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A COMPARATIVE STUDY OF ANALGESIC EFFICACY OF DEXMEDETOMIDINE VS BUPRENORPHINE AS ADJUVANTS TO ISOBARIC ROPIVACAINE FOR INFRAUMBILICAL SURGERIES UNDER SPINAL ANAESTHESIA

Dr.Fathimath Rifna — Junior Resident Dept. of Anaesthesiology and Critical Care, Shridevi Institute of Medical Sciences & Research Hospital, Tumakuru - 572106, Karnataka, India.

Dr. Ravi R* — Professor & HOD Dept. of Anaesthesiology and Critical Care, Shridevi Institute of Medical Sciences & Research Hospital, Tumakuru - 572106, Karnataka, India.*Corresponding Author

ABSTRACT **INTRODUCTION:** Duration of post operative analgesia by local anaesthetics alone for subarachnoid blocks is limited. Hence supplementation of adjuvants with local anaesthetics helps to improve the efficacy of subarachnoid block to prolong the duration of post operative analgesia. Opioids are the most preferred drug, but alpha-2 adrenergic agonists also have synergistic action. **AIMS AND OBJECTIVES:** The objectives of this study was to compare the efficacy of dexmedetomidine and buprenorphine as adjuvants to intrathecal isobaric ropivacaine for postoperative analgesia in patients undergoing infraumbilical surgeries. **MATERIALS & METHODS:** A total of 100 patients belonging to ASA physical status 1 and 2 undergoing infraumbilical surgeries under subarachnoid block were randomised into two groups of 50 each. 3 ml of isobaric 0.75% ropivacaine was used for subarachnoid block with either dexmedetomidine 10mcg (group A) or buprenorphine 75mcg (group B) as adjuvants. The duration of sensory block and time for first rescue analgesia postoperatively were recorded. **RESULTS:** Duration of sensory block was longer in dexmedetomidine group (186.08±26.19 min) as compared to buprenorphine group (101.29±37.49 min), $p<0.05$. The duration to first rescue analgesia postoperatively was longer in dexmedetomidine group (402.6±69 min) than buprenorphine group (232.2±78.6 min). Side effects were not significant in either groups and was comparable among both the groups. **CONCLUSION:** Dexmedetomidine as an adjuvant to intrathecal isobaric ropivacaine is superior to buprenorphine for subarachnoid block in infraumbilical surgeries in prolonging the duration of sensory block and duration of post operative analgesia.

KEYWORDS : Dexmedetomidine, Buprenorphine, Ropivacaine, Infraumbilical, Subarachnoid block

BACKGROUND

Spinal anaesthesia is a form of neuraxial regional anaesthesia used for a wide variety of surgical procedures but its advantages are limited by its short duration of action and side effects such as hypotension and bradycardia resulting due to sympathetic blockade. [1]

The injection of a local anaesthetic drug into the cerebrospinal fluid produces anaesthesia/analgesia of the lower extremities and torso.

In recent years, the supplementation of local anaesthetics with adjuvants is widely in practice to reduce the dose of local anaesthetics, minimise side effects, prolong the duration of anaesthesia and analgesia, increase the quality of block, to modify the modulation of noxious stimuli as they are transmitted to the brain via the spinal cord. [2]

Ropivacaine provides shorter duration of sensory and motor block, with reduced risk of cardiotoxicity, neurotoxicity and a good hemodynamic stability. It has lower lipid solubility than Bupivacaine, which is responsible for its lower penetration into myelinated motor fibres and thus lesser motor blockade with greater sensory-motor differentiation. [3]

Dexmedetomidine is a potent alpha 2 adrenergic agonist used for its short-term sedative, anxiolytic and analgesic properties. The effects result from binding of α-2 adrenoceptors in the locus ceruleus in the pons. Dexmedetomidine also exerts anti-shivering properties via central modulation of thermoregulation as well as peripheral vasodilation. [4]

Buprenorphine is an agonist-antagonist opioid derivative with analgesic property at spinal and supraspinal level, and has been proven to prolong the duration of anaesthesia. [5]

Since there are a limited literature available comparing Dexmedetomidine and Buprenorphine as an adjuvant to 0.75% isobaric Ropivacaine for subarachnoid block in infraumbilical surgeries, this prospective randomised control study was undertaken to compare their effectiveness with respect to duration of sensory block and prolongation of post operative analgesia

MATERIALS AND METHODS

Study Area

Department of Anaesthesiology, Shridevi Institute of Medical Sciences and Research Hospital, Tumkur.

Study population:

Patients undergoing infraumbilical surgeries under spinal anaesthesia in the Department of Anaesthesiology during the proposed study period.

STUDY DESIGN:

Double blinded Randomised control study

STUDY PERIOD:

18 months, January 2021- June 2022

SAMPLE SIZE: The sample size was calculated using the findings from a study by Kishan C30 et al. The mean duration of post operative analgesia was 184.33±26.48 minute in group P(premedication) and 166.33±32.53 in group S(spinal). Keeping 95% confidence level and 80% power, the sample size was calculated using the following formula

$$n \geq \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 \left(\sigma_1^2 + \frac{\sigma_2^2}{r}\right)}{(\mu_1 - \mu_2)^2}$$

We get a sample size of 48 ,rounded off to 50 subjects each in 2 groups

Sampling method:

Simple random sampling

Inclusion criteria:

1. Age: 18-65 years of either gender.
2. American Society of Anaesthesiologists (ASA) physical status 1 and
3. Patients undergoing elective or emergency infraumbilical or lower limb surgeries requiring subarachnoid block.

Exclusion criteria:

1. BMI <18 or >35 kg/m2
2. Patients with coagulopathies, vertebral column defects, local sepsis
3. Pregnancy and lactation
4. Patient not willing to give informed consent

Methodology:

Hundred patients in the age group 18-65 years belonging to ASA physical status 1 and 2 of either gender undergoing infraumbilical surgeries were included in the study after institutional ethical clearance. Two groups of 50 each were made (Group A and Group B, n=50) by a computer generated closed enveloped technique.

Group A (Dexmedetomidine): received 22.5mg of 0.75% isobaric ropivacaine with 10mcg dexmedetomidine (1ml of 100mcg dexmedetomidine diluted to 2.5ml by adding 1.5ml normal saline and to take 0.25ml of it) to a total volume of 3.25ml .

Group B (Buprenorphine): received 22.5mg of 0.75% isobaric ropivacaine with 75mcg buprenorphine(1 ml contains 0.3mg) to a total volume of 3.25ml.

Under aseptic precaution and patient in sitting position, subarachnoid block was performed in L3-L4 space through midline approach using 25gauge Quincke Babcocks spinal needle and 3ml (22.5mg) of 0.75% isobaric ropivacaine was deposited with either Dexmedetomidine 10mcg or Buprenorphine 75mcg as adjuvants intrathecally in all patients.

Patients were given supine position immediately after the subarachnoid block and the table kept in neutral position.

The following parameters were noted:
- Two segment regression of sensory block.
- Total duration of sensory block.
- Time of first rescue analgesia
- Sensory block was assessed using sterile pinprick method in midaxillary line in both sides of chest with a 27gauge blunt tip needle every minute until highest level of dermatomal sensory block was achieved. Thereafter, it was tested every 15 minutes to look for sensory regression by two segments and complete resolution of sensory block.
- Level of sedation was assessed using Ramsay sedation score
- Hemodynamic monitoring included Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and oxygen saturation (SpO2) till the end of the procedure and in postoperative care unit.

Postoperative pain was assessed by using visual analogue scale.
VAS 0: No pain
VAS 1-3: mild pain
VAS 4-6: moderate to severe pain
VAS 7-9: very severe pain
VAS 10: Worst possible pain.

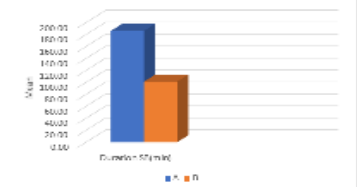
Patients with a VAS score of 3 or more received Inj. Tramadol 50mg intravenously as rescue analgesia. Hence, the time of request for analgesia was recorded as the duration of total postoperative analgesia.

RESULTS

The data was entered into MS Excel spreadsheet and statistical analysis performed using IBM Statistical Package for Social Sciences (SPSS) version 20.0.

Table 1: Duration of sensory blockade:

	A		B		p-value
	mean	±sd	mean	±sd	
Duration of sensory block	186.08	±26.19	101.29	±37.49	<0.001



Graph 1: mean time of duration of sensory blockade.

The duration of mean time of sensory block was 186.08±26.19 minutes in Group A, while it was 101.29±37.49 minutes in Group B intraoperatively which is statistically significant (p-value: <0.05).

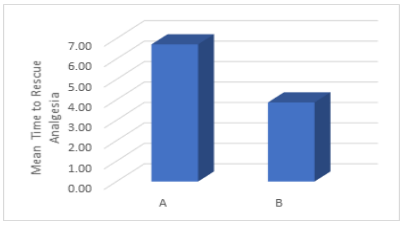
Table 2: regression of sensory block, Visual analogue score, time of rescue analgesia.

	A		B		p-value
	mean	±sd	mean	±sd	
Regression of sensory block	52.34	±3.99	41.02	±4.04	<0.001
VAS score	5.78	±1.34	6.08	±1.29	0.129
Time of rescue analgesia	6.71	±1.15	3.87	±1.31	<0.001

It is found that in Group A the mean time of regression of sensory block was found to be 52.34±3.99 minutes as compared to Group B which was found to be 41.02±4.04 minutes which is statistically significant(p-value: <0.05)

Group A patients had a VAS score of 5.78±1.34 as compared to Group B patients with VAS score of 6.08±1.29 which is not statistically significant(p value>0.05)

It was found in this study that the mean time for rescue analgesia was 6.71±1.15 hours in Group A patients and 3.87±1.31 in Group B which is statistically significant(p-value: <0.05)



Graph 2: mean time for rescue analgesia

DISCUSSION

Regional anaesthesia with subarachnoid block is considered ideal when it allows the surgeons enough time to operate, also ensuring that there is less intraoperative and postoperative side effects, as well as good postoperative analgesia. Ropivacaine is a new long-acting amide local anaesthetic agent and has been in the focus of interest because it has increased CNS and Cardiovascular safety. Local anaesthetic when used alone may not be adequate. Thus in order to enhance the duration of anaesthesia as well as analgesia, adjuvant drugs are added.

Various adjuvants that usually added are opioids, ketamine, magnesium sulphate, benzodiazepines. Buprenorphine is a semisynthetic opioid obtained from thebaine with high lipid solubility and strong binding with mu-opioid receptor and slow offset. The analgesic effect of opioids is due to the suppression of spinal synaptic transmission. It also leads to all opioid effects: analgesia, sedation, euphoria and respiratory depression, but to a lesser degree than morphine.

Dexmedetomidine is a selective alpha-2 agonists and are known to enhance the local anaesthetic action for producing sensory and motor block. It produces analgesia by decreasing the release of nociceptive substances from substantia gelatinosa and by inactivating descending inhibitory medullo spinal pathways. The ratio of alpha-1 to alpha-2 receptor affinity is much higher in dexmedetomidine (1:1620) making it nearly 8 times more specific to alpha-2 receptors as compared to clonidine (1:220). Most studies using these agents as adjuvants have been done with bupivacaine in spinal anaesthesia. However, studies using them as adjuvants to ropivacaine spinal anaesthesia foe infraumbilical surgeries is limited.

This study was aimed to study and compare the effects on duration of sensory block followed by postoperative analgesia when using dexmedetomidine versus buprenorphine as intrathecal adjuvants to 0.75% isobaric ropivacaine in infraumbilical surgeries under subarachnoid block.

Hundred patients of ASA physical status 1 and 2 who were posted for various infraumbilical surgeries were included in the study and randomly divided into two groups, Group A and Group B of 50 patients each (n=50) , by computer generated sealed enveloped technique.

DATA ANALYSIS OF SENSORY BLOCK CHARACTERISTICS DURATION OF ANALGESIA

In a similar study conducted by Gupta M et al[34], authors observed that the mean duration of analgesia of 493.56±385.95 min in dexmedetomidine group and 289.66±64.94 min buprenorphine group. It was found in this study that the mean time for rescue analgesia was 402.6±69 min Group A patients and 232.2±78.6 min in Group B. Analgesia duration was significantly higher in dexmedetomidine

group as compared to buprenorphine group. Similar results were seen in studies conducted by Bansal DI et al[26], C Boini et al[38], where patients receiving dexmedetomidine had prolonged duration of postoperative analgesia.

TIME TAKEN FOR REGRESSION OF SENSORY BLOCK BY TWO SEGMENTS AND TOTAL DURATION OF SENSORY BLOCK.

In our study, it is found that in Group A the mean time of regression of sensory block was found to be 52.34±3.99 minutes as compared to Group B which was found to be 41.02±4.04 minutes. Previous similar study done by T Deepa et al[29], Kishan C et al[30], Mahima Gupta et al[34], showed that regression by two segments were longer in dexmedetomidine group. The total duration of mean time of sensory block was 186.08±26.19 minutes in Group A, while it was 101.29±37.49 minutes in Group B intraoperatively.

Studies by Al-Ghanem[40], Gupta R et al[4] showed that there was a statistically significant longer duration of sensory block for alpha-2 agonist groups

HEMODYNAMIC EFFECTS

HEART RATE

There was no significant statistical difference in fall in heart rate among the two groups in our study.

Dexmedetomidine group A showed mean decrease in heart rate by 8bpm from the basal value, while in Buprenorphine group B there was a fall in mean heart rate by 5bpm from the baseline. One patient in group B required one dose of Inj.Atropine as the Heart rate dropped to 46bpm after 10 minutes.

Studies by Kaabachi O et al[43], had showed bradycardia requiring atropine in their studies dexmedetomidine groups, however the dose of dexmedetomidine (1µg/kg) used in their study was higher as compared to ours, which may explain the bradycardia.

Whereas studies done by Kanazi GE et al[45], AlGhanem SM et al[40] also showed no significant difference in fall in heart rate across groups.

MEAN ARTERIAL PRESSURE

In group A the least basal mean arterial pressure is 97.33±8.021 which decreased to a maximum of 84.67±7.98 mmHg, Whereas the basal diastolic blood pressure is 95.62±7.35 which decreased to a maximum of 86.79±7.34 mmHg in group B. Inj. Mephentermine 6mg was used in 5 patients in both A and B groups for a 20% fall in Blood pressure.

C Boini et al[38], in their study stated that no patients in dexmedetomidine group had no hypotension as compared to 8 patients in buprenorphine group and received hypotension.

SEDATION:

Sedation was assessed by Ramsay sedation score. The mean sedation score was similar among the two groups. This was consistent with studies done by Al-Ghanem SM et al[40] and Al-Mustafa MM et al[42] where no significant differences were seen in sedation scores across the groups.

CONCLUSION

In our study, it may be concluded that dexmedetomidine in dose of 10mcg as an intrathecal adjuvant to 0.75% isobaric ropivacaine 22.5mg (3ml) in subarachnoid block for infraumbilical surgeries:

- Produces prolonged duration of sensory blockade
- Produces slower regression of sensory block
- Produces prolonged postoperative analgesia
- Has no side effects or bradycardia or significant sedative effects when given in above mentioned dose.

Thus, dexmedetomidine is a more effective drug as an intrathecal adjuvant to isobaric ropivacaine in subarachnoid block than buprenorphine in infraumbilical surgeries

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