A COMPARATIVE STUDY OF PLAIN ROPIVACAINE 0.75% AND DEXMEDETOMIDINE 1 µG/KG ADDED TO ROPIVACAINE 0.75% DURING EPIDURAL ANAESTHESIA IN PATIENTS UNDERGOING LOWER ABDOMINAL SURGERIES

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ABSTRACT

BACKGROUND

Epidural anaesthesia can be used as a sole anaesthetic for procedures involving the lower limbs, pelvis, perineum and lower abdomen. Different local anaesthetics are used for epidural anaesthesia, most popular being Lignocaine, Bupivacaine and now Ropivacaine. Ropivacaine is a new amino amide long-acting local anaesthetic and has got all the advantages of ideal local anaesthetic for epidural anaesthesia. Dexmedetomidine, a highly selective α_2 agonist, is the most recent agent. It has sedative, analgesic and haemodynamic stabilising effects in addition to reduction of anaesthetic drug requirement when used as an adjuvant in regional anaesthesia.

MATERIALS AND METHODS

With Institutional Ethical Committee clearance, this prospective non-blinded randomised clinical study was conducted at Seven Hills Hospital, Visakhapatnam, to compare clinical effects of epidural Ropivacaine 0.75% alone with Ropivacaine plus Dexmedetomidine 1 µg/kg for lower abdominal surgeries among 60 patients of ASA Grade I and II as per inclusion and exclusion criteria. These patients were selected in random fashion [computer-based randomisation] to avoid any kind of bias and to allow comparability of results. Group-A patients received 20 mL of 0.75% Ropivacaine plus 1 mL of sodium chloride 0.9% epidurally and Group-B patients received 20 mL of 0.75% Ropivacaine plus 1 mL of Dexmedetomidine 1 µg/kg diluted with Sodium chloride 0.9%, so that the volume will be completed to 1 mL epidurally in strict aseptic conditions in sitting position at L2-L3 interspace and monitored for sensory and motor blockade parameters and complications occurred among both groups were observed.

RESULTS

Results showed that the average time of onset of sensory blockade Group-B (4.2 ± 1.21 min) was significantly earlier when compared to Group-A (9.333 ± 2.84 min). Time taken to achieve Highest Sensory Level in Group-B (12.97 ± 2.87 min) was less when compared to Group-A (18.73 ± 2.03 min), duration of sensory blockade in Group-A was shorter with mean value of 284.1667 ± 25.86 minutes compared to mean value of 368.83 ± 25.16 minutes in Group-B. The average onset of motor block for Group-B (17.07 ± 4.60 min) was earlier than Group-A (25.07 ± 3.95 min). The mean total duration of motor blockade of Group-B (302.16 ± 31.03 min) was longer than Group-A (223.5 ± 24.71 min). Coming to complications, Group-A had higher complications when compared to Group-B, but the difference was not statistically significant. But in case of complication- Bradycardia, the proportion of patients having bradycardia was significantly more in Group-B when compared with Group-A.

CONCLUSION

With this study, we concluded that Dexmedetomidine at a dose of 1 µg.kg⁻¹ added to Ropivacaine 0.75% for epidural anaesthesia provides early onset of sensory and motor blockade and prolongs the duration of analgesia and motor blockade when compared to Ropivacaine 0.75% alone in patients undergoing lower abdominal surgeries.

KEYWORDS

Epidural Anaesthesia, Ropivacaine, Dexmedetomidine.

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BACKGROUND

Central neuraxial blockade in the form of epidural is very popular for lower abdominal and lower limb surgeries, as

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these techniques avoid the disadvantages associated with general anaesthesia like airway manipulation, polypharmacy and other untoward effects like postoperative nausea and vomiting and need for supplemental intravenous analgesics.⁽¹⁾

Epidural anaesthesia can be used as sole anaesthetic for procedures involving the lower limbs, pelvis, perineum and lower abdomen. It has the ability to maintain continuous anaesthesia after placement of an epidural catheter, thus making it suitable for procedures of longer duration.⁽²⁾

An ideal local anaesthetic in the epidural space should provide early onset, sufficient motor block for surgical relaxation and good sensory block for providing post-operative analgesia with minimal central nervous system and

cardiovascular toxicities. The advantage of this technique is that graded epidural anaesthesia or supplementation of the drug is possible even during the surgery.⁽³⁾

Different local anaesthetics are used for epidural anaesthesia, most popular being Lignocaine, Bupivacaine and now Ropivacaine. The drawback of Lignocaine is its intermediate duration of action and Bupivacaine is long-acting, but with increased incidence of severe cardiac toxicity.⁽⁴⁾

Ropivacaine is a new amino amide long-acting local anaesthetic and has got all the advantages of Bupivacaine for epidural anaesthesia and also advantage of being less cardiac toxicity.⁽⁵⁾ Hence, it appears that Ropivacaine may be an ideal local anaesthetic agent for epidural anaesthesia.

Sedation, stable haemodynamics and an ability to provide smooth and prolonged post-operative analgesia are the main desirable qualities of an adjuvant in neuraxial anaesthesia.

Dexmedetomidine, a highly selective α_2 agonist is the most recent agent. It has sedative, analgesic⁽⁶⁻¹⁶⁾ and haemodynamic stabilising effects in addition to reduction of anaesthetic drug requirement when used as an adjuvant in regional anaesthesia.

In this study, we compared epidural Ropivacaine 0.75% [20 mL] alone with Ropivacaine 0.75% [20 mL] plus Dexmedetomidine 1 μ g/kg for lower abdominal surgeries with respect to time of onset of sensory and motor blockade, duration of sensory and motor blockade, time taken to achieve highest sensory level, any intraoperative analgesic requirement and its complications were studied.

Aims and Objectives

Aims

Aims of this randomised prospective study is to compare the effect of 20 mL of 0.75% Ropivacaine alone and 20 mL of 0.75% Ropivacaine plus Dexmedetomidine 1 μ g/kg given epidurally.

Primary Objectives

- Onset of sensory blockade.
- Time to achieve highest sensory level.
- Onset of motor blockade.
- Duration of motor blockade.
- Duration of analgesia (sensory blockade).

Secondary Objectives

- Any intraoperative discomforts/supplementations. As determined by perception of dragging sensation/pain and need for any systemic analgesic agents are observed.
- Any intraoperative or postoperative complications like nausea, vomiting, shivering, hypotension and bradycardia.

MATERIALS AND METHODS

After obtaining approval from Hospital Scientific and Ethical Committee and written informed consent, 60 patients will be enrolled in this study.

The study population includes patients of either sex, ASA Grade 1 and 2, in ages between 25 - 65 years; all patients posted for elective lower abdominal surgeries who will undergo epidural procedure will be included in this study.

Study Design

Study was prospective, randomised, controlled study.

Study Area

Dept. of Anaesthesiology, Seven Hills Hospital, Visakhapatnam between August 2014 and September 2015.

Study Population

Patients of either sex, between ages of 25 years and 65 years undergoing elective lower abdominal surgeries under epidural anaesthesia as per inclusion and exclusion criteria.

Sample Size

Sample size was taken according to our convenience as 60 patients who came for elective lower abdominal surgeries and were randomly selected for the study without any bias based on inclusion and exclusion criteria and they were randomly divided into two groups, each Group having 30 patients based on randomisation software by using computer without any bias. [GraphPad based software randomisation technique].

Inclusion Criteria

- Age between 25 - 65 years.
- ASA Grade 1 and 2.
- Elective lower abdominal surgeries.

Exclusion Criteria

- Patient's refusal for regional anaesthesia.
- Pregnancy and lactation.
- Patients posted for emergency surgeries.
- Patients with morbid obesity.
- Patients having-
 - Local infection.
 - Severe hypovolaemia.
 - Bleeding coagulopathy.
 - Uncontrolled hypertension/ diabetes mellitus.
 - Neurological disorder.
 - Raised intracranial tension and deformities of spine.
 - Allergy to local anaesthetics and Dexmedetomidine.
 - Hepatic disease.

Data Collection Techniques and Tools

After approval from Institutional Ethical Committee, proper written informed consent, patients included in this study were randomly divided into 2 Groups of 30 patients in each group.

Group-A

Were given 20 mL of 0.75% Ropivacaine plus 1 mL of Sodium chloride 0.9% epidurally.

Group-B

Were given 20 mL of 0.75% Ropivacaine plus 1 mL of Dexmedetomidine 1 μ g/kg diluted with sodium chloride 0.9%, so that the volume will be completed to 1 mL epidurally.

Preoperative assessment was done for each patient and written informed consent was taken. Patients were allowed for a period of fasting of 8 hours and were given premedication with Tab. Alprazolam 0.5 mg and Tab. Ranitidine 150 mg on night before surgery.

On the day of surgery patient was shifted into operation theatre, 18-G IV cannula was secured and as per ASA standards all monitors, electrocardiogram (ECG), non-invasive blood pressure (NIBP), pulse oximeter (SPO2) were connected and basal vital parameters were noted.

Patients were placed in sitting position. Epidural space was identified with loss of resistance technique at L2-L3 level using 18-G Tuohy's needle. Test dose of 3 mL of 1.5% lignocaine with 1:200000 Epinephrine was given after negative aspiration of CSF and blood. After the test dose, in the absence of any adverse sequelae, total amount of study drug was given slowly through epidural needle.

Intraoperatively, onset of sensory and motor blockade, maximum level of sensory blockade attained and duration of sensory and motor blockade were noted. Any intraoperative events like hypotension, bradycardia, shivering, nausea and vomiting were recorded.

After the surgery, patients were shifted to the recovery room (PACU) post anaesthesia care unit, where they remained until complete recovery of sensory and motor blockade. Postoperatively, vital parameters were monitored.

Sensory Blockade

Sensory blockade was checked for loss of sensation with 24-G blunt tipped needles along midaxillary line; onset time, maximal cephalad spread and first request for analgesics were observed.

a) Onset of Sensory Block

It is time taken from the completion of the injection of study drug till the patient does not feel the pin prick at L1 level.

b) Time to Achieve Highest Sensory Blockade

It is the time from the completion of the injection of the study drug to the highest sensory blockade attained.

c) Duration of Analgesia

It is the time taken from onset of analgesia to the time when patient complains of pain at the site of surgery.

RESULTS

1. Onset of Sensory Blockade

Onset Sensory [min]	Group	n	Mean	SD	T-Value	P-Value	Inference
	Group-A	30	9.3333	2.84464	9.09	0.000	Significant
	Group-B	30	4.2000	1.21485			

Table 1. Comparison of Onset Time of Sensory Blockade

The above table specifies that there is a significant difference in time with regard to onset of sensory blockade by the groups at 5% level of significance. The average time of onset of sensory blockade in Group-B (4.2 ± 1.21 min) is significantly earlier when compared to Group-A (9.33 ± 2.84 min) with p-value of 0.000.

The same is mentioned below as bar diagram.

Any intraoperative analgesic supplementation for both groups was noted.

Motor Blockade

a) Onset of Motor Block

It is time taken from the completion of the injection of study drug till the patient develops modified Bromage scale grade 1 motor blockade.

Modified Bromage Scale

- 0 Able to perform a full straight leg raise over the bed for 5 secs
- 1 Unable to perform a leg raise, but can flex the leg on knee and ankle
- 2 Unable to flex knee, but can flex ankle
- 3 Unable to flex ankle
- 4 Unable to move toes

b) Duration of Motor Block

It is the time taken from the time of onset of motor blockade (grade 1) to complete recovery of motor blockade.

c) Any Complications

HR < 60 was considered as bradycardia and treated with Inj. Atropine 0.6 mg IV. SBP < 90 mmHg was considered as hypotension and treated with Inj. Mephentermine 6 mg IV boluses. Nausea and vomiting were treated with Inj. Ondansetron 4 mg IV. Shivering was treated with Inj. Pethidine IV 25 mg.

Data Analysis

Data was collected from study proformas, tabulated, coded and analysed. Demographic data was analysed by using chi square test. Anaesthetic characters were analysed using independent samples t-test. Incidence of complications and maximal dermatomal blockade were analysed using One-Way Anova test.

Data is reported as a mean value $\pm$ standard deviation. A 'p' value of < 0.05 was considered statistically significant (S) between two groups.

Figure 1. Comparison of Onset of Sensory Blockade

2. Onset of Motor Blockade

Onset Motor Blockade [min]	Group	n	Mean	SD	T-Value	P-Value	Inference
	Group-A	30	25.0667	3.95608	7.221	0.000	Significant
	Group-B	30	17.0667	4.60085			

Table 2. Comparison of Onset Time of Motor Blockade

The average onset time of Motor blockade for Group-B (17.07 ± 4.60 min) is significantly earlier than Group-A (25.07 ± 3.95 min) with p-value of 0.000.

The graphical representation is shown below.

Figure 2. Comparison of Onset of Motor Blockade

3. Time Taken to Achieve Highest Sensory Level

Time to achieve Highest Sensory Level (min)	Group	N	Mean	SD	T-Value	P-Value	Inference
	Group-A	30	18.7333	2.03306	8.979	0.000	Significant
	Group-B	30	12.9667	2.87058			

Table 3. Comparison of Time Taken to achieve Highest Sensory Level

Time taken to achieve Highest Sensory Level for Group-B (12.97 ± 2.87 min) is less when compared to Group-A (18.73 ± 2.03 min) and has significant difference with p-value of 0.000.

The graphical representation is shown below.

Figure 3. Comparison of Time to achieve Highest Sensory Level

4. Duration of Sensory Blockade

Duration of Sensory Block [min]	Group	N	Mean	SD	T-Value	P-Value	Inference
	Group-A	30	284.1667	25.86715	-12.738	0.000	Significant
	Group-B	30	368.8333	25.61934			

Table 4. Comparison of Duration of Sensory Block

The average duration of sensory block by Group-B (368.83 ± 25.61 min) is significantly longer than Group-A (284.16 ± 25.86 min) as per the significant p-value (0.000) observed from the student t-test value (-12.738).

The graphical representation is shown below.

Figure 4. Comparison of Duration of Sensory Block in between Two Groups

5. Degree of Motor Blockade

Group	Degree of Motor Block (Grade)		Total
	2	3	
Group-A	17 (56.7%)	13 (43.3%)	30 (100%)
Group-B	14 (46.7%)	16 (53.3%)	30 (100%)
Total	31 (51.7%)	29 (48.3%)	60 (100%)
Chi-Square	0.601		
P-value	0.438		
Inference	Not Significant		

Table 5. Comparison of Degree of Motor Blockade

There is no significant difference in the percentages between the two groups with regard to the degree of Motor block (in grades) as per the insignificant P-value (0.438) of the chi-square test mentioned above, i.e. Group and Degree of motor block are independent at 5% level of significance.

Graphical representation is shown as a multiple bar diagram.

Figure 5. Comparison of Degree of Motor Block

6. Duration of Motor Blockade

Duration of Motor Block (Min)	n	Mean [Min]	SD	T-Value	P-Value	Inference
Group-A	30	223.5000	24.71039	-10.861	0.000	Significant
Group-B	30	302.1667	31.03622			

Table 6. Comparison of Total Duration of Motor Blockade

From the above table and the below graph, it clearly shows that the mean total duration of Motor block of Group-B (302.1667 ± 31.03 min) is significantly longer than Group-A (223.50 ± 24.71 min) at 5% level of significance as per the significant p-value of 0.000 observed from the t-test.

Figure 6. Comparison of Total Duration of Motor Block

7. Intraoperative Analgesic Requirement

Group	Intraop Analgesic Requirement		Total
	No	Yes	
Group-A	15 (50%)	15 (50%)	30 (100%)
Group-B	25 (83.3%)	5 (16.7%)	30 (100%)
Total	40 (66.67%)	20 (33.33%)	60 (100%)
Chi-Square	7.50		
P-value	0.006		
Inference	Significant		

Table 7. Comparison of Intraoperative Analgesic Requirement

From the above table it shows that there is a significant association between group and intraoperative analgesic requirement with a significant p-value of 0.006, i.e. Group-A patients needed higher intraoperative analgesics when compared to Group-B. The same is represented as bar diagram.

Figure 7. Comparison of Intraoperative Requirement of Analgesics

8. Complications

Complications	Group-A	Group-B	Total	Z-Value	P-Value	Inference
Hypotension	10 (33.33%)	6 (20%)	16 (26.67%)	1.18	0.238	Not Significant
Bradycardia	0 (0.00)	5 (16.67%)	5 (8.33%)	2.45	0.014	Significant
Nausea	2 (6.67%)	0 (0.00)	2 (3.33%)	1.46	0.143	Not Significant
Shivering	3 (10%)	2 (6.67%)	5 (8.33%)	0.47	0.640	Not Significant
No Complications	18 (43.9%)	23 (56.1%)	41 (68.33%)	-1.41	0.158	Not Significant

Table 8. Comparison of Complications in both the Groups

From the above table, it was concluded that Group-A has higher complications when compared to Group-B, but the difference is not statistically significant. In case of complication- Bradycardia, the proportion of patients having bradycardia is significantly more in Group-B when compared with Group-A and it is statistically significant at 5% level as per the proportion test.

DISCUSSION

Dexmedetomidine, a highly selective α -2 agonist, is the most recent and advanced agent. It has sedative, analgesic, haemodynamic stabilising effects in addition to reduction of anaesthetic drug requirement.

This prospective non-blinded, randomised study was conducted at Seven Hills Hospital, Visakhapatnam, to compare clinical effects of epidural Ropivacaine 0.75% alone with Ropivacaine plus Dexmedetomidine 1 μ g/kg for lower abdominal surgeries among 60 patients of ASA Grade I and II as per inclusion and exclusion criteria. These patients were selected in random fashion [computer-based randomisation] to avoid any kind of bias and to allow comparability of results. Group-A patients received 20 mL of 0.75% Ropivacaine plus 1 mL of Sodium chloride 0.9% epidurally and Group-B patients received 20 mL of 0.75% Ropivacaine plus 1 mL of Dexmedetomidine 1 μ g/kg diluted with Sodium chloride 0.9%, so that the volume will be completed to 1 mL epidurally in strict aseptic conditions in sitting position at L2-L3 interspace and monitored for sensory and motor blockade parameters and complications occurred among both groups were observed. Sensory blockade assessed by loss of pin prick sensation and motor blockade by modified Bromage scale.

Patient Characteristics across the Groups

The patients studied across the two groups did not vary much with respect to Age, Sex, Height, Weight and ASA grading. These parameters were identical in both the groups. P-value regarding all these demographic characters was > 0.05 suggests no difference among groups with regard to these parameters.

Sensory Parameters

In the present study, the average time of onset of sensory blockade Group-B (4.2 ± 1.21 min) is significantly earlier when compared to Group-A (9.333 ± 2.84 min), which was statistically highly significant ($P = 0.000$). These results were comparable to study done by Manjunath Thimmappa et al (2014).⁽¹⁾

Time taken to achieve Highest Sensory Level in Group-B (12.97 ± 2.87 min) was less when compared to Group-A (18.73 ± 2.03 min), which was statistically significant among two groups with significant value of 0.000.

In the present study, duration of sensory blockade was assessed by pain at surgical incision was studied among populations. In Group-A it was with mean value 284.1667 ± 25.86 minutes compared to mean value of 368.83 ± 25.16 minutes in Group-B suggests longer duration of sensory blockade in Group-B, which was statistically highly significant ($P < 0.000$). It is comparable with study of Manjunath Thimmappa et al in 2014.⁽¹⁾ This shows that Dexmedetomidine when added to Ropivacaine 0.75% epidurally has a more reliable duration of analgesia. Only five patients in Group-B required analgesic supplementation, but 15 patients in Group-A during intraoperative period and it was statistically significant.

In comparison with other previous studies, our study concludes that Group-B patients had faster time of onset of sensory blockade and took less time to achieve highest sensory level and prolonged duration of sensory blockade with less intraoperative analgesic requirement when compared to Group-A patients, which was statistically significant.

Motor Blockade Parameters

The average onset of Motor block for Group-B (17.07 ± 4.60 min) earlier than Group-A (25.07 ± 3.95 min), which was statistically highly significant ($P < 0.000$). These results were comparable with studies of Sukhminder Jit Singh Bajwa et al (2011).

There is no significant difference in the percentages between the two groups with regard to the degree of Motor block (in grades) as per the insignificant P-value (0.438) of the chi-square test.

The mean total duration of Motor blockade of Group-B (302.16 ± 31.03 min) is longer than Group-A (223.5 ± 24.71 min), which was statistically highly significant ($P < 0.000$). Our results were comparable with studies of Mausumi Neogi et al (2011) observed that the longer duration of analgesia and motor block produced by Dexmedetomidine along with the 0.75% Ropivacaine epidurally should be suitable for lower abdominal procedures of intermediate duration requiring a prolonged duration of analgesia.

Coming to complications, it was concluded that Group-A has higher complications when compared to Group-B, but the difference is not statistically significant. But in case of complication- Bradycardia, the proportion of patients having bradycardia is significantly more in Group-B when compared with Group-A.

In addition to early onset of sensory and motor blockade and prolonged duration of analgesia, it was also observed that Group-B patients had good sedation but arousable and also associated with anxiety and hypnosis.

Limitation of the Study

Sample size was not calculated and was taken as 60 patients, as we were restricted to only patients who were undergoing lower abdominal surgeries based on inclusion and exclusion criteria, and we did not include patients undergoing lower limb surgeries and perineal surgeries.

Summary

The study was conducted to compare epidural Ropivacaine 0.75% alone with Ropivacaine plus Dexmedetomidine 1 µg/kg in patients undergoing lower abdominal surgeries.

60 patients belonging to ASA Grade I and II, aged between 25 - 65 years, posted for elective lower abdominal surgeries were randomly allocated for the study in a non-blinded manner into two groups based on computer-based randomisation. Group-A were given 20 mL of 0.75% Ropivacaine plus 1 mL of Sodium chloride 0.9% epidurally. Group-B were given 20 mL of 0.75% Ropivacaine plus 1 mL of Dexmedetomidine 1 µg/kg diluted with Sodium chloride 0.9%, so that the volume will be completed to 1 mL epidurally.

The population studied across the Groups did not vary much with respect to Age, ASA grade, Sex, Height and Weight.

The onset of sensory blockade was delayed by about 5 - 10 minutes in Group-A and the onset of motor blockade was delayed by about 10 - 15 minutes in Group-A when compared to Group-B. Time taken to attain maximum sensory level was faster in Group-B. The total duration of sensory and motor blockade was also significantly longer in Group-B in comparison to Group-A. It was observed that intraoperative analgesic requirement was significantly high in Group-A patients when compared to Group-B patients.

The adverse effects observed in the study were minimal. Hypotension was the most common complication observed in both groups, but more in Group-A and Bradycardia was significantly observed in Group-B.

With this present study, we can summarise that 1 µg/kg Dexmedetomidine added to Ropivacaine 0.75% 20 mL when given epidurally brings about better quality and longer duration of analgesia and motor blockade with less intraoperative analgesic requirement and fewer complications than 0.75% Ropivacaine alone.

CONCLUSION

We conclude that Dexmedetomidine at a dose of 1 µg.kg⁻¹ added to Ropivacaine 0.75% for epidural anaesthesia provides early onset of sensory and motor blockade and prolongs the duration of analgesia and motor blockade when compared to Ropivacaine 0.75% alone in patients undergoing lower abdominal surgeries.

REFERENCES

- [1] Thimmappa M, Madhusudhana R, Potli S, et al. Clonidine and dexmedetomidine with ropivacaine in epidural anaesthesia: a comparative study. *World Journal of Pharmacy and Pharmaceutical Sciences* 2014; 3(4):1218-30.
- [2] Tuohy EB. Continuous spinal anaesthesia: its usefulness and technique involved. *Anaesthesiology* 1944; 5:142-8.
- [3] Brill S, Gurman GM, Fisher A. A history of administration of local analgesics and opioids. *Eur J Anaesth* 2003; 20(9):682-9.
- [4] Kuthiala G, Chaudhary G. Ropivacaine: a review of its pharmacology and clinical use. *Indian J Anaesth* 2011; 55(2):104-10.
- [5] McClure JH. Ropivacaine. *British Journal of Anaesthesia* 1996; 76(2):300-7.
- [6] Bajwa SJS, Bajwa SK, Kaur J. Dexmedetomidine and clonidine in epidural anaesthesia: a comparative evaluation. *Indian Journal of Anaesthesia* 2011; 55(2): 116-21.
- [7] Kamibayashi T, Maze M. Clinical uses of alpha-2 adrenergic agonists. *Anesthesiology* 2000; 93(5): 1345-9.
- [8] Scafati A. Analgesia and alpha agonists 2. *Medens Rev* 2004;4-7.
- [9] Mauro VA, Brandão ST. Clonidine and dexmedetomidine through epidural route for post-operative analgesia and sedation in a colecistectomy. *Rev Bras Anesthesiol* 2004; 4:1-10.
- [10] Gabriel JS, Gordin V. Alpha 2 agonists in regional anaesthesia and analgesia. *Curr Opin Anaesthesiol* 2001; 14(6):751-3.

- [11] Hall JE, Uhrich TD, Ebert TJ. Sedative, analgesic and cognitive effects of clonidine infusions in humans. *Br J Anaesth* 2001; 86(1):5-11.
- [12] Hall JE, Uhrich TD, Barney JA, et al. Sedative, amnesic, and analgesic properties of small-dose dexmedetomidine infusions. *Anesth Analg* 2000; 90(3): 699-705.
- [13] Neogi M, Bhattacharjee DP, Dawn S, et al. A comparative study between clonidine and dexmedetomidine used as adjuncts to ropivacaine for caudal analgesia in paediatric patients. *J Anaesth Pharmacol* 2010; 26:149-53.
- [14] Salgado PF, Sabbag AT, Silva PC, et al. Synergistic effect between dexmedetomidine and 0.75% ropivacaine in epidural anesthesia. *Rev Assoc Med Bras* 2008; 54(2): 110-5.
- [15] Anand VG, Kannan M, Thavamani A, et al. Effects of dexmedetomidine added to caudal ropivacaine in paediatric lower abdominal surgeries. *Indian J Anaesth* 2011; 55(4):340-6.
- [16] Elhakim M, Abdelhamid D, Abdelfattach H, et al. Effect of epidural dexmedetomidine on intraoperative awareness and post-operative pain after one-lung ventilation. *Acta Anaesthesiol Scand* 2010; 54(6): 703-9.