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ORIGINAL RESEARCH

A comparative evaluation of epidural dexmedetomidine and magnesium sulphate as adjuvants to ropivacaine for lower abdominal and lower limb surgeries

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Abstract

Background: The most secure, efficient method of delivering anaesthesia for surgery and postoperative pain management is epidural insertion. There is currently no known medication that selectively decreases nociception without causing any negative side effects.We, therefore, conducted a prospective, randomised, double blind, controlled clinical study to compare the effects of magnesium sulphate vs. Dexmedetomidine administered epidurally as adjuvants to ropivacaine for lower abdominal and lower limb surgeries.

Material and methods: 90 patients (ASA 1 and 2) between 18-55 yrs of age, weighing 45-75kg with height between 150 -180 cm were randomly divided into three groups according to computer generated random numbers. GROUP (R) (n =30): received bolus of 19 ml epidural injection of 0.75% ropivacaine plus 1ml normal saline. GROUP (D) (n =30): received bolus of 19 ml epidural injection of 0.75% ropivacaine plus injection dexmedetomidine 25 mcg (25 mcg/ml). GROUP (M) (n =30): received bolus of 19 ml epidural injection of 0.75% ropivacaine plus injection magnesium sulfate 50 mg (50mg/ml). The onset of motor and sensory block, duration of block, hemodynamic parameters, and any adverse events were monitored.

Results: Onset of the sensory and motor block was earliest in dexmedetomidine followed by magnesium and longest in control (ropivacaine) group.

Conclusion: Hence, addition of dexemedetomidine to epidural ropivacaine can be advantageous with respect to increased duration of motor and sensory blockade and arousable sedation.

Key words: Epidural Dexmedetomidine, Magnesium Sulphate, Lower Abdominal, Lower Limb Surgeries

Introduction

Central neuraxial blockade is very popular for lower abdominal and lower limb surgeries. The cost effectiveness, ease of administration, rapidity of onset, adequacy of muscle relaxation and profound analgesia during the operative as well as during the post-operative period provide excellent operating conditions and make it an indispensable technique to provide anaesthesia for the surgeries below umbilicus.[1]

Epidural anaesthesia can be used as sole anaesthetic for procedures involving the lower limbs, pelvis, perineum and lower abdomen. The major advantages of epidural compared with spinal anaesthesia are the ability to titrate the extent and duration of anaesthesia, ability to maintain continuous anaesthesia after placement of an epidural catheter, thus making it suitable for procedures of long duration. It is also associated with lesser complication of haemodynamic changes than that seen with comparable levels of spinal block2 and puncture of durameter associated with sub-arachnoid block3.[2,3]

Ropivacaine, a new amide local anaesthetic has been produced as a pure'S' isomer of the propyl analogue of bupivacaine. It is a long acting local anaesthetic with low lipid solubility, low potency and low cardiovascular and CNS toxicity compared to bupivacaine.[4] It blocks nerve fibres involved in pain transmission (Aδ and C fibres) to a greater degree than those controlling motor function (Aβ fibres).[5] Therefore, ropivacaine has been found to induce less intense motor blockade than bupivacaine.[6]

A number of adjuvants have been introduced to improve the efficacy of neuraxial/regional anaesthesia such as Opioids, Vasoconstrictors, Alpha-2 adrenergic agonists, Acetylcholine esterase inhibitors, N-methyl-d-aspartate (NMDA) antagonists and γ-aminobutyric acid (GABA) receptor agonists.[7]

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Dexmedetomidine is a new addition to the class of alpha-2 agonist which has got numerous beneficial effects when used through epidural route. It suppresses the activity in the descending noradrenergic pathway which modulates nociceptive neurotransmission and terminates propagation of pain signals leading to analgesia.[8]
Magnesium is the fourth most plentiful cation in our body. It has antinociceptive effects in animal and human models of pain.[9] The biological basis for potential antinociceptive effect of magnesium is its voltage-dependent regulation of calcium influx in to the cell, and noncompetitive antagonism of N-methyl-D aspartate(NMDA)receptors.[10]
Very few studies have examined the effect of magnesium sulphate and dexmedetomidine administered epidurally as adjuvants to epidural ropivacaine. We, therefore, conducted a prospective, randomised, double blind, controlled clinical study to compare the effects of magnesium sulphate vs. Dexmedetomidine administered epidurally as adjuvants to ropivacaine for lower abdominal and lower limb surgeries.

Material and methods
Study design- Prospective double blind randomized controlled study
The present study was conducted in the Department of Anaesthesiology, Critical Care and Perioperative Medicine, NDMC Medical College & Hindu Rao Hospital, Delhi after due clearance from the hospital ethical committee. After written informed consent, 90 patients (ASA 1 and 2) between 18-55 yrs of age, weighing 45-75kg with height between 150 -180 cm were randomly divided into three groups according to computer generated random numbers.
1. GROUP (R) (n =30): received bolus of 19 ml epidural injection of 0.75% ropivacaine plus 1ml normal saline.
2. GROUP (D) (n =30): received bolus of 19 ml epidural injection of 0.75% ropivacaine plus injection dexmedetomidine 25 mcg (25 mcg/ml).
3. GROUP (M) (n =30): received bolus of 19 ml epidural injection of 0.75% ropivacaine plus injection magnesium sulfate 50 mg (50mg/ml).
Each of the solution was made to a total volume of 20 ml.

Inclusion criteria
- Adult patient aged between 18-55 years of either sex undergoing lower abdominal and lower limb surgeries.
- Patient belonging to ASA Class I and II.
- Patients weighing between 45kg to 75 kg.
- Patients with height between 150cm and 180cm.

Exclusion criteria
- Unwilling patients.
- Psychiatric Diseases.
- Emergency surgeries.
- History of drug abuse and known case of hypersensitivity to local anaesthetics or adjuvants.
- Patient with medical complications like raised intracranial tension, anaemia, heart disease, diabetes mellitus, severe hypovolemia, shock, septicaemia, and hypertension.
- Patients with coagulation disorders or on anticoagulant therapy.
- Local infection at the proposed site of puncture for epidural anaesthesia.
- Spinal deformities like kypho-scoliosis, lordosis etc.
- Heart block or Dysrrhythmia or patients on therapy with adrenergic receptor agonist/antagonist.

Preparation of the study drug
The study drug was prepared aseptically just before the execution of epidural block. The neck of the commercially available ampoules of injection ropivacaine0.75%, injdexmedetomidine or Inj magnesium sulfate were wiped with alcohol swab (isopropyl alcohol) and then we waited a while for the excess of alcohol to evaporate. After this the ampoule was broken at the designated mark on its neck. A sterile 20 ml syringe was taken and 19 ml of ropivacaine was loaded in this syringe. Preparation of inj.dexmedetomidine was done by adding 0.5 ml of dexmedetomidine (50 mcg/0.5 ml) to 1.5 ml of normal saline in a sterile 2 ml syringe to make the solution of 25 mcg/ml. Preparation of magnesium sulfate was done by adding 1 ml of Inj. magnesium sulfate (500 mg/ml) to 9 ml of normal saline in 10 ml sterile syringe to make the solution of 50 mg/ml. Now according to the group allocation, in Group R, 1 ml of normal saline, in Group D, 1 ml of dexmedetomidine and in Group M, 1 ml of magnesium sulphate was mixed with19 ml of ropivacaine to make the solution of 20 ml in each group .

Anaesthesia technique
Pre-operative

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The anaesthetic procedure and visual analogue scale was explained to the patient.
Written informed consent was taken.
All patients were asked to fast overnight.
All patients were premedicated with oral ranitidine 150 mg and alprazolam 0.25 mg a night before and 2 hour before on the morning of surgery.
Patient was accompanied by an escort on the day of surgery.

Intra-operative

In the operation theatre, patients were made to lie comfortably on the operation table. After placing the monitors baseline parameters were noted (pulse rate, blood pressure, oxygen saturation, and electrocardiograph). Intravenous access was secured with 18G IV cannula in non-dominant hand and 10 ml/kg of ringer lactate was infused as a pre-loading fluid.
The subjects were placed in sitting position. A second anaesthesiologist, who was blind to study, prepared the study drug solution. Wide area of the back including the lumbar and lower thoracic spine was cleaned and draped. L3-L4 inter-vertebral space was identified by palpation and infiltrated with 2% lignocaine. 18G Tuohy needle was inserted in the space for about 1 cm. The stylet was removed and LOR syringe half filled with air column was firmly attached to the hub of the needle. The needle was slowly advanced until it enters the epidural space, which was identified by the loss of resistance to air. Once the epidural space was confirmed, syringe was disconnected. Absence of blood or CSF was verified. 20G epidural catheter was passed through epidural space in cephalad direction until 4cm is in the space. 3ml of 2% Lignocaine with adrenaline 1:200000 was given as test dose to exclude the presence of needle in epidural vein or subarachnoid space. After confirming the correct position of the catheter, patients were turned to supine position and 20 ml of the study drug was injected through the epidural catheter intermittently over 3 minutes.
Time of completion of injection was noted and labeled as ‘0 min’. Patients were given supplementary oxygen at 2-4 litres/min by nasal prongs. Vital parameters were monitored at every 5 minutes until 30 minutes and at 10 minutes interval till the end of surgery. If systolic blood pressure fell below 90 mmHg or 30% below the baseline (hypotension), it was treated by injection mephentermine 3 mg intravenous in addition to i.v fluid. If heart rate fell below 50/min (bradycardia), injection atropine sulphate 0.6 mg intravenous was given.
Sensory block was assessed by bilateral pin prick method with a blunt 27 G needle along the mid-clavicular line every two minutes till two consecutive readings of both sensory and motor blocks remained the same (i.e. when highest cephalad spread of sensory block and highest level of motor block had occurred), after which it was assessed at ten minute intervals till the end of surgery. In case there was a difference in the height of sensory block achieved on the two sides, the side with the lower level of sensory block was taken as the dermatomal level of the sensory block. Onset of sensory block at T6 was noted.
Motor block was assessed by Modified Bromage Scale (Annexure 1) (0: No motor block; 1: Inability to raise extended legs; 2: Inability to flex knees; 3: Inability to flex ankle joints). As in sensory block, motor block was assessed every two minutes till two consecutive readings of both sensory and motor blocks remained the same (i.e. when highest cephalad spread of sensory block and highest level of motor block had occurred) .Grade 1 motor block was noted as onset of motor block. The surgical position was made after complete establishment of sensory and motor block.
If adequate sensory and motor block was not attained even at 30 minutes after epidural injection of the drug, patient was given general anaesthesia and was excluded from the study. In patients undergoing surgery under epidural anaesthesia, no analgesia was given during the surgery unless the patient complained of pain. Inj. Fentanyl (1.5 mcg/kg) intravenous was given if patient complains of pain intraoperatively. If patient still complained of pain, then no more analgesics was given and patient was given general anaesthesia.
Sedation was assessed at 10 minutes interval by Ramsay Sedation Scale (RMS 1-6) (Annexure 2) with RMS 1 being anxious or restless or both and RMS 6 being no response to stimulus. In the patients of sedation score 1, Inj. Midazolam 0.02 mg/kg I.V were given.

Post-operative

After completion of surgery, level of sensory block and motor block was noted with the patient still on the operation table. This recording was labeled as the ‘immediate post operative’ in the postoperative period. The patients were shifted to the Post Anaesthesia Care Unit (PACU) and they were assessed every 30 minutes for sensory block, motor block, sedation, pain and haemodynamic changes. The motor block was assessed till they attain complete motor recovery. The duration between maximum motor block to complete recovery was noted as total duration of motor block. Sensory block was assessed till the requirement of first rescue analgesic. Visual analogue scale (0-10) (Annexure 3) was used to assess the post-operative pain till the patient developed pain (VAS > 3). The onset of pain (VAS>3) was taken as the time for first rescue analgesia and was managed by top-up doses of 8 ml of 0.2% ropivacaine.Sedation was assessed every 30 minutes by Ramsay Sedation Scale (RMS 1-6) and maximum greade of sedation achieved during perioperative period was noted.

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On the day after the surgery patients will be asked about their well-being. Any persistent symptoms like pain, nausea, vomiting, headache, backache, hypotension, delayed voiding and transient neurologic symptoms will be noted and treated accordingly. They will be instructed to report if they suffered from any of the above mentioned symptoms within one week after the anaesthetic procedure.

Statistical analysis

Statistical analysis was performed by the SPSS program for Windows, version 17.0. Continuous variables were presented as mean ± SD, and categorical variables were presented as absolute numbers and percentage. Data was checked for normality before statistical analysis using ShaiproWilk test. Normally distributed continuous variables were compared using ANOVA. If the F value was significant and variance was homogeneous, Tukey multiple comparison test was used to assess the differences between the individual groups; otherwise, Tamhane's T2 test was used. The Kruskal Wallis test was used for the variables which were not normally distributed and further comparisons were done using Mann Whitney U test. Categorical variables were analyzed using the chi square test. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

Results

Table 1: Age, height, and weight of patients in different groups (mean ± SD)

	Group R (n=30)	Group D (n=30)	Group M (n=30)	P Value
	Mean ± SD	Mean ± SD	Mean ± SD	
Age(yrs)	42.83 ± 8.84	40.33 ± 8.52	41.37 ± 7.87	0.516
Height (cm)	162.20 ± 5.39	161.67 ± 6.22	161.03 ± 5.95	0.743
Weight (kg)	64.03 ± 5.49	63.20 ± 6.57	62.57 ± 6.87	0.669

No statistically significant differences were found among the three groups with respect to distribution of age, height, weight and sex. ASA physical status, type of surgery and duration of surgery were also comparable among all the three groups.

Table 2: Sensory block: Time to onset

Sensory Block	Group R (N=30)	Group D (N=30)	Group M (N=30)	P Value	Group R V/S Group D	Group R V/S Group M	Group D V/S Group M
	Mean ± SD	Mean ± SD	Mean ± SD				
Time to onset (at T6) (min)	14.33 ± 1.83	11.27 ± 1.78	12.20 ± 2.37	<0.001***	<0.001***	<0.001***	0.176

Table 3: Sensory block: Maximum sensory level

Max. Sensory Level	Drug			P Value	Group R V/S Group D	Group R V/S Group M	Group D V/S Group M
	Group R	Group D	Group M				
	Frequency (%)	Frequency (%)	Frequency (%)				
T4	8 (26.7%)	14 (46.7%)	11 (36.7%)	0.447	0.162	0.702	0.493
T5	10 (33.3%)	10 (33.3%)	9 (30.0%)				
T6	12 (40.0%)	6 (20.0%)	10 (33.3%)				
Total	30 (100%)	30 (100%)	30 (100%)				

Table 4: Sensory block: Time to achieve maximum sensory level

Sensory Block	Group R (n=30)	Group D (n=30)	Group M (n=30)	P Value	Group R V/S Group D	Group R V/S Group M	Group D V/S Group M
	Mean ± SD	Mean ± SD	Mean ± SD	0.002**	0.001**	0.053	0.386
Time to achieve max. sensory level	16.73 ± 2.85	14.13 ± 2.35	15.07 ± 2.96				

Table 5: Sensory block: Two segment regression and First rescue analgesia

SENSORY	Group R (n=30)	Group D (n=30)	Group M (n=30)	P Value	Group R V/S	Group R V/S	Group D V/S

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BLOCK-Time to					Group D	Group M	Group M
	Mean ± SD	Mean ± SD	Mean ± SD				
Two segment regression(min)	158.87 ± 16.62	232.57 ± 21.45	191.33 ± 23.70	<0.001***	<0.001***	<0.001***	<0.001***
First rescue analgesic (min)	219.87 ± 20.40	328.57 ± 26.09	260.50 ± 17.80	<0.001***	<0.001***	<0.001***	<0.001***

Table 6: Motor block: Time to onset (Bromage 1)

MOTOR BLOCK	Group R (n=30)	Group D (n=30)	Group M (n=30)	P Value	Group R V/S Group D	Group R V/S Group M	Group D V/S Group M
	Mean ± SD	Mean ± SD	Mean ± SD				
Time to onset (Bromage1) (min)	12.53 ± 2.22	8.13 ± 1.81	10.67 ± 3.17	<0.001***	<0.001***	0.012*	<0.001***

Table 7: Motor block: Maximum motor block

Max.Motor Block (Modified Beomage Score)	Drug			P value	Group R V/S Group D	Group R V/S Group M	Group D V/S Group M
	Group R	Group D	Group M				
	Frequency (%)	Frequency (%)	Frequency (%)				
1	8 (26.7%)	4 (13.3%)	6 (20.0%)	**0.128**	**0.235**	**0.432**	**0.057**
2	12 (40.0%)	10 (33.3%)	17 (56.7%)				
3	10 (33.3%)	16 (53.3%)	7 (23.3%)				
Total	30 (100%)	30 (100%)	30 (100%)				

Table 8: Motor block: Time to maximum motor block and duration of block

BLOCK	Group R (n=30)	Group D (n=30)	Group M (n=30)	P Value	Group R V/S Group D	Group R V/S Group M	Group D V/S Group M
	Mean ± SD	Mean ± SD	Mean ± SD				
Time to Max. motor block (min)	21.47 ± 7.12	19.73 ± 5.82	20.00 ± 5.97	0.523	0.541	0.643	0.985
Total duration of motor block (min)	185.87 ± 18.22	281.57 ± 25.89	231.83 ± 20.44	<0.001***	<0.001***	<0.001***	<0.001***

Table 9: Sedation effect

MAXIMUM SEDATION SCORE, (1-6)	Drug			P Value	Group R V/S Group D	Group R V/S Group M	Group D V/S Group M
	Group R	Group D	Group M				

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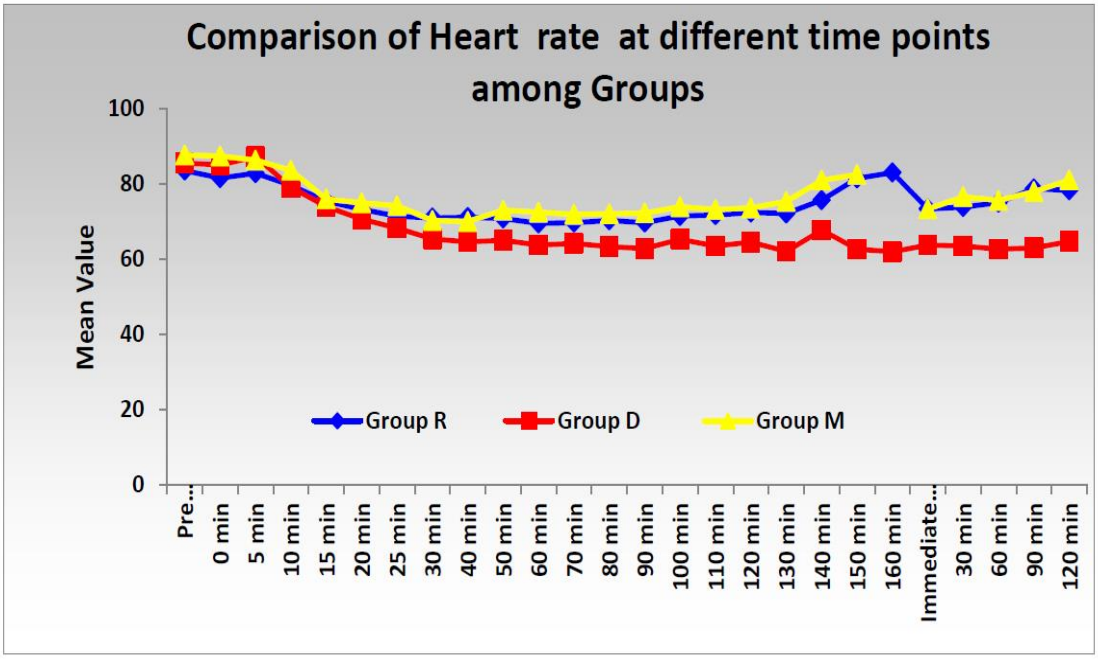
1	7 (23.3%)	0 (0.0%)	6 (20.0%)	<0.001***	<0.001***	0.754	<0.001***
2	23 (76.7%)	6 (20.0%)	24 (80.0%)				
3	0 (0.0%)	20 (66.7%)	0 (0.0%)				
4	0 (0.0%)	4 (13.3%)	0 (0.0%)				
5	0 (0.0%)	0 (0.0%)	0 (0.0%)				
6	0 (0.0%)	0 (0.0%)	0 (0.0%)				
Total	30 (100%)	30 (100%)	30 (100%)				

Figure 1: Intraoperative and post operative changes in heart rate



The heart rate decreases in all the groups after injecting the study drug and the difference in decrease in heart rate was not significant till 30 minutes of injecting drug but it was statistically significant between Group R V/S Group D after 40 minutes (p value <0.05) and between Group D V/S Group M after 50 minutes (p value <0.05) during intraoperative period, and also in postoperative period. No significant difference in the mean heart rate was found between Group R V/S Group M during intraoperative as well as in the postoperative period.

Figure 2: Intraoperative and post operative changes in Systolic BP

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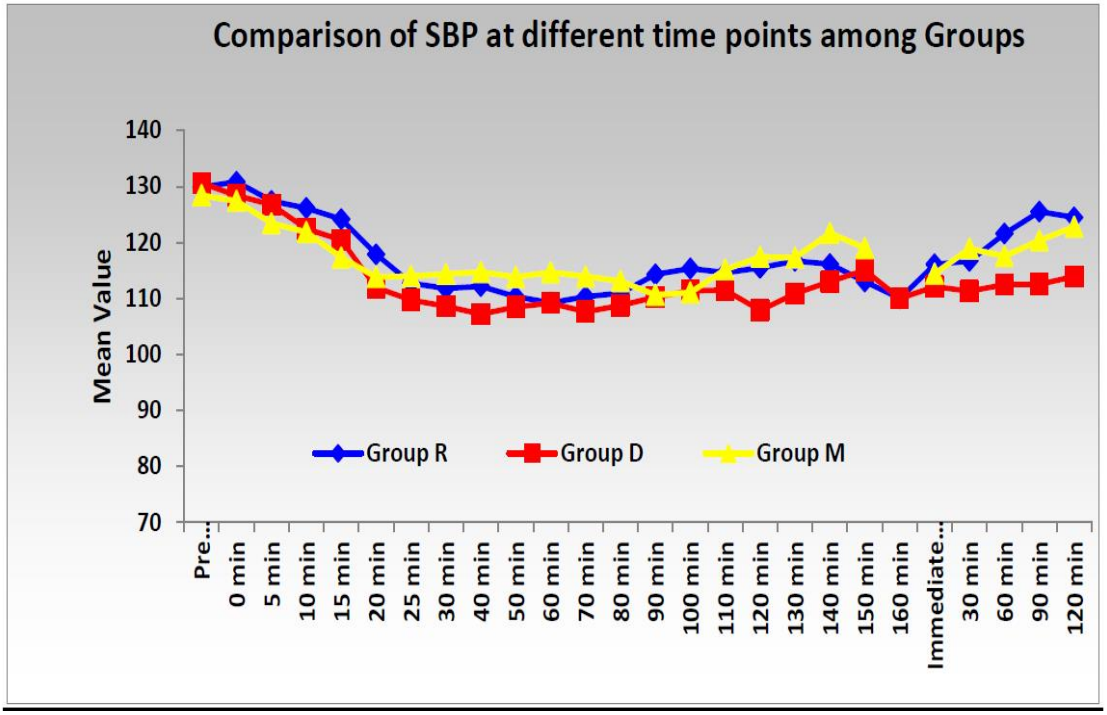

Figure 3: Intraoperative and post operative changes in Diastolic BP

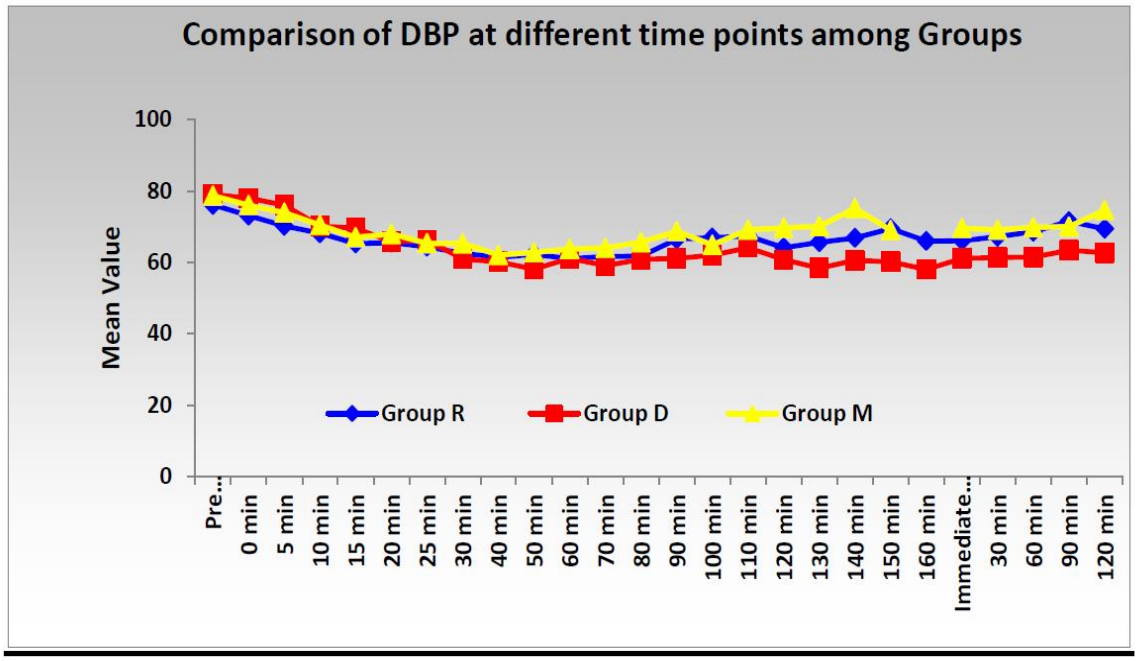

Figure 4: Intraoperative and post operative changes in Mean arterial blood pressure

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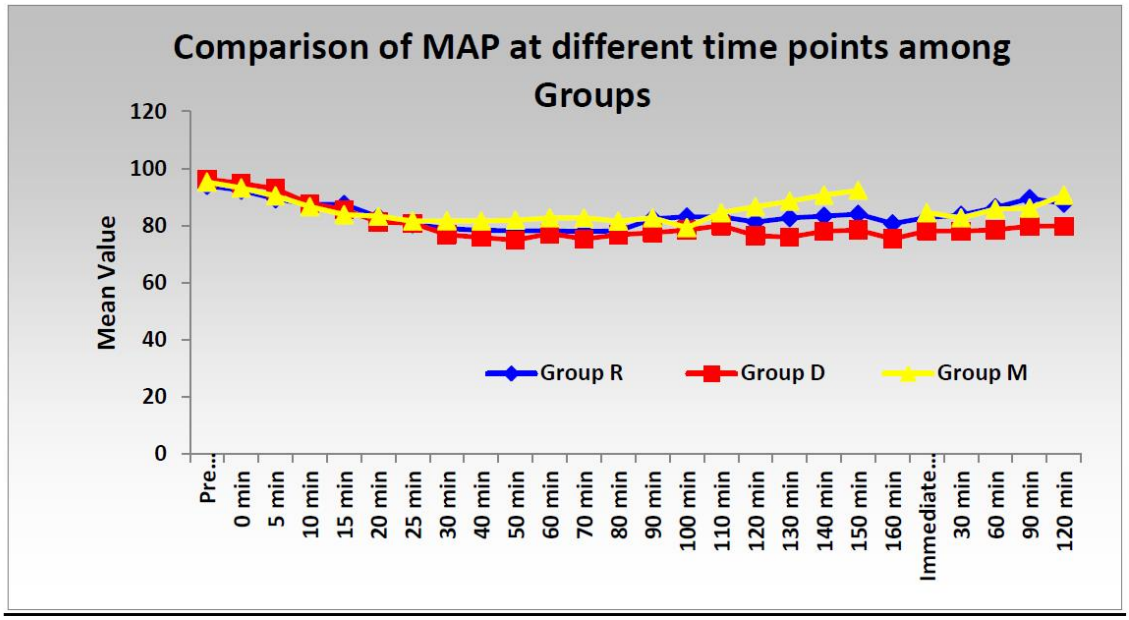

The mean systolic blood pressure and diastolic blood pressure decreased in all the groups after injecting the study drug and the difference in decrease was not found insignificant during the intraoperative period except only at few sporadic moments when it was significant between Group R V/S Group D and Group D V/S Group M (p value <0.05). The mean arterial blood pressure decreased in all the groups after injecting the study drug and the difference in decrease in mean arterial blood pressure was found significant between Group R V/S Group D at 90,100 and 130 minutes (p value <0.05) and between Group D V/S Group M from 40 minutes onward after the end of epidural injection during the intraoperative period (p value <0.05). For the systolic, diastolic and mean arterial blood pressure, significant difference was found in the postoperative period between Group R V/S Group D and Group D V/S Group M (p value <0.05). No significant difference was found between Group R V/S Group M during the intraoperative as well as in the postoperative period**.**

Table 10: Adverse events

Adverse Events	Drug			P value
	Group R	Group D	Group M	
	Frequency (%)	Frequency (%)	Frequency (%)	
Hypotension	7 (23.3%)	11 (36.7%)	8 (26.7%)	0.495
Bradycardia	3 (10.0%)	6 (20.0%)	2 (6.7%)	0.260
Shivering	9 (30.0%)	0 (0.0%)	8 (26.7%)	0.005**
Nausea/ Vomiting	3 (10.0%)	4 (13.3%)	3 (10.0%)	0.894
Respiratory depression	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Dry mouth	0 (0.0%)	3 (10.0%)	0 (0.0%)	

The occurrence of bradycardia, hypotension and nausea/vomiting was found similar among all the three groups. The occurrence of shivering was found significantly lower with dexmedetomidine. Respiratory depression was not noted in any patients. Dry mouth was found only in 3 patients in Group D.

Discussion

Demographic profile

No statistically significant differences were found among the three groups with respect to distribution of age, height, weight and sex. ASA physical status, type of surgery and duration of surgery were also comparable among all the three groups.

Sensory block characteristics

In our study the onset of sensory block at T6 was earliest in Group D (11.27 ± 1.78 min) followed by Group M (12.20 ± 2.37 min) and longest in Group R (14.33 ± 1.83 min). The difference was statistically very highly significant between Group R V/S Group D (p value <0.001) and between Group R V/S Group M (p value <0.001) but no statistically significant difference was found between Group D V/S Group M (p value 0.176). The result is comparable with the results of M. Thimmappaet al[11] in which they found the onset of sensory block significantly faster with addition of dexmedetomidine with epidural 0.75% ropivacaine. The result is also similar with the study conducted by T. Ghatak et al[12] in which they compared the effect of addition of magnesium or clonidine as adjuvant to epidural bupivacaine and found that the Onset of sensory block at T6

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was most rapid in magnesium group (P value<0.001). Our study is also in corroboration with the study of V. Shahi et al[13] who conducted a comparative study of magnesium sulfate and dexmedetomidine as adjuvant to epidural bupivacaine and found that the addition of magnesium and dexmedetomidine decreased the time to onset of sensory block (P <0.05).

In our study we found that the higher number of patients achieved the level of T4 in Group D and Group M compared to Group R but the difference in maximum sensory level was statistically not significant among the three groups (p value 0.447). The result is comparablewith the results of study conducted by P.F. Salgado et al[14] in which they did not find significant difference (p> 0.05) for the maximum analgesic block level with addition of dexmedetomidine to epidural .75%ropivacaine. S.H.R.Faizet al[15] also found that the addition of magnesium sulfate to intrathecal bupivacaine increases the maximum sensory level but the difference was not significant (P>0.05). S.kauret al[16] found that addition of dexmedetomidine to epidural ropivacaine increased the median maximum sensory level reached (P < 0.001). They used dexmedetomidine 1mcg /kg, higher than the dose used in our study, 0.25 mcg/kg, which might be the reason for the significant difference observed by them.

Maximum level of sensory block was achieved earliest in Group D (14.13 ± 2.35 min) followed by Group M (15.07 ± 2.96 min) and then in Group R (16.73 ± 2.85 min). We found that the difference in the mean time taken for maximum level of sensory block was statistically highly significant between Group R V/S Group D (p value 0.001). The differences were not found statistically significant between Group R V/S Group M (p value 0.053) and between Group D V/S Group M (p value 0.386). Similar to our finding, M.Thimmappa et al[11] also found the time to achieve maximum sensory level significantly decreased with addition of dexmedetomidine with epidural 0.75% ropivacaine (p value<0.001). S.kauret al[16] also found that addition of dexmedetomidine to epidural ropivacaine decreases the time to achieve maximum sensory level but the difference was not significant (p value 0.122). Similar result was shown by Yousef and Amr[17] who found no significant difference in the time taken to reach the highest level of sensory block by adding magnesium sulphate to epidural bupivacaine and fentanyl.

The mean time to two segment regression of sensory block was 232.57 ± 21.45 min in Group D, 191.33 ± 23.70 min Group M and 158.87 ± 16.62 min in Group R. The mean time to first rescue analgesic was 328.57 ± 26.09 min in Group D, 260.50 ± 17.80 min in Group M and219.87 ± 20.40 min in Group R. We found that the mean time to two segment regression of sensory block and time to first rescue analgesic was longest in Group D followed by Group M and shortest in Group R (D > M > R). The differences were statistically very highly significant between Group R V/S Group D (p value <0.001), between Group R V/S Group M (p value <0.001) and also between Group D V/S Group M (p value <0.001).The results are in accordance with the studies conducted by V. Shahi et al[13] who conducted a comparative study of magnesium sulfate and dexmedetomidine as adjuvant to epidural bupivacaine and found that the time to first epidural top up was longest in dexmedetomidine group followed by magnesium group and shortest in control group of patients. The differences among groups were highly significant (P < 0.001). R.K. Singh et al[18] also found similar result for two segment regression and duration of analgesia, longest in dexmedetomidine group followed by magnesium group and shortest in control group in spinal anaesthesia. The differences among groups were highly significant (P < 0.001). Our result is also in corroboration with the result of M Thimmappa et al[11] who found that the time to two segment regression and duration of analgesia was significantly prolonged with addition of dexmedetomidine with epidural 0.75% ropivacaine (p value<0.001). Similar result was also found by R. Hasaneinet al[19] who found significantly longer duration of epidural analgesia when magnesium was added to bupivacaine and fentanyl (p value <0.01).

Motor block characteristics

The mean time to onset of motor block (Modified Bromage grade 1) was earliest in Group D (8.13 ± 1.81 min), followed by Group M (10.67 ± 3.17 min) and then in Group R (12.53 ± 2.22 min). The difference in the mean time to onset of motor block was statistically significant between Group R V/S Group D (p value <0.001), between Group D V/S Group M (p value <0.001) and also between Group R V/S Group M (p value 0.012). Similar result was found by Al-Mustafa et al[20] who found dose dependent effect of dexmedetomidine on theonset of motor block when used as an adjuvant to bupivacaine in spinal anesthesia. Similar result was also found by Shrutiet al[21] that addition of magnesium sulphate to epidural bupivacaine significantly decreases the time to onset of motor block (p value <0.001).

We found that only 10 patients (33.3%) patients achieved complete motor block in Group R and addition of dexmedetomidine and magnesium sulfate to ropivacaine increases the number of patients who achieved complete motor block but the difference was statistically not significant among the three groups (p value 0.128). Similar result was also found by S.Kaur et al[16] who found only 24% patients achieved complete motor block with 0 .75% epidural ropivacaine and higher number of patients achieved complete motor block with addition of dexmedetomidine (p value <0.001). They used dexmedetomidine 1 mcg/kg which might be the reason for the difference to be significant. P.F .Salgado et al[14] also found that only 24% patients achieved complete motor block with 0.75% ropivacaine that increased with addition of dexmedetomidine (p value <0.05). They had also used dexmedetomidine 1mcg / kg in their study. Similar result was also found by R. Hasanein et al[21] who found

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that addition of magnesium with .125% epidural bupivacaine increases the frequency of complete motor block but the difference was not significant(p value 0.089). Since ropivacaine is less lipophilic than bupivacaine and thus less likely to penetrate large myelinated motor fibres, it has selective action on the pain-transmitting A δ and C nerves rather than Aβ fibres, which are involved in motor function.12 This might be the reason of not achieving complete motor block in many patients.

Maximum motor block was achieved earliest in Group D (19.73 ± 5.82 min) followed by Group M (20.00 ± 5.97 min) and then in Group R (21.47 ± 7.12 min) but the difference in the mean time taken for achieving maximum motor block was not found statistically significant among the three groups (p value 0.523). Similar result was also found by S.Kauret al[16] that addition of dexmedetomidine decreases the time to achieve maximum motor block but thedifference was not significant (p value 0.123). M. Thimmappa et al[11] found significant difference in time to achieve complete motor block with addition of dexmedetomidine to epidural ropivacaine(p value<0.001), finding not similar to our study. The use of higher dose of dexmedetomidine(1mcg/kg) by them might be the reason for significant difference.

The total duration of motor block was longest in Group D (281.57 ± 25.89 min) followed by Group M (231.83 ± 20.44 min) and shortest in Group R (185.87 ± 18.22 min). The difference in the total duration of motor block was statistically very highly significant between Group R V/S Group D (p value <0.001), between Group R V/S Group M (p value <0.001) and also between Group D V/S Group M (p value <0.001). Our findings are in corroboration with the finding of V. Shahi et al[13] who also found that the duration of motor block in epidural block was longest in dexmedetomidine group followed by magnesium group and then in control, bupivacaine group (p value <0.001).[15] S. Kaur et al[16] also found prolongation of duration of motor block with addition of dexmedetomine to epidural ropivacaine (p value<0.001). Similar result was found by D. Shukla et al[22] who observed longest motor block in dexmedomidine group followed by magnesium and then in control (bupivacaine) group in spinal block (p value< 0.001).

Sedation effect

The level of maximum sedation score were in the range of 1-2 in Group R and Group M, and 1-4 in Group D. The difference in the maximum sedation score was found statistically very highly significant between the Group R V/S Group D and between Group D V/S Group M (p value <0.001). Similar result was also found by V .Shahiet al[13] that dexmedetomidine causes arousable sedation as compared to magnesium and control group (bupivacaine) (p value <0.05). Our study is also in corroboration with the study of P.F .Salgado et al[14] who found significant sedation (p value < 0.05) with addition of dexmedetomidine with epidural ropivacaine. S. Banwaitet al[23] in also found that addition of magnesium to epidural fentanylfor postoperative pain does not causes sedation in both group (p=1). Jabalameli and Pakzadmoghadam[24]conducted a study on different dose of magnesium sulfate to spinal bupivacaine and found the similar result that there was no significant difference between the groups with respect to sedation score all the times (P > 0.05).

Haemodynamic parameters

The heart rate decreases in all the groups after injecting the study drug and the difference in decrease in heart rate was not significant till 30 minutes of injecting drug but it was statistically significant between Group R V/S Group D after 40 minutes (p value <0.05) and between Group D V/S Group M after 50 minutes (p value <0.05) during intraoperative period, and also in postoperative period. No significant difference in the mean heart rate was found between Group R V/S Group M during intraoperative as well as in the postoperative period. Similar result was also found by R. Prakashet al[25] that addition of dexmedetomidine to .25 % epidural bupivacaine causes significant change in heart rate (p value < 0.001). The decrease in heart rate with dexmedetomidine in our study and also in other studies could be explained with the fact that dexmedetomidine causes stimulation of the presynaptic α2-adrenoceptor leading to a decreased norepinephrine release. Even at slow infusion rates, dexmedetomidine lead to decrease in heart rate followed by stabilization of the heart rate below the baseline.

The mean systolic blood pressure, diastolic blood pressure decreased in all the groups after injecting the study drug and the difference in decrease was not found insignificant during the intraoperative period except only at few sporadic moments when it was significant between Group R V/S Group D and Group D V/S Group M (p value <0.05). The mean arterial blood pressure also decreased in all the groups after injecting the study drug and the difference in decrease in mean arterial blood pressure was found significant between Group R V/S Group D at 90,100 and 130 minutes (p value <0.05) and between Group D V/S Group M from 40 minutes onward after the end of epidural injection during the intraoperative period (p value <0.05). For the systolic, diastolic and mean arterial blood pressure, significant difference was found in the postoperative period between Group R V/S Group D and Group D V/S Group M (p value <0.05). No significant difference was found between Group R V/S Group M during the intraoperative as well as in the postoperative period. Similar result was found by R. Hasaneinet al[26] that no significant difference in mean arterial pressure observed with addition of magnesium

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sulfate to epidural bupivacaine and fentanyl. R. Shabana[27] also found similar result that addition of magnesium sulphate to epidural levobupivacaine does not produce any significant haemodynamic changes. B. Rastogi et al[28] also found that addition of dexmedetomidine to epidural ropivacaine produces significant change in mean SBP only at 180 minutes and in mean DBP at 5 minutes to 60 minutes after drug administration. The decrease in blood pressure with dexmedetomidine in our study and also in other studies could be explained with the fact that dexmedetomidine causes Inhibition of the central sympathetic outflow and thus it causes decreases in blood pressure after administration of dexmedetomidine.

Adverse effects

The difference in the occurrence of bradycardia, hypotension and nausea/vomiting was not found significant among all the three groups. The occurrence of shivering was found significantly lower with dexmedetomidine. Respiratory depression was not noted in any patients. Dry mouth was found only in 3 patients in Group D. Similar result was also found by A. Bilir et al[29] that addition of epidural magnesium sulfate does not produce any significant difference in the adverse effects with respect to haemodynamic and respiratory variables, sedation, pruritus, and nausea. S.Farouk84 also found the same result that addition of epidural magnesium does not produce significant difference in adverse effect with respect to haemodynamic and respiratory variables, sedation, pruritus, nausea, and vomiting. .M.Maroof et al[30] found that addition of epidural dexmedetomidine produces decreased incidence of shivering and no difference with respect to occurrence of hypotension similar to our finding but they found higher incidence of bradycardia, that might be due to very high dose of dexmedetomodine (2mcg /kg) used by them. P.F Salgado et al[14] found no significant difference in the adverse events with respect to incidence of hypotension, bradycardia, shivering, vomiting and respiratory depression with addition of epidural dexmedetomidine. The incidence of shivering being less in dexmedetomidine group in our study might be explained with the fact that dexmedetomidine is an α-2 receptor agonist, so, it reduces shivering by lowering vasoconstriction and shivering thresholds.

Conclusion

Both magnesium sulfate and dexmedetomidine can be used as adjuvant to epidural ropivacaine, however, dexmedetomidine may be preferred because of its better block characteristics as compared to magnesium sulfate without any additional adverse events. Lower incidence of shivering with dexmedetomidine is also a distinct clinical advantage but dexmedetomidine causes prolonged motor block. This might be a disadvantage for day care anaesthesia and ambulatory surgeries. Dexmedetomidine and Magnesium both, causes prolonged sensory and motor block when they are added to epidural ropivacaine and first rescue analgesic time is also much prolonged with them, further studies can be done for their use as postoperative analgesics epidurally so that total consumption of analgesics could be less.

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