightly higher in group T, but statistically insignificant with p value 0.67. sedation scores at 150 min and 180 min in two groups were comparable and statistically insignificant with p value 1. In our study postoperative analgesia was assessed by VAS at 6hr, 12hr, 18hr, 24hr. The scores were lower in buprenorphine group than tramadol group which was statistically highly significant with p values < 0.001.*Conclusion:* To conclude, Buprenorphine (60 mcg) seems to be an attractive alternative to tramadol (25 mg) as an adjuvant to spinal bupivacaine in surgical procedures. It provides good quality of intraoperative analgesia, haemodynamically stable conditions, and excellent quality of postoperative analgesia. Hence, Buprenorphine seems to be a better choice as Intrathecal adjuvant with Bupivacaine when compared with Tramadol.

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Introduction

Spinal anaesthesia is the most preferred regional anaesthesia technique as it is easy to perform, economical and produces rapid onset of anaesthesia and muscle relaxation. The aim of intrathecal local anaesthetic is to provide adequate sensory and motor block necessary for all infra umbilical surgeries. Hyperbaric bupivacaine is the most commonly used intrathecal local anaesthetic [1,2]. Various adjuvants have been added to bupivacaine Hcl to shorten the onset of block and prolong the duration of block. Buprenorphine, a mu receptor partial agonist with low intrinsic activity, when given intrathecally, significantly prolongs the duration of spinal block. Tramodol a mu receptor agonist and weak kappa and delta receptor agonist which prolongs the duration of analgesia [3,4]. In addition to mu receptor agonist effects tramadol also enhances spinal descending inhibitory pathways by inhibition of neuronal reuptake of norepinephrine and serotonin as well as presynaptic stimulation of serotonin release. Therefore, the present study is performed to compare Buprenorphine and Tramodol in their efficacy as adjuvants to subarachnoid block.

Patients and Methods

Inpatients, posted for major surgeries, below umbilical level, in Osmania general hospital and Govt. maternity Hospital, Hyderabad were chosen for the study.

Inclusion Criteria

ASA physical status, class I and II, Age between 18-60 years of either sex.

Exclusion Criteria

Emergency surgery, deformities of spine, hypersensitivity to any of drugs, contraindications to spinal anaesthesia, patient refusal, bleeding diathesis.

Methodology

After approval from the ethical committee of our Hospital, 100 ASA I and II patients scheduled for major surgeries under spinal anaesthesia were chosen for the study. Preanesthetic check-up was done one day prior to the surgery. Patients were evaluated for any systemic diseases and laboratory investigations recorded. The procedure of SAB was explained to the patients and written consent was obtained. The patients were educated about the use of visual analogue scale. Preparation of patients included period of overnight fasting. Patients were premedicated with Tab. Rantac 150mg and Tab. Alprazolam 0.5mgH/S. Boyle's anaesthesia machine was checked. Appropriate size endotracheal tubes, working laryngoscope with medium and large size blades, stylet and working suction apparatus were kept ready before the procedure. Emergency drug tray consisting of atropine, adrenaline, mephenteramine, ephedrine and dopamine were kept ready. Patients shifted to Operating table, Baseline vitals were recorded. I.V access was obtained on the forearm with No. 18G IV cannula and all patients were preloaded with 15ml/Kg, Ringer's Lactate, 15 mins before the surgery. Patients were randomly allocated into groups. Under strict asepsis, using 23G Quincke-babcock spinal needle, lumbar puncture was performed at L3-L4 space. Group B received 3ml, 0.5% hyperbaric bupivacaine + Buprinorphine 60mcg, Group T received 3ml, 0.5% hyperbaric bupivacaine + Tramadol 25mg, Intraoperatively pulse rate, non invasive blood pressure, electro cardiogram, SpO_2 was recorded, at 0min , 2min, 4min, 8min, 10min, 15min, 30min, 45min, 60min and 90min. Time of onset of sensory block was noted using pin prick method, time of onset of motor block was noted.

Motor Block was Assessed with Modified Bromage Scale

Bromage 0 – the patient is able to move the hip, knee and ankle, Bromage 1 – the patient is unable to move the hip but is able to move the knee and ankle. Bromage 2 – the patient is unable to move the hip and knee but able to move the ankle, Bromage3 –the patient is unable to move the hip, knee and ankle. Modified Ramsay sedation scale was used for intraoperative sedation: 1=agitated, restless, 2=cooperative, tranquil, 3=responds to verbal commands while sleeping, 4=brisk response to glabellar tap or loud noise while sleeping, 5=sluggish response to glabellar tap or loud noise while sleeping, 6=no response to glabellar tap or loud noise while sleeping. Pain was assessed using "Visual Analogue Scale" advocated by Revill and Robinson in 1976. It is linear scale, consists of 10cm line anchored at one end by a label such as "No pain" and other end by "Worst pain". Patient simply marks the line to indicate the pain intensity.

A Comparative two group randomized clinical

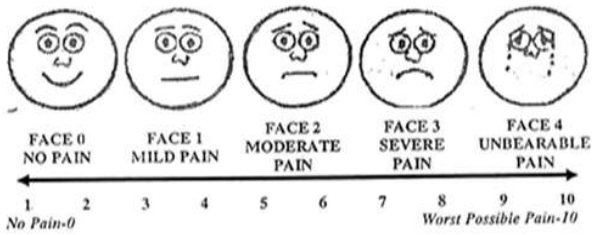


Fig. 1: Shows Visual Analogue Scale

study with 100 patients, with 50 patients in Group B (Buprinorphine) and 50 patients in Group T (Tramadol) was undertaken to study the changes in haemodynamics and side effects. Statistical analysis was done by applying Chi-square test, Anova test and students 't' test to analyze the data, p value was determined. P>0.05 is not significant, P<0.05 is significant, P<0.001 is highly significant.

Observations and Results

Table 1 shows that there is no statistical significance in age, height and weight characteristics among study groups (p value >0.05).

Table 1: Shows distribution of study groups, sex distribution of study groups, patient characteristics, age, height, weight distribution of study groups

Study Group	Frequency	Percentage
Group B	50	50
Group T	50	50
Total	100	100

Sex Distribution Study Group	Males	Females	Total
Group B	25 (50%)	25 (50%)	50 (50%)
Group T	25 (50%)	25 (50%)	50 (50%)
Total	50 (100%)	50 (100%)	100 (100%)

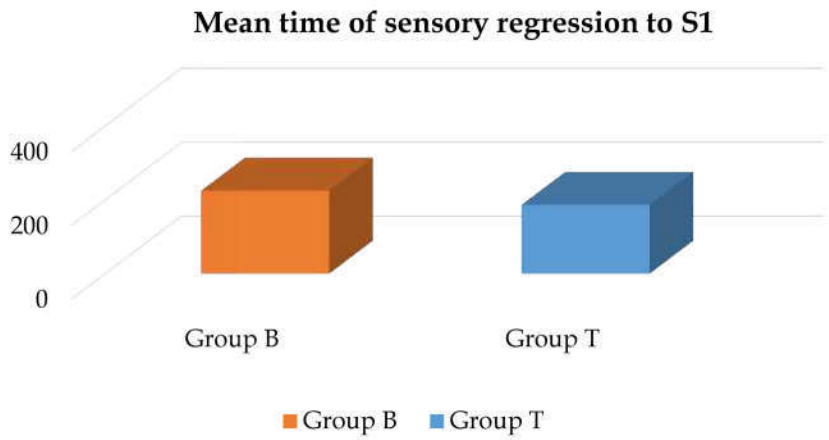
Parameter	Study Group	N	Mean	SD	P Value
Age	Group B	50	41.5	8.1	0.22
	Group T	50	43.86	10.95	
Height	Group B	50	155.5	5.85	0.92
	Group T	50	155.66	5.16	
Weight	Group B	50	57.16	9.68	0.66
	Group T	50	58.12	12.35	

Table 2: Shows comparison of (a) Time of onset of sensory block, (b) Time of Sensory regression to S1, (c) Onset of Motor block, (d) Regression to bromage-0 and (e) duration of Analgesia

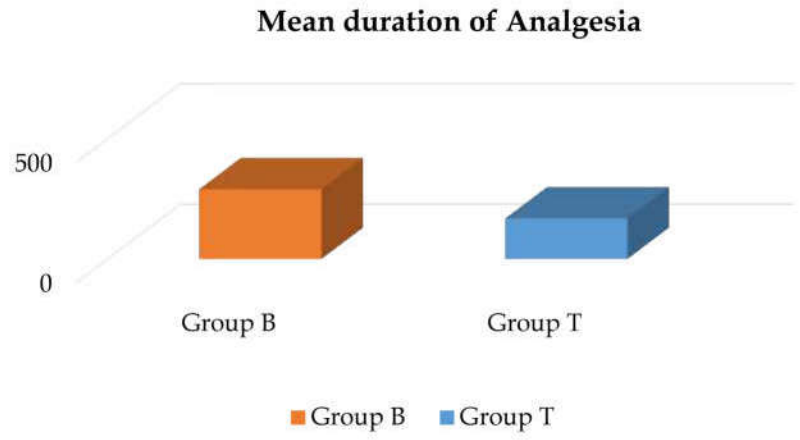
Parameter	Study Group	N	Mean	SD	P Value
Time of onset of sensory block (min)	Group B	50	3.12	0.6	0.052
	Group T	50	3.4	0.832	
Time of sensory regression to S1 (min)	Group B	50	225.68	41.88	<0.0001
	Group T	50	187.32	8.31	
Onset of motor block	Group B	50	3.2	0.534	<0.0001
	Group T	50	3.95	0.80	
Regression to bromage- 0 mins	Group B	50	204.58	34.45	<0.0001
	Group T	50	153.32	7.93	
Duration of analgesia	Group B	50	291	33.7	<0.0001
	Group T	50	169.34	10.51	

Table 2 shows comparison of (a) Time of onset of sensory block, (b) Time of Sensory regression to S1, (c) Onset of Motor block, (d) Regression to bromage-0 and (e) duration of Analgesia.

Table 2 shows time of onset of sensory block is higher in Group T with p value 0.052 ,which is statistically not significant, time of sensory regression to S1 is higher in Group B, with p<0.0001,which is statistically highly significant. Mean time of onset of motor blockade is higher in Group T, with p <0.0001, which is statistically highly significant. Mean time of regression to bromage-0 is higher in Group B, with p<0.0001, which is statistically highly significant. Mean duration of analgesia is higher in Group B, with p<0.0001, which is statistically highly significant (Graph-1 and Graph-2).



Graph 1
(a) time of sensory regression to S1 is higher in Group B,with p<0.0001,which is statistically highly significant



Graph 2:
(e) Mean duration of analgesia is higher in Group B,with p<0.0001,which is statistically highly significant

Table 3 shows that both the groups have similar MAP values throughout the intraoperative and postoperative periods with p>0.05. Variation in heart rate in both groups is not statistically significant as p > 0.05.

Table 4 shows variation in mean respiratory rate are comparable in both the groups with p value 1 indicating statistical insignificance. Variation in mean SpO2 values are comparable in both the groups with p value 1,which is statistically insignificant.

Table 5 shows that comparison of the modified ramsay sedation score 30mins between the two groups shows that modified ramsay sedation score 30 mins is higher in group B group and is statistically significant with a p value of 0.044. Comparison of the modified ramsay sedation score 60mins between the two groups shows that modified ramsay sedation score 60 mins is higher in group B group and is statistically significant with a p value of <0.001. Comparison of the modified ramsay sedation score 90 mins between the two groups shows that modified ramsay sedation score 90mins is higher in group B group and is statistically significant with a p value of <0.001. Comparison of the modified ramsay sedation score 120mins between the two groups shows that modified ramsay sedation score 120 mins is slightly higher in group T and is statistically non significant with a p value of 0.679. Sedation scores at 150 min and 180 min in two groups were comparable and statistically insignificant with p value 1. Comparison of the modified ramsay sedation score 150 mins between the two groups shows that modified ramsaysedation score 150mins is higher in group T and is statistically non significant with a p value of 1. Comparison of the modified ramsay sedation score 180mins between the two groups shows that modified ramsay sedation score 180mins is higher in group T

Table 3: Shows variation of MAP in study groups, variation of heart rate in study groups

MAP (mm Hg)	Group B		Group T		'p' value
	Mean	SD	Mean	SD	
0 min	88.84	5.86	89.0	7.66	0.9
2 min	87.82	4.94	88.44	7.08	0.61
4 min	84.94	6.05	84.62	8.4	0.82
8 min	78.34	6.62	79.7	9.08	0.39
10 min	75.04	6.50	76.02	9.49	0.54
15 min	72.22	7.35	73.9	9.96	0.33
30 min	77.06	10.31	76.12	4.74	0.55
45 min	76.58	6.52	78.32	4.26	0.11
60 min	77.9	4.47	78.9	4.26	0.25
90 min	80.06	5.14	81.18	4.16	0.23
	Group B		Group T		
HR (bpm)	Mean	SD	Mean	SD	'p' value
0 min	84.36	13.71	82.68	12.42	0.52
2 min	83.36	13.94	82.04	12.16	0.61
4 min	83.82	14.32	81.02	11.16	0.27
8 min	83.02	14.03	79.78	10.72	0.19
10 min	80.34	12.51	78.58	9.67	0.43
15 min	77.75	10.80	77.6	8.79	0.93
30 min	76.26	11.38	76.42	8.14	0.93
45 min	75.48	11.20	75.46	7.70	0.99
60 min	74.92	10.87	74.68	7.62	0.89
90 min	74.92	9.7	74.48	7.7	0.97

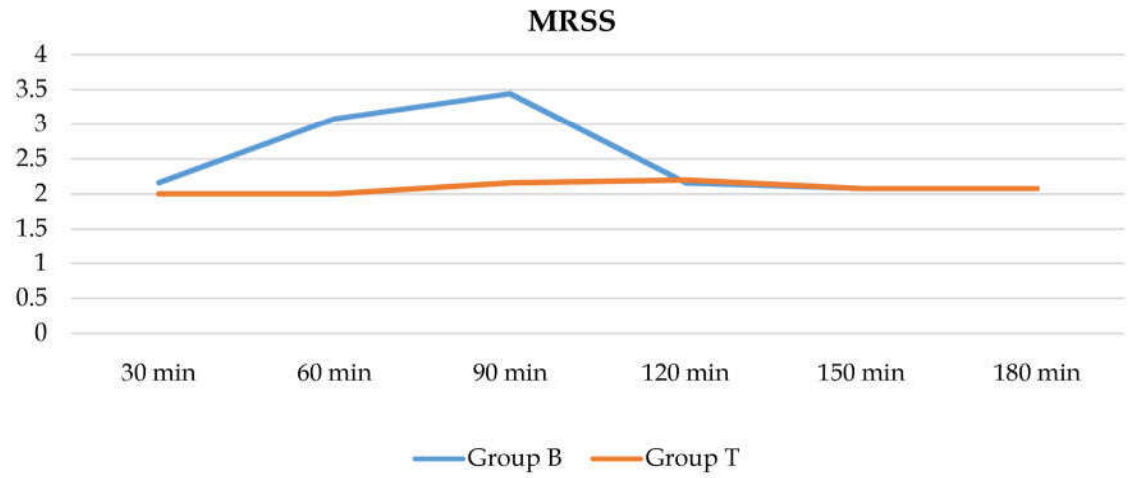
Table 4: Shows distribution of respiratory rate, SpO_2 in two groups

Parameter	Study Group	N	Mean	SD	P Value
Respiratory Rate	Group B	50	16.1	1.619	1
	Group T	50	16.1	1.619	
Spo2	Group B	50	97.92	0.752	1
	Group T	50	97.92	0.752	

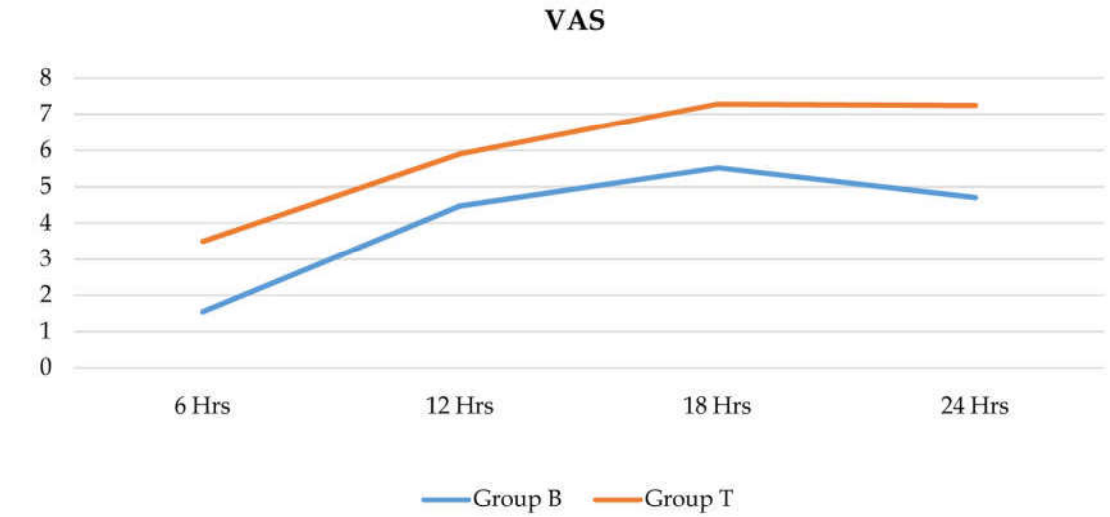
Table 5: Shows comparison of modified Ramsay sedation score between two groups, comparison of VAS among the two groups

Modified Ramsay Sedation	Study Group	N	Mean	SD	P Value
Score 30 mins	Group B	50	2.16	0.548	0.044
	Group T	50	2	0	
Score 60 mins	Group B	50	3.08	0.274	<0.001
	Group T	50	2	0	
Score 90 mins	Group B	50	3.44	0.501	<0.001
	Group T	50	2.16	0.37	
Score 120 mins	Group B	50	2.16	0.548	0.679
	Group T	50	2.2	0.404	
Score 150 mins	Group B	50	2.08	0.274	1
	Group T	50	2.08	0.274	
Score 180 mins	Group B	50	2.08	0.274	1
	Group T	50	2.08	0.274	
Visual Analogue Scale	**Study Group**	**N**	**Mean**	**SD**	**P Value**
Scale 6 Hours	Group B	50	1.54	0.994	<0.001
	Group T	50	3.5	0.505	
Scale 12 Hours	Group B	50	4.48	0.505	<0.001
	Group T	50	5.9	0.974	
Scale 18 Hours	Group B	50	5.52	0.505	<0.001
	Group T	50	7.28	0.948	
Scale 24 Hours	Group B	50	4.7	1.093	<0.001
	Group T	50	7.24	0.96	

and is statistically non significant with a p value of 1. Comparison of the visual analogue scale 6 Hrs between the two groups shows that visual analogue scale 6 Hrs is higher in group T and is statistically significant with a p value of <0.001. Comparison of the visual analogue scale 12 Hrs between the two groups shows that visual analogue scale 12 Hrs is higher in group T and is statistically significant with a p value of <0.001. Comparison of the visual analogue scale 18 Hrs between the two groups shows that visual analogue scale 18 Hrs is higher in group T and is statistically significant with a p value of <0.001. Comparison of the visual analogue scale 24 Hrs between the two groups shows that visual analogue scale 24 Hrs is higher in group t and is statistically significant with a p value of <0.001. (Graph-3 and Graph-4).



Graph 3:



Graph 4:

Table 6 shows distribution of side effects in the study groups.

Side Effects	Number (%)		P value
	Group B	Group T	
Nausea	12(24)	29(58)	<0.001
Vomiting	10(20)	20(40)	<0.001
Pruritus	0	0	-
Hypotension	21(42)	14(28)	0.141
Bradycardia	3(6)	0	0.242

Table 6 shows nausea and vomiting are significantly higher in group T, with p value <0.001. Hypotension and bradycardia are more in group B which is statistically insignificant.

Discussion

Lower abdominal and lower limb surgeries may be performed under local, regional (spinal or epidural) or general anaesthesia. Spinal block is still the first choice because of its rapid onset, superior blockade, low risk of infection as from catheter *in situ*, less failure rates and cost-effectiveness, but has the drawbacks of shorter duration of block and lack of adequate postoperative analgesia. Many studies have been reported. Dalvi NP, Patil N et al [5], conducted a study in which Sixty patients were randomized to the group F (n = 30) and group T (n = 30). The duration of sensory blockade was significantly prolonged in group F (314.66±49.25 minutes) as compared to group T (261.66±27.92 minutes). Similarly, dura- tion of motor blockade was longer in group F (263.66±40.97 minutes) compared to group T (214.66±26.61 minutes). The total duration of analgesia was significantly prolonged (p < 0.001) in group F (412 ± 97.888 minutes) compared to group T (301 ± 38.75 minutes). Hemodynamic parameters, such as pulse, systolic blood pressure, diastolic blood pressure and oxygen saturation were comparable in both the groups. Visual analog scores were significantly lower in the group F patients as compared to the group T patients. The group F patients had got significantly higher sedation scores as compared to Group T patients. Dr Alok Pratap Singh et al [6], conducted a study which comprised of 90 cases of ASA grade I and II, of both sexes and age ranging between 18 to 60 years, posted for routine surgies of lower abdominal and lower limb surgeries. 90 patients were given either of the three sets of intrathecal drugs randomly so the each group comprised 30 patients. Group A – bupivacaine HCL 15 mg (3ml) 0.5% heavy, Group B – bupivacaine HCL 15 mg (3ml) 0.5% heavy and tramadol HCL 25 mg (0.5ml) Group C – bupivacaine HCL 15 mg (3ml) 0.5% heavy and Fentanyl citrate 25 μg. They concluded that there is no effect of addition of tramadol or fentanyl to bupivacaine in hemodynamics, respiration, on onset of sensory blockade, in time of onset and duration of motor block but duration of sensory block is prolonged significantly in both tramadol and fentanyl group. Afolayan J M, Olajumoke T O et al [7], conducted a study in which a total of 195 American Society of Anesthesiologists (ASA) I or II patients scheduled for emergency appendicectomy, aged between 18 years and 60 years were recruited for the study. All eligible patients were randomly assigned into three groups of 65 each by opening unmarked envelop indicating the type of coded spinal solution package to be used. A second anesthetist who was not involved in the study prepared the spinal solutions. The anesthetist performing the block was blinded to the spinal solution administered. Each of the spinal solutions was coded FB, SB or TC This study showed that intrathecal tramadol 25 mg is equipotent with 25 μg of intrathecal fentanyl in mitigating intra-operative pain and discomfort following peritoneal and intestinal manipulation during bupivacaine subarachnoid block for appendicectomy. The intrathecal opioids both produce comparable haemodynamic changes and post-operative analgesia with minimal peri-operative side-effects. Verma D *et al [8]*, conducted a prospective, randomised double blind placebo controlled study 90 adult patients of ASA grade I-II scheduled for lower limb orthopaedic surgery under spinal anaesthesia were randomised to three groups of 30 each destined to receive 2.5ml (12.5mg) hyperbaric bupivacaine (0.5%) along with 1 ml of either normal saline (Group C) 50mg tramadol (Group T) or 2mg nalbuphine (Group N), making intrathecal drug volume to 3.5ml in each group. Sensory-motor block characteristics, postoperative analgesia in terms of VAS score, time to first rescue analgesic (duration of analgesia) and rescue analgesic consumption (tramadol) in 24 hours were compared in three groups. They concluded that addition of nalbuphine (2 mg) to intrathecal hyperbaric bupivacaine (12.5mg) for spinal anaesthesia is effective in prolonging the duration of sensorimotor block and enhancing the postoperative analgesia following lower limb orthopaedic surgery. However, addition of intrathecal tramadol (50 mg) could not make a significant difference in postoperative analgesia as compared to when bupivacaine was used alone. Hence, present study establishes the efficacy of nalbuphine (2mg) as an intrathecal adjuvant to bupivacaine for enhancing the postoperative analgesia. Chakraborty S et al [9], conducted a study which was undertaken to evaluate the duration of analgesia and/or pain free period produced by intrathecal tramadol added to bupivacaine in patients undergoing major gynecological surgery in a randomized double blind placebo controlled protocol Fifty patients ASA I & II scheduled for Wardmayo's operation and Fothergill's operation were randomly allocated to two equal groups. Group A (n=25) received 3 ml of 0.5% hyperbaric bupivacaine (15 mg) with 0.2 ml of normal

saline and Group B (n=25) received 3 ml 0.5% hyperbaric bupivacaine and 0.2 ml (20 mg) tramadol by intrathecal route at L3-4 inter space. this study has demonstrated that tramadol (0.25 mg /kg body weight) when used with 0.5% hyperbaric bupivacaine intrathecally, significantly prolongs postoperative analgesia after major gynecological surgeries. Dixit S *et al [10]*, conducted a study to compare intrathecal bupivacaine 0.5% and buprenorphine 60µg with bupivacaine 0.5% for postoperative analgesia in ceasarean section. Sixty participents undergoing elective lower segment caesarean section ((LSCS) were randomly selected after dividing into two groups of 30 each. Control group (C) received 1.70 ml (8.5mg) of bupivacaine (0.5%) while patients of study group (S) received 1.70ml (8.5mg) of bupivacaine (0.5%) + 60µg buprenorphine. They concluded that combination of buprenorphine 60µg with (0.5%) bupivacaine (8.5mg) provided analgesia of clinical onset and longer duration of postoperative analgesia after caesarean section with no effects on neonatal apgar scores with minimal side effects. Alhashemi J *et al [11]*, Sixty four patients undergoing TURP were randomized to receive bupivacaine 0.5% 3 ml intrathecally premixed with either tramadol 25 mg or saline 0.5 ml. After operation, morphine 5 mg i.m. every 3 h was administered as needed for analgesia. Postoperative morphine requirements, visual analogue scale for pain at rest (VAS) and sedation scores, times to first analgesic and hospital lengths of stay were recorded by a blinded observer. There were no differences between the groups with regard to postoperative morphine requirements (mean (SD): 10.6 (7.9) *vs* 9.1 (5.5) mg, *P*=0.38), VAS (1.6 (1.2) *vs* 1.2 (0.8), *P*=0.18) and sedation scores (1.2 (0.3) *vs* 1.2 (0.2), *P*=0.89). Times to first analgesic (6.3 (6.3) *vs* 7.6 (6.2) h, *P*=0.42) and length of hospital stay (4.7 (2.8) *vs* 4.4 (2.2) days, *P*=0.66) were similar in the two groups.

Conclusion

Addition of Buprenorphine (60 mcg) with hyperbaric bupivacaine significantly prolongs both sensory and motorblock. Intraoperatively, there was less incidence of side effects with Intrathecal Buprenorphine when compared to Intrathecal tramadol with hyperbaric bupivacaine. The postoperative 24 hours analgesic requirements were significantly less in the Buprenorphine group than tramadol group. To conclude, Buprenorphine (60 mcg) seems to be an attractive alternative to tramadol (25 mg) as an adjuvant to spinal bupivacaine in surgical procedures. It provides good quality of intraoperative analgesia, haemodynamically stable conditions, and excellent quality of postoperative analgesia. Hence, Buprenorphine seems to be a better choice as Intrathecal adjuvant with Bupivacaine when compared with Tramadol.

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