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Research Article

A COMPARATIVE STUDY OF POST-OPERATIVE EPIDURAL ANALGESIA WITH ROPIVACAINE (0.2%) ALONE AND ROPIVACAINE (0.2%) WITH DEXMEDETOMIDINE FOR ABDOMINAL SURGERIES

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ABSTRACT

Dexmedetomidine is a potent highly selective α-2 adrenergic agonist acts centrally, also possesses synergistic action with local anaesthetics is a commonly used adjuvant for regional and neuraxial blocks, used as anxiolytic, sympatholytic, hypnotic, sedative, and analgesic properties without generating significant respiratory depression. To compare the post-operative analgesia, hemodynamic changes produced by epidural injection ropivacaine (0.2%) against ropivacaine (0.2%) with dexmedetomidine (1mcg/kg) in patients undergoing open abdominal surgeries. This is a randomised double blind controlled trail among 60 patients who were scheduled for elective surgery under general anaesthesia under the department of anaesthesiology, government thoothukudi medical college, thoothukudi. Group r (epidural analgesia with ropivacaine(0.2%)) and group rd (epidural analgesia with ropivacaine(0.2%) and dexmedetomidine (1mcg/kg)). Post-operative analgesia, and hemodynamic changes were compared between the groups. Baseline characteristics such as age, gender, anthropometry and asa status were not significantly different between the groups. Haemodynamic changes were comparable between the groups, except a lower heart rate at initial hour among the group ropivacaine-dexmedetomidine. Compared with the ropivacaine group, group ropivacaine-dexmedetomidine had a significantly earlieronset and complete analgesia, and a significantly higher duration of analgesia. Dexmedetomidine (1mcg/kg) can be combined with ropivacaine (0.2%) in epidural injection among patients undergoing open abdominal surgeries for its good post-operative analgesia, and hemodynamic stability.

INTRODUCTION

Epidural anaesthesia remains the gold standard method for providing effective analgesia during the intra operative and post operative period. Nonetheless, Epidural anaesthesia along with local anaesthetic agents requires higher doses, can cause sympathetic blockade and systemic toxicity.(Epidural anaesthesia is preferred for the following reasons such as reduction of metabolic stress, reduced loss of blood, reduced pulmonary complications, lesser incidence of venous thrombo embolism, faster early arrival of bowel function, shorter admission-discharge interval.

Ropivacaine causes reversible inhibition of influx of sodium ion, and hence it blocks impulse conduction in nerve fibres. Ropivacaine has longer duration of action that is structurally related to Bupivacaine. Ropivacaine, has a good efficacy, reduced motor block, and less CVS toxicity and CNS toxicity, thereby a better option epidural anaesthesia and treatment of post operative and labour analgesia Although Bupivacaine remains the popular choice for regional anaesthesia and analgesia, it has been linked with adverse effects such as cardio toxicity. Ropivacaine, being a pure S(-) enantiomer, has higher clearance and lower lipid solubility than Bupivacaine which contributes to its decreased systemic toxicity and provides hemodynamic stability However, when added with adjuvants produces functional results by decreasing the dose of local anaesthetics, besides providing additional benefits of intense motor and sensory blockade.

Recently alpha 2 agonists are becoming popular for their primary effect of sympatholytic and additionally anxiolysis, sedation, and analgesia. Dexmedetomidine – a potent highly selective α2 adrenergic agonist acts centrally, also possesses synergistic action with local anaesthetics is a commonly used adjuvant for regional and neuraxial blocks. Dexmedetomidine acts with a α2:α1 selectivity 8 times higher than that of Clonidine.

FDA approved Dexmedetomidine, in 1999, for use in humans as a short-term medication for sedation and analgesia in intensive care. Later it is recognised for the usage as anxiolytic, sympatholytic, hypnotic, sedative, and analgesic properties without generating significant respiratory

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depression. It provides better analgesia but at the risk of bradycardia and hypotension which is dose dependant.Multiple studies have been done on this topic and showed the effectiveness of dexmedetomidine as adjuvant in Epidural anaesthesia. But the studies in this topic are less in Indian context. Therefore, this study aims to compare the post-operative analgesia, hemodynamic changes produced by epidural injection ropivacaine(0.2%) against ropivacaine(0.2%) with dexmedetomidine(1mcg/Kg) in patients undergoing open abdominal surgeries.

AIM

To compare the post-operative analgesia, hemodynamic changes produced by epidural injection ropivacaine(0.2%) against ropivacaine(0.2%) with dexmedetomidine(1mcg/Kg) in patients undergoing open abdominal surgeries.

Objectives

Primary Objectives

- To assess Post-operative analgesia
  - To assess onset of analgesia
  - To assess duration of analgesia

Secondary Objectives

- To assess the hemodynamic changes (Oxygen Saturation, Heart rate, Systolic BP, Diastolic BP, Mean BP).
- To assess the motor blockade.

To assess other complications.

METHODOLOGY

Study subjects:60 patients who were scheduled for elective surgery under general anaesthesia under the department of anaesthesiology, government thoothukudi medical college, after the pre anaesthetic assessment if they met the inclusion criteria.

Study Design

Randomised Double blind controlled trail.

Study Period

Data collection – 1 ½ year (2019 December to 2021 June).

Study setting

Department of Anaesthesiology, Government Thoothukudi Medical College, Thoothukudi.

Sampling Procedure

Convenient Non-probability Sampling, with computer generated randomisation for allocation of study groups.

Inclusion Criteria

- American Society of Anaesthesiologist Physical status class I and class II.
- Age between 18 to 65 years
- Both Gender.
- Patient undergoing all upper and lower open abdominal surgeries.

Exclusion criteria

- Patient refusal.
- Any spinal deformity or spinal disease
- Infection or skin disease at the site of procedure
- Any patients on anti-coagulant therapy or patients with bleeding disorder.
- Morbid obese patients or anticipated difficulty in regional anaesthesia
- Uncontrolled Systemic hypertension
- Patients with coronary artery disease, valvular heart disease.
- H/o cerebrovascular accidents.
- Patients with major kidney and liver diseases.
- Patients with allergy to any drugs used in the study.
- Patients with neurological disorders or pre-existing lower limb weakness
- Patient with spinal tuberculosis.
- Patients with psychiatric illness on treatment.
- Pre-existing rhythm disturbance and ECG changes.
- Emergency surgeries.
- Age less than 18 years and above 65 years.

Sample Size

According to Sarabjit Kaur *et al* study, considering the mean and standard deviation of Duration of sensory block in min among group received 150 mg of 0.75% ropivacaine as epidural anaesthesia as 375 ± 150, mean and standard deviation of Duration of sensory block in min among group received 150 mg of 0.75% ropivacaine with dexmedetomidine (1 µg/kg) as epidural anaesthesia as 491 ± 170 at 95% confidence interval with 80% power, the sample size is calculated as

$$N = (Z_{1-\alpha/2} + Z_{1-\beta})^2 * 2 * \sigma^2 / (\mu_1 - \mu_2)^2$$

Z1-α/2 - two tailed probability for 95% confidence interval = 1.96

Z1-β - two tailed probability for 80% power = 0.84

µ1 - mean of Duration of sensory block in min among group received 150 mg of 0.75% ropivacaine as epidural anaesthesia = 375

µ2 - mean of Duration of sensory block in min among group received 150 mg of 0.75% ropivacaine with dexmedetomidine (1 µg/kg) as epidural anaesthesia = 491

σ - average standard deviation of Duration of sensory block in min among group received 150 mg of 0.75% ropivacaine as epidural anaesthesia & Duration of sensory block in min among group received 150 mg of 0.75% ropivacaine with dexmedetomidine (1 µg/kg) as epidural anaesthesia = 160

N = (1.96 + 0.84) ^2 * 2 * 160^2 / (375 - 491) ^2

N = 29.86

Thus, the sample size required for each group is 30 and the total sample size is 60

Institutional Ethical Committee approval, from Govt. Thoothukudi Medical College, Thoothukudi, was obtained before the start of the study. Informed written consent was obtained.

Source of Funding: None declared

Conflict of Interest: None declared

Study procedure

After the pre anaesthetic assessment if they met the inclusion criteria, Study procedure was explained, and informed written consent was sought.

Preanaesthetic Assessment

All patients undergone a pre anaesthetic check up one day prior to the surgery. Patients were evaluated for any systemic disease. The routine laboratory parameters, ECG, echocardiogram and other investigations as per surgical need were verified. Patients were premedicated with tablet *al*prazolam 0.25 mg, tablet ranitidine 150mg appropriately and were be kept in fasting for 8 hours prior to surgery.

Conduct Of Anaesthesia

Boyle's machine was checked. Emergency drug tray consisting of atropine, adrenaline, ephedrine and dopamine were kept ready. The patients were allotted into two randomly assigned groups in a double blinded manner based on the day of surgery (same drug was given to patients on a specific day of surgery). The patient were explained about the visual linear analogue scale for pain to determine the level of analgesia in the postoperative period. This was carried out with 10 cm line. The first end mark '0' means 'no pain' and the end marked '10' means 'severe pain'. The following figure represents the Visual Analogue Scale (VAS).

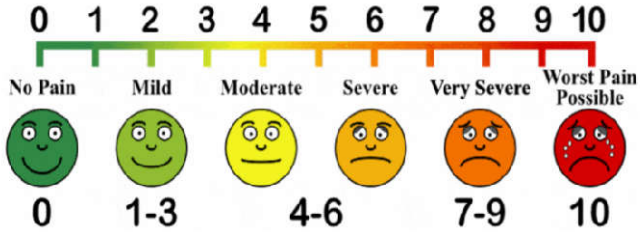

Figure 1 Visual Analogue Scale (VAS)

Patients were shifted to the operation theatre and connected to the standard multipara monitor monitoring the ECG, SpO2, non-invasive automated blood pressure and heart rate were recorded. Intravenous access secured using 18G IV cannula and all patients were premedicated with InjGlycopyrolate 0.2 mg + Inj Midazolam 1mg prior to procedure.

Patients were explained about the procedure and were kept in sitting position for the procedure. After painting and draping the lower back, a skin wheal was raised at the desired interspinous level using 2 ml of 2% lignocaine. The epidural space was identified using 18G Tuohy's needle using loss of resistance or hanging drop method.

Epidural catheter was threaded 5 cm into the epidural space. Test dose was given with 3ml of 1.5% lignocaine with adrenaline (5 mcg /ml) after negative aspiration for both blood and CSF to rule out intrathecal or intravascular placement of the epidural catheter. Following this patient was given General anaesthesia for the surgical procedure. At the end of the surgery, patient extubated. After extubation, when patient first complained of pain (VAS ≥4), epidural analgesia was given with the prepared solution.

The patients were divided into two groups of 30 patients each. Group R (epidural analgesia with Ropivacaine(0.2%)) and group RD (Epidural analgesia with Ropivacaine(0.2%) and Dexmedetomidine(1mcg/Kg)).

The total volume of injection was kept at 16 ml by adding saline for both groups to avoid bias. A colleague of the investigator was preparing the drug and was handing it over to the investigator who injected the drug epidurally and monitored the patient parameters.

RESULTS

Baseline Characteristics

- **Study groups:** Among the subjects, 30 (50%) were allocated to Group RD who received Dexmedetomidine (1mcg/kg) with Ropivacaine (0.2%) post operatively and 30 (50%) were allocated to Group R who received Ropivacaine (0.2%) only.
- **Age:** The mean Age among Group RD was 41.57 (± 8.25) which is higher by 0.2 but not statistically significant compared to 41.37 (± 10.21) in Group R.
- **Gender:** 50% of the Group RD had Males and 50% had Females compared to Group R of whom 46.66% had Males and 53.33% had Females and the difference was not statistically significant ($p > 0.05$)
- **Anthropometry:** The Height, and Weight were not significantly different between the groups.
- **ASA status:** Comparing the ASA with Drug Group distribution, 46.66% of the Group RD group had grade I compared to Group R group of whom 46.66% had grade I and the difference was not statistically significant ($p > 0.05$).

Analgesia Conditions

- **Time for Onset of Analgesia:** The mean Time for Onset of Analgesia among Group RD was 7.92 (± 0.56)min which was significantly lower in Group R, 8.34 (± 0.45)min.
- **Time for Complete Analgesia:** The mean Time for Complete Analgesia among Group RD was 13.33 (± 0.82) min which was significantly lower compared to 14.08 (± 0.79) min in Group R.
- **Duration of Analgesia:** The mean Duration of Analgesia among Group RD was 502.67 (± 22.54) min which was significantly higher compared to 309.5 (± 20.36) min in Group R.

Haemodynamic parameters

- **Heart Rate:** Heart rate was not significantly different at baseline, 5 min and 10 min, but significantly lower at 15 min, 20 min, 25 min and 30 min among the Group RD. Postoperatively Heart rate significantly lower at 1,2,3,6 hours and was not significantly different after 9 hours.
- **Systolic Blood Pressure:** The mean of the Systolic Blood Pressure were not significantly different between the groups throughout.
- **Diastolic Blood Pressure:** The mean of the Systolic Blood Pressure were not significantly different between the groups throughout.
- **Mean arterial blood pressure:** The mean of the Mean arterial blood pressure were not significantly different between the groups throughout.
- **Respiratory Rate:** The mean of the Respiratory Rate were not significantly different between the groups throughout.
- **Spo2:** The mean of the saturation were not significantly different between the groups throughout.

Table 1 Comparison of ASA Grading with the Drug group

ASA Grading	Drug group		Total	p value
	Group RD	Group R		
grade I	14 (46.66%)	14 (46.66%)	28 (46.66%)	
grade II	16 (53.33%)	16 (53.33%)	32 (53.33%)	1
Total	30 (100%)	30 (100%)	60 (100%)	

DISCUSSION

Dexmedetomidine is a potent highly selective α-2 adrenergic agonist acts centrally, also possesses synergistic action with local anaesthetics is a commonly used adjuvant for regional and neuraxial blocks. It is used as anxiolytic, sympatholytic, hypnotic, sedative, and analgesic properties without generating significant respiratory depression.is is a Randomised Double blind controlled trail among 60 Patients who were scheduled for elective surgery under general anaesthesia under the Department of Anaesthesiology, Government Thoothukudi Medical College, Thoothukudi. Group R (epidural analgesia with Ropivacaine(0.2%)) and group RD (Epidural analgesia with Ropivacaine(0.2%) and Dexmedetomidine (1mcg/Kg)). Post-operative analgesia, and hemodynamic changes were compared between the groups.

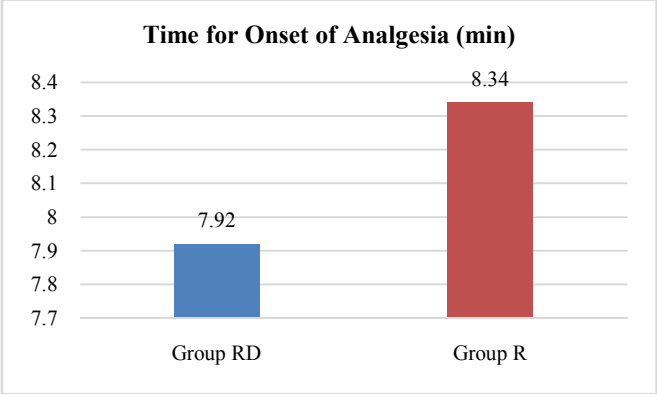

Figure II Comparison of Time for Onset of Analgesia with Drug group

The main objective of the study is to compare the post-operative analgesia, hemodynamic changes produced by epidural injection ropivacaine (0.2%) against ropivacaine (0.2%) with dexmedetomidine (1mcg/Kg) in patients undergoing open abdominal surgeries.

Baseline Characteristics

Baseline characteristics such as age, gender, anthropometry and ASA status were not significantly different between the groups, and hence the role of confounding by other factors cannot be ruled out. This may be due to the randomisation followed in the allocation of the study groups.

- **Study groups:** Among the subjects, 30 (50%) were allocated to Group RD who received Dexmedetomidine (1mcg/kg) with Ropivacaine (0.2%) post operatively and 30 (50%) were allocated to Group R who received Ropivacaine (0.2%) only.
- **Age:** In this study, The mean Age among Group RD was 41.57 (± 8.25) which is higher by 0.2 but not statistically significant compared to 41.37 (± 10.21) in Group R.
- **Gender:** In this study, 50% of the Group RD had Males and 50% had Females compared to Group R of whom 46.66% had Males and 53.33% had Females and the difference was not statistically significant ($p > 0.05$)
- **Anthropometry:** In this study, The Height, and Weight were not significantly different between the groups.
- **ASA status:** In this study, Comparing the ASA with Drug Group distribution, 46.66% of the Group RD group had grade I and 53.33% had grade II compared to Group R group of whom 46.66% had grade I and 53.33% had grade II and the difference was not statistically significant ($p > 0.05$).

Analgesia Conditions

- **Time for Onset of Analgesia:** In this study, The mean Time for Onset of Analgesia among Group RD was 7.92 (± 0.56) min which was significantly lower than Group R, 8.34 (± 0.45) min.
- **Time for Complete Analgesia:** In this study, The mean Time for Complete Analgesia among Group RD was 13.33 (± 0.82) min which was significantly lower compared to 14.08 (± 0.79) min in Group R.
- **Duration of Analgesia:** In this study, The mean Duration of Analgesia among Group RD was 502.67 (± 22.54) min which was significantly higher compared to 309.5 (± 20.36) min in Group R.

The following studies compared the addition of dexmedetomidine to ropivacaine with the ropivacaine alone in epidural analgesia of various surgical procedures and established an effectiveness.

Sarabjit Kaur *et al*, observed that the Epidural Dexmedetomidine played an excellent adjuvant to Ropivacaine is provided with extended sensory and motor block, hemodynamic stability, sustained postoperative analgesia and decreased requirement for rescue analgesics when compared with the group received only Ropivacaine. Vivek Maratha *et al*, observed that the usage of dexmedetomidine provided a prolonged duration of motor block and sedation. They suggested that dexmedetomidine may be undesirable for shorter surgeries Zhao Yang *et al*, concluded that the Dexmedetomidine (0.5 µg/kg) is an effective epidural adjuvant in Labour Analgesia since it provided comparable stable Hemodynamics, prolonged post-operative analgesia (visual analogue scales), reduced motor blockade, and good scores of sedation.

Ashem Jack Meitei *et al*, observed that Addition of dexmedetomidine to ropivacaine provided a stable hemodynamic, prolonged sensory and motor blockade, protracted postoperative analgesia, and decreased demand for rescue analgesics when compared to plain ropivacaine in epidural anaesthesia for lower limb orthopaedic surgeries The following studies compared the addition of dexmedetomidine with other drugs such as clonidine and fentanyl, when used with ropivacaine in epidural analgesia of various surgical procedures and established an effectiveness of dexmedetomidine.

Sukhminder Jit Singh Bajwa *et al*, concluded that the Dexmedetomidine is better than fentanyl as an epidural adjuvant since it provided comparable stable Hemodynamics, prolonged post-operative analgesia, early onset, and creation of sensory anaesthesia, reduced consumption of post-operative LA for epidural analgesia, and good scores of sedation.

S Kiran *et al*, observed that the Epidural anaesthesia achieved with 10µg of dexmedetomidine as an additive to 0.5%-Ropivacaine is more effective with respect to duration and intensity of analgesia when compared to 0.5%-Ropivacaine alone or addition of 20µg-Fentanyl to 0.5%-Ropivacaine.

- **Heart Rate:** In this study, Heart rate was not significantly different at baseline, 5 min and 10 min, but significantly lower at 15 min, 20 min, 25 min and 30 min among the Group RD. Postoperatively Heart rate significantly lower at 1,2,3,6 hours and was not significantly different after 9 hours.
- **Systolic Blood Pressure:** In this study, The mean of the Systolic Blood Pressure were significantly different between the groups throughout.
- **Diastolic Blood Pressure:** In this study, The mean of the Systolic Blood Pressure were significantly different between the groups throughout.
- **Mean arterial blood pressure:** In this study, The mean of the Mean arterial blood pressure were significantly different between the groups throughout.
- **Respiratory Rate:** In this study, The mean of the Respiratory Rate were significantly different between the groups throughout.
- **Spo2:** In this study, The mean of the Respiratory Rate were significantly different between the groups throughout.

Dexmedetomidine (1mcg/Kg) can be combined with ropivacaine (0.2%) in epidural injection among patients undergoing open abdominal surgeries for its good post-operative analgesia, and hemodynamic stability.

CONCLUSION

Baseline characteristics such as age, gender, anthropometry and ASA status were not significantly different between the groups. Haemodynamic changes were comparable between the groups, except for a difference in heart rate at first hour between the groups.

Addition of demedetomidine with ropivacaine produces faster onset and complete analgesia and also prolonged the duration of analgesia Hence, Dexmedetomidine (1mcg/Kg) can be combined with ropivacaine(0.2%) in epidural injection among patients undergoing open abdominal surgeries for its good post-operative analgesia and better hemodynamic stability.

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