Original Research Article

Dexmedetomidine as epidural adjuvant to Ropivacaine in elective lower limb surgeries

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Abstract

Epidural adjuvants are used to prolong the action of local anesthetic agent so as to have prolongation of motor and sensory block. Dexmedetomidine a newer α_2 agonistic agent with predominant affinity to $\alpha_2$receptor, α_2:α_1 affinity is 1600:1.Ropivacaine an amide local anesthetic agents.Which is an 'S' isomer of the propyl analogue of Mepivacaine and Bupivacaine with long acting potential. Pharmacologically it has similar properties to Bupivacaine, but with lesser cardiotoxicity profile. In our study we divided 40 patients posted for elective lower limb surgeries into two group of 20 patients each. Patients in Group R received total of (150 mg) 20ml of 0.75% Inj.Ropivacaine with 1 ml of Normal saline epidurally. Patients in Group RD received total of (150 mg) 20ml of 0.75% Inj.Ropivacaine with 1 ml of 1 microgram per kg of Inj.Dexmedetomidine and saline to make up volume of 1 ccepidurally. We compared the onset of motor and sensory block; duration of motor block and post-operative analgesia, two segment regression time and sedation scores of both the groups. From our study we found that not only the onset of sensory and motor blockade were hastened in Group RD but also, duration of motor block, duration of post-operative analgesia were prolonged. Sedation scores were higher in Group RD and two segment regression was prolonged in Group RD.

Key Words:ropivacaine. dexmedetomidine., epidural anesthesia.

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INTRODUCTION

Epidural blockade is very versatile technique in hands of anaesthesiologist; virtually epidural catheter can be placed in any segment of spine from cervical region to sacral region. It outscores spinal anaesthesia by its capability of producing continuous anaesthesia and analgesia and also has a better hemodynamic stability. Orthopedic patients pose their own problems to anesthetist and there is need to deal with geriatric age group of patients with post trauma physiology. Most of the patients posted for lower limb surgeries are administered regional anaesthesia, and for managing post-operative pain epidural analgesia is often used. Use of epidural adjuvants not only attenuates the dose requirement for local anaesthetic agents and but also by synergestic effectprolongs the duration of the block.

MATERIAL AND METHODS

After obtaining institutional ethics committee approval, a double blinded prospective study involving 40 patients was carried out.

Table 1:

Inclusion Criteria	Exclusion Criteria
ASA I and II patients	Patient refusal
Age between 18-60 years	Allergy to study drugs
Posted for elective orthopedic lower limb surgery under epidural anaesthesia	Local infection, uncontrolled bleeding diathesis and other contraindications for regional anaesthesia
Proposed surgery in supine position	Patients with suspected increased epidural pressure (weight more than 90 kg)

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Patients were preoperatively assessed and after ascertaining inclusion and exclusion criteria patients were divided into two groups of 20 each by computer generated random charts. To equalise the operative time in all the groups 8 patients posted for femur plating, 8 patients posted for tension band wiring of patella, 8patients undergoing tibia nailing, 8 patients for open reduction internal fixation of bimalleolar ankle fracture and 8 patients posted for tendo-achillis repair were divided into two groups. Patients who had an operative time of more than 3 hours were excluded from the study.The chosen patients were advised for an overnight fasting of 8 hours. 18 G I.V cannula was used to obtain the intravenous access and all the patients were preloaded with 8ml per kg of Ringer's Lactate solution over 20 minutes. Multipara monitor was connected and NIBP, ECG and pulse oximeter were monitored. Patients were kept in sitting position for placing the epidural catheter at L2-L3 interspace. 18G Tuohy needle was used for epidural puncture after local skin infiltration by 2 ml of 2 % Inj.Lignocaine and byusing LOR technique by air, epidural space was identified, 20 gauge epidural catheter was placed 4 cm in space. The catheter was directed cephalad and was assumed to be placed at T12 level. After carefully aspirating for blood or CSF and only after negative aspiration4 ml of study drug was injected as test dose, 5 minutes later 17 ml of study drug was injected over period of 2 minutes.The drug mixture for the patients was prepared by anesthesiologist who was not involved in the study. Patients in Group R received total of (150 mg) 20ml of 0.75% Inj.Ropivacaine with 1 ml of Normal saline epidurally. Patients in Group RD received total of (150 mg) 20ml of 0.75% Inj.Ropivacaine with 1 ml of 1 microgram per kg of Inj.Dexmedetomidine and saline to make up volume of 1 ccepidurally. Patients were monitored intra-operatively for hemodynamic profile and characteristics of epidural block. Post operatively patients were monitored at recovery room until the patients had complete motor and sensory recovery.

Definition of Variables: Patient was assessed every 2 minutes after the end of injecting of the drugs and till at least sensory block level reaches T8 and motor block of bromage scale of 1 or more till 20 minutes. Those patients who do not get the desired sensory or motor block intensity were excluded from the study.

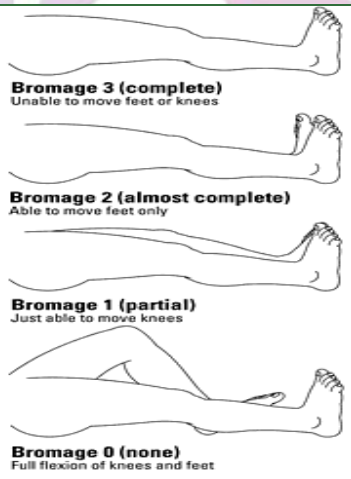
Sensory Block Onset Time: Time interval between end of anesthetic injection and appearance of cutaneous analgesia in dermatomes T-12for pin prick was taken as sensory block onset time.

Motor Blockonset Time: From administration of local anesthetic drug epidurally and attainment of grade 1 in Bromage motor scale (limb contralateral to trauma was being assessed).

Intensity of Motor Block: It was assessed by Modified Bromagescale at20 minutes, following which surgery was commenced.

Table 2:

Grade	Description
Grade 3	Unable to move feet or knees
Grade 2	Able to move feet only
Grade 1	Able to move knees
Grade 0	Full flexion of knees and feet



Duration of Motor Block: It is time interval between onset of motor block and grade 0 in Bromage motor scale. It was checked at interval of every 15 minutes in post op ward.

Sedation Score: It is calculated by using Ramsay sedation score at end of one hour following injection of epidural local anaesthetic mixture.

1. Anxious or agitated patient
2. Patient is Co-operative, oriented
3. Patient responds to commandsonly
4. A Brisk response to light glabellar tap
5. A Sluggish response to a light glabellar tap
6. No response

Post-Op Analgesia Duration: It is the time duration from the administration of local anesthetic agent to first

dose of analgesic usage in PACU when Visual Analogue Scale score was 3.

If there was hypotension, (measured as systolic blood pressure less than 30 % of its initial value or below 90 mmHg or MAP less than 60 mm of Hg)during anesthesia, it was treated with administration of Inj.Ephedrine 6mg. Bradycardia(heart rate<50bpm) was treated with Inj.Atropine, 0.6 mg.

Statistical Analysis: In our double blind randomized controlled study, statistical tabulations were done with Student't' test, Chi Square test'p' value less than 0.05 was taken as significant. Demographic variables like age, sex, weight, height and duration of surgery were compared using Levene's test for equality of variance.

RESULTS

There was no significant difference between groups in demographic parameters like age, gender distribution, weight, height, and duration of surgery. The groups were comparable also on the ASA risk stratification. Mean age of patients in Group R was 40.6 years and in Group RD was 39.65 years; the variation between the groups was not statistically significant with p value of 0.549.

Table 3:

GROUP	MEAN AGE
GROUP R	40.6
GROUP RD	39.65

There were 4 female patients and 16 male patients in Group R and 5 female patients and 15 male patients in Group RD, the p value for above distribution was 0.705 and was statistically insignificant.

Table 4:

GROUP	FEMALE	MALE
GROUP R	4	16
GROUP RD	5	15

Mean height of patients in Group R was 162.25cm, and in Group RD was 159.75cm this variation carried the significance of 0.189, and was statistically insignificant. Similarly mean weight of patients in kg showed that mean weight in Group R was 60.3 kg and in Group RD was 60.1 kg with p =0.897, and was statistically insignificant.

Table 5:

GROUP	Height in cm	Weight in Kg
GROUP R	162.25	60.3
GROUP RD	159.75	60.1

There were 7 patients in Group R and 8 patients in Group RD who belonged to ASA 1 risk stratification group and 13 patients in Group R and 12 patients in Group RD belonged to ASA risk grade 2, the variation did not carry any statistical significance with p value of 0.744.Mean duration of surgery in both groups were similar with p value of 0.742.

Table 6:

GROUP	Duration Of Surgery in Minutes
GROUP R	155.95
GROUP RD	156.6

Time of onset of sensory block in two groups had a significant variation with block onset time being longer in Group R (mean 8.9 minutes) than in Group RD (mean 6.7 minutes) with p=0.00.

Table 7:

GROUP	Sensory block onset time in minutes
GROUP R	8.9
GROUP RD	6.7

Motor block onset time in Group R was 14.1 minutes and in Group RD was 11.9 minutes; the variation carried a p value of 0.00 and was statistically significant. Duration of motor block in Group R was 182.75minutes and in Group RD was 247 minutes and variation had p value of 0.00 and was statistically significant.

Table 8:

GROUP	Motor block onset time in minutes	Duration ofmotor block time in minutes
GROUP R	14.1	182.75
GROUP RD	11.9	247

19 patients in Group R and 15 patients in Group RD had a Modified Bromage Scale score of 1; 1 patient in Group R and 5 patients in Group RD had a Modified Bromage Scale score of 2 and the above variation had a p value of 0.077 and was statistically insignificant.

Table 9:

GROUP	Modified Bromage Score 1	Modified Bromage Score 2
GROUP R	19	1
GROUP RD	15	5

Further 18 patients in Group R had a sedation score of 2 and 2 patients had a sedation score of 3, but 18 patients in Group RD had a sedation score of 3 and 2 had a sedation score of 4, the variation was statistically significant with p=0.00.

Table 10:

GROUP	Ramsay Sedation Score 2	Ramsay Sedation Score 3	Ramsay Sedation Score 4
GROUP R	18	2	0
GROUP RD	0	18	2

Duration of post-operative analgesia in Group R was 306.5minutes, which was significantly lesser compared to post op analgesia duration in Group RD which was 496.25minutes, and associated p (0.00) value which was statistically significant. Two segment regression time in Group R was 60.05minutes and that in Group RD was 84.75minutes, and above variation was statistically significant with p = 0.00.

Table 11:

GROUP	Post-op analgesia in minutes	Two segment regression in minutes
GROUP R	306.5	60.05
GROUP RD	496.25	84.75

Patients in both groups had comparable hemodynamics. Even though there was mild reduction of pulse rate and mean arterial pressures in Group RD which were statistically insignificant, none of the patients required Inj. Atropine and need for pressor agents was similar in both the groups.

DISCUSSION

From our study it was seen that epidurally administered Inj.Dexmedetomidine together with Inj.Ropivacaine not only hasten the onset of sensory and motor block but also prolong the duration of post op analgesia and duration of motor block. The sedation score obtained was higher, and two segment regression time was also prolonged by using epidural Dexmedetomidine with Ropivacaine.Many studies done shows the positive synergistic effect of α_2 agonistclonidine added to epidural local anaesthetic agent.[1,2,3]Dexmedetomidine a newer α_2 agonistic agent. Three $\alpha_2$adrenoreceptor sub types have been found namely α_{2A}, α_{2B}, and α_{2C}.[4,5] of which $\alpha_{2A}$is found in periphery and α_{2b} and α_{2c} receptors are found in brain and spinal cord. Postsynaptic $\alpha_2$adrenoreceptors in peripheral blood vessels produce vasoconstriction, whereas presynaptic $\alpha_2$adrenoreceptors inhibit the release of norepinephrine, potentially attenuating the vasoconstriction. The overall response to $\alpha_2$adrenoreceptors agonists is predominantly related to the stimulation of α_{2B} andα_{2C} receptors which causesympatholysis, sedation, and antinociceptioneffects. Dexmedetomidine has a predominant affinity to $\alpha_2$receptor,α_2:$\alpha_1$affinityis 1600:1. It also exhibits a dose dependent action on epidural administration and has a better profile in neuraxial administration as compared to intravenous administration since α_{2B} and α_{2C} are located in brain and spinal cord. It also causes prolongation of action of local anesthetic agents in epidural space by causing reduced systemic absorption due to local vasoconstriction caused byα_{2C} adrenergic receptors stimulation in smooth muscle of epidural venous plexus[6,7,8].Cephalad spread of drug is responsible for sedation, it also causes reduction in minute ventilation but response to increased carbon dioxide is retained this can be taken as a safety feature of the drug. Dexmedetomidine additionally causes reduced histamine release and bronchoconstriction; it also has effect to reduce intra-operative shivering.Ropivacaine an amide local anesthetic agent which is an 'S' isomer of the propyl analogue of Mepivacaine and Bupivacaine with long acting potential. Pharmacologically it has similar properties to Bupivacaine, but with lesser cardiotoxicity profile because of its early dissociation from sodium channels.

Demographic profile of our study matched in both the groups, and the onset of sensory and motor block was hastened by epidural Dexmedetomidine which is comparable to many studies done earlier.[9]Duration of motor block and sensory block were significantly prolonged with addition of epidural Dexmedetomidine, and the results were comparable with studies done by Sarabjitetal and Bajwa etal.[10,11]Two segment regression time was also prolonged by epidural Dexmedetomidine, this result was also in conjunction with previous studies of Sarbjitetal and Bajwaetal. Similarly the sedation score obtained was higher in Dexmedetomidine group and these results were also similar to study done earlier by Sarbjitetal.

CONCLUSION

Dexmedetomidine together with Ropivacaine not only hastens the onset of sensory and motor block but also prolongs the duration of post op analgesia and duration of motor block. The sedation score obtained was higher, and two segment regression time was also prolonged by using epidural Dexmedetomidine with Ropivacaine.

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