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Anesthesiology

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COMPARISON OF INTRATHECAL DEXMEDETOMIDINE AND INTRATHECAL BUPRENORPHINE AS AN ADJUVANT TO BUPIVACAINE FOR SPINAL ANAESTHESIA IN LOWER ABDOMINAL SURGERIES.

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ABSTRACT

BACKGROUND: Spinal anaesthesia is one of the most suitable modality of anaesthesia for lower abdominal surgeries. In recent years, the supplementation of local anaesthetics with adjuvants is widely in practice, to reduce the dose of local anaesthetic, minimize side effects and prolong the duration of anaesthesia. This study was designed to evaluate characteristics of the spinal block achieved with the use of adjuvants, dexmedetomidine and buprenorphine with bupivacaine, in terms of achievement and maintenance of block, haemodynamics, post-operative analgesia & adverse effects.

METHODS: This clinical study was conducted on 90 ASA physical grade 1 & 2 patients of either sex, in the age group of 18 years to 60 years, scheduled for elective lower abdominal surgeries under spinal anaesthesia at GGH, KURNOOL MEDICAL COLLEGE, KURNOOL from the period of 2016 May-2017 August. Patients were randomly divided on an alternative basis into three groups of 30 each.

Group-A: Patients received 3ml of 0.5% hyperbaric Bupivacaine with 0.5ml normal saline intrathecally.

Group-B: Patients received 3ml of 0.5% hyperbaric bupivacaine with 60μg of buprenorphine intrathecally.

Group-D : Patients received 3ml of 0.5% hyperbaric Bupivacaine with 5μg dexmedetomidine intrathecally.

RESULTS: The characteristics of subarachnoid block between the three groups were comparable in terms of age, sex, weight and height. Buprenorphine group has early onset of motor block compared to Dexmedetomidine and control group. The time for two segmental regression was higher and statistically significant in Buprenorphine when compared with dexmedetomidine and control. Duration of analgesia in Dexmedetomidine group was significantly prolonged when compared with groups B and A, and Buprenorphine group has prolonged duration of analgesia compared to control group and it is statistically significant.

CONCLUSION: The present study demonstrated that addition of 5μg dexmedetomidine to bupivacaine in patients undergoing lower abdominal surgeries compared to 60μg buprenorphine provided a longer duration of sensory and motor block, with relative haemodynamic stability.

INTRODUCTION :

Spinal anaesthesia is one of the most suitable modality of anaesthesia for lower abdominal surgeries. The advantages of subarachnoid block are limited by its short duration of action and side effects such as hypotension and bradycardia resulting due to sympathetic blockade. In recent years, the supplementation of local anaesthetics with adjuvants is widely in practice, to reduce the dose of local anaesthetic, minimize side effects and prolong the duration of anaesthesia.

Buprenorphine is a centrally acting lipid soluble analogue of alkaloid thebaine. It exhibits analgesic property both at spinal and supraspinal levels.It has consistently proven to prolong the duration of anaesthesia. At higher doses, it causes pruritus, drowsiness, nausea and vomiting. Dexmedetomidine is a specific α-2 adrenergic agonist.It has been extensively used as premedicant, for sedation in the Intensive Care Unit (ICU) and for awake fibreoptic intubation. It prolongs both sensory and motor block and has nociceptive action for both visceral and somatic pain.

This study was designed to evaluate characteristics of the spinal block achieved with the use of adjuvants, dexmedetomidine and buprenorphine with bupivacaine, in terms of achievement and maintenance of block, haemodynamics, post-operative analgesia & adverse effects.

AIMS AND OBJECTIVES OF THE STUDY :

To compare the characteristics of subarachnoid block 0.5% hyperbaric bupivacaine with dexmedetomidine, versus 0.5% hyperbaric bupivacaine with buprenorphine, versus 0.5% hyperbaric bupivacaine with 0.9% normal saline for patients undergoing elective lower abdominal surgeries.The following parameters were compared and evaluated :Onset of sensory blockade,Onset of motor blockade,Time to reach maximum height of sensory block,Time for two dermatomal regression,Duration of complete analgesia,Time for recovery from motor block, & Haemodynamic parameters.

PATIENTS AND METHODS :

This clinical study was conducted on 90 ASA physical grade 1 & 2 patients of either sex, in the age group of 18 years to 60 years, scheduled for elective lower abdominal surgeries under spinal anaesthesia at GGH, KURNOOL MEDICAL COLLEGE, KURNOOL from the period of 2016 May-2017 August.

After approval from the hospital ethical committee, a prospective randomized study was carried out on 90 patients. Patients were randomly divided on an alternative basis into three groups of 30 each.

Group-A: Patients received 3ml of 0.5% hyperbaric Bupivacaine with 0.5ml normal saline intrathecally.

Group-B: Patients received 3ml of 0.5% hyperbaric bupivacaine with 60μg of buprenorphine intrathecally.

Group-D: Patients received 3ml of 0.5% hyperbaric Bupivacaine with 5μg dexmedetomidine intrathecally

Inclusion criteria were patients in age group of 18 – 60 years of either sex and ASA Physical status I and II with informed consent for undergoing elective lower abdominal surgery. Patients who refused, ASA grade 3 & 4, cardiac diseases, heart blocks, dysarhythmias, betablockers,drug allergies, gross spinal deformity, haemorrhagic diseases were excluded from the study. The detailed pre-anesthetic check-up was done on all patients and relevant hematological, biochemical, and radiological investigations were carried out for all patients as per surgical requirements.All patients were kept nil per oral for 8 hours and premedicated with tablet diazepam 0.1mg/kg orally on the night before the surgery and in the morning. Injection atropine 0.6mg was administered Intramuscular (IM) to all patients 30 minutes before procedure. On arrival to the operation room (OR), intravenous access was started and

patients preloaded with 10ml/kg of Ringer Lactate over 15 minutes.Appropriate equipment for the airway management and emergency drugs were kept ready. Non-invasive blood pressure monitor, pulse oximeter, and electrocardiogram (ECG) leads were connected to the patient. Pre-operative baseline systolic and diastolic blood pressure recorded.

On sitting position, the skin over the back was prepared with antiseptic solution and draped with sterile towel. After skin infiltration lignocaine 2%, 26G Quinke needle was inserted at L3-4 intervertebral space after confirmation of free flow of cerebrospinal fluid, the prepared solution was injected. The patients were made lie after the injection immediately and time was noted.

The follow-up parameters noted are as follows: (a) Time of onset and duration of sensory block, (b) time of onset and duration of motor block, (c) degree of sedation, (d) time for sensory regression to S1 dermatome and, and (e) systolic and diastolic blood pressure, mean arterial blood pressure, pulse rate and oxygen saturation were recorded at 0, 3, and 5 min and there after every 5 min up to 45 min of the procedure.

Hypotension was defined as fall in SBP 30% from baseline and was treated with intravenous fluids and injection Mephentermine , Bradycardia was defined as HR <50 beats per minute and treated with intravenous atropine 0.6 mg, Respiratory depression if respiratory rate <8/min or SpO_2 <90%,Ramsay sedation scale was used to assess the degree of sedation, Motor block was assessed using Modified Bromage Scale. The incidence of any adverse effects such as hypotension, bradycardia, shivering, nausea, vomiting, pruritis, respiratory depression and ECG changes were noted.

STATISTICAL ANALYSIS

Descriptive statistics of sensory block, motor block, time to rescue analgesia would be analysed and expressed in terms of mean and standard deviation, number, and frequencies. Parametric data are analysed using an analysis of variance test among groups followed by post-hoc test if needed. Complications were expressed in frequencies and analysed through chi-quare test. P-value less than 0.05 is considered significant.

RESULTS

The characteristics of subarachnoid block between the three groups as shown in table 1 were comparable in terms of age, sex, weight and height.

Table 1: Demographic data

Variable	Group A	Group B	Group D	P value
Age(years)	34.73±13.09	39.73±13.32	36.26±11.09	0.291 (NS)
Sex (M/F)	27/3	25/5	22/8	0.236 (NS)
Height (in cms)	157.00±3.34	156.03±2.68	155.90±2.95	0.307 (NS)
Weight (in kgs)	59.20±4.24	58.30±4.08	57.30±3.27	0.173 (NS)

ONSET OF SENSORY BLOCKADE:

The mean onset of sensory blockade in group A was 3.20±0.61min, group B was 3.06±0.73min and in group D was 3.10±0.54 min. The values analyzed were statistically not significant. On intergroup comparison there was no significant difference in onset of sensory blockade and the values were summarized in Table no 2.

Table2 : Onset of sensory blockade among three groups:

	GROUPS Onset of sensory blockade (in mins)		P value	
Student T tests	A (3.20 ±0.61)	B (3.06 ± 0.73)	0.424	Not Significant
	A (3.20 ±0.61)	D (3.10 ±0.54)	0.504	Not Significant
	B (3.06 ± 0.73)	D (3.10 ±0.54)	0.810	Not Significant

ONSET OF MOTOR BLOCKADE:

The mean onset of motor blockade in group A was 4.46±0.62 min, group B was 4.03±0.85min , group D was 4.10±0.75. The mean onset of motor blockade is faster in group B compared to group A and group D. On intergroup comparison by unpaired t test, time to onset of motor blockade is significantly faster in group B than group A, and between group A and group D significantly faster in group D. The values were summarized in Table no.3

Table 3: Onset of motor block

	GROUPS Onset of Motor blockade (in mins)		P value	
Student T tests	A (4.46 ± 0.62)	B (4.03 ± 0.85)	0.029	Significant
	A ((4.46 ± 0.62)	D (4.10 ±0.75)	0.047	Significant
	B (4.03 ± 0.85)	D (4.10 ±0.75)	0.736	Not Significant

TIME FOR PEAK SENSORY BLOCKADE

The mean time for peak sensory blockade in group A was10.00±1.36min, group B was 9.66±1.60, group D was 9.40±1.22. The values were analyzed by ANOVA test were statistically not significant. On inter group comparison there was no significant difference between three groups with regard to time for peak sensory blockade. The values were summarized in below table no 4.

Table 4: Time for peak sensory blockade

	GROUPS Onset of peak sensory blockade (in mins)		P value	
Student T tests	A (10.00 ±1.36)	B (9.66 ± 1.60)	0.379	Not Significant
	A (10.00 ±1.36)	D (9.40 ± 1.22)	0.077	Not Significant
	B (9.66 ± 1.60)	D (9.40 ± 1.22)	0.482	Not Significant

TIME FOR TWO SEGMENTAL REGRESSION:

The time taken in minutes for highest sensory level regressed by two segments. The mean time for two segmental regression in group A was 90.46±6.92 min, group B was120.70±9.78min and in group D was 150.40±11.38 min. The time for two segmental regression was prolonged and statistically significant in group D when compared with group A and group B. On intergroup comparison, time for two segmental regression prolonged and statistically significant in group B compared to group A, in group D compared to group A, and in group D compared to group B. The values were summarized in below table no.5

Table 5: Statistical analysis of two segmental regression

	GROUPS Time for two segmental regression (in mins)		P value	
Student T tests	A (90.46 ± 6.92)	B (120.70 ± 9.78)	0.001	Significant
	A (90.46 ± 6.92)	D(150.40± 11.38.)	0.001	Significant
	B (120.70 ± 9.78)	D(150.40± 11.38.)	0.001	Significant

DURATION OF COMPLETE ANALGESIA :

The time taken from deposition of drug to first complain of pain made by the patients. The mean duration of complete analgesia in group A was 180.56±11.30min, in group B was 220.43±13.71 min and in group D was 300.53±11.0 min. The duration of analgesia was prolonged and statistically significant in group D when compared with group A and B. On intergroup comparison, the duration of complete analgesia was prolonged and statistically significant in group B compared to group A, and in group D compared to group B. The values were summarized in below table 6.

Table 6: statistical analysis of duration of complete analgesia

	GROUPS Duration of complete analgesia (in mins)		P value	
Student T tests	A (180.56 ± 11.30)	B (220.43 ± 13.71)	0.001	Significant
	A (180.56 ± 11.30	D(300.53± 11.06)	0.001	Significant
	B (220.43 ± 13.71	D(300.53± 11.06)	0.001	Significant

DURATION OF MOTOR BLOCKADE: The time taken from onset of motor blockade to till patient attains complete motor recovery. The average duration of motor blockade in group A was150.80±6.06 min, in group B was 190.13±15.80 min, and in group D was 270.20±24.37 min.The values analyzed by ANOVA test were prolonged and statistically significant in group D when compared with group A and B. Intergroup comparison of values were analyzed by unpaired t test and shows the duration of motor blockade was prolonged and statistically significant in group B when compared with group A, and in group .The values were summarized in below table 7.

Table 7: Duration of motor block

	GROUPS Duration of motorblockade (in mins)		P value	
Student T tests	A (150.80 ± 6.06)	B (190.13 ± 15.80)	0.001	Significant
	A (150.80 ± 6.06)	D(270.20± 24.37)	0.001	Significant
	B (190.13 ± 15.80)	D(270.20± 24.37)	0.001	Significant

There was no significant difference between the three groups in heart rate, systolic blood pressure, diastolic blood pressure, SpO2 and mean arterial pressure ($p > 0.05$) at any point of time.Hypotension (53.33%) and bradycardia (23.33%) was observed more in group D patients, and was not significant difference with remaining two groups. ($p>0.05$).Nausea and vomiting (20%) was observed significantly more in group B patients. ($p>0.05$). Shivering was observed in 10% patients in group A, 10% paitents in group B and in 3.3% patients in group D, and had no statistical significance. ($p>0.05$).Pruritus was observed only in group B patients (13.33%).This doesn't show any significance. ($p>0.05$) Complications such as urinary retention, respiratory depression were not observed in any group. The intraoperative and postoperative complications were summarized in below table 8.

Table 8 : Intraoperative and Postoperative Complications

Complications	Group A	Group B	Group D	P value
Hypotension	9 (30%)	12 (40%)	16 (53.33%)	NS
Bradycardia	3 (10%)	6 (20%)	7 (23.33%)	NS
Nausea and vomiting	2 (6.67%)	6 (20%)	4 (13.33%)	S
Pruritus	0	4 (13.33%)	0	NS
Shivering	3 (10%)	3 (10%)	1 (3.33%)	NS
Urinary retention	0	0	0	NS
Respiratory depression	0	0	0	NS

DISCUSSION

There are few studies in the literature comparing the benefits and side effects of 60μg buprenorphine and 5μg dexmedetomidine as adjuvants to bupivacaine for lower abdominal surgeries. This study investigated and compared buprenorphine and dexmedetomidine as an adjuvant to hyperbaric bupivacaine and normal saline added in control group.

Intrathecal dexmedetomidine combined with spinal bupivacaine prolongs the sensory block through suppression of C-fibre transmitter release and hyperpolarization of post synaptic dorsal horn neurons while prolongation of motor block of spinal anaesthetics might result from the binding of α2 adrenoreceptor agonists to motor neurons.

Buprenorphine is a mixed agonist – antagonist type of opioid with a long duration of action. The high lipid solubility; high affinity for opioid receptors and prolonged duration of action makes buprenorphine a suitable choice for intrathecal site administration. Opioids administered in subarachnoid space appear to act principally on μ receptor in substantia gelatinosa of dorsal horn of spinal cord by suppressing excitatory neuropeptide release from C- fibres.

In the present study, time of onset of sensory block was comparably similar among all the groups and has no statistical significance. Buprenorphine group has early onset of motor block compared to Dexmedetomidine and control group. Statistical comparison between three groups with regard to time for sensory blockade was found to be insignificant. The time for two segmental regression was higher and statistically significant in Buprenorphine when compared with dexmedetomidine and control. Duration of analgesia in Dexmedetomidine group was significantly prolonged when compared with groups B and A, and Buprenorphine group has prolonged duration of analgesia compared to control group and it is statistically significant. Duration of motor block was more in Group D as compared to Group B and Group A .

Regarding haemodynamic parameters in the current study, HR and MAP started to decrease after spinal anaesthesia in both groups at different times of measurement. This decrease however was not statistically significant between both groups but was lower in group D. The bradycardia and hypotension observed in dexmedetomidine group were tolerable and safely treated without rebound effect in accordance with other reports Changes in heart rate was comparable in all the three groups and had no statistical significance at any point of time.Present study also showed a comparable decrease in MAP among all patients in the three groups, 15-30 min after intrathecal injection. Decrease in MAP is a know occurrence after intrathecal bupivacaine injection due to block of the sympathetic afferent activity and it is dose related In the present study, hypotension occurred in 30% of patients in group A, 40% in group B and 53.3% in group D, bradycardia occurred in 10% of patients in group A, 20% in group B, 23% in group D, which was statistically insignificant.

CONCLUSION

The present study demonstrated that addition of 5μg dexmedetomidine to bupivacaine in patients undergoing lower abdominal surgeries compared to 60μg buprenorphine provided a longer duration of sensory and motor block,with relative haemodynamic stability.To conclude, present study shows that use of intrathecal dexmedetomidine is an excellent additive to bupivacaine for quality of anesthesia and prolonged duration of analgesia without any deleterious effects.

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