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# A COMPARATIVE STUDY OF EPIDURAL ROPIVACAINE 0.75% ALONE WITH ROPIVACAINE PLUS CLONIDINE AND ROPIVACAINE PLUS DEXMEDETOMIDINE FOR LOWER ABDOMINAL AND LOWER LIMB SURGERIES

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## ABSTRACT

**Aims and Objectives**:To compare epidural ropivacaine 0.75% alone and Ropivacaine 0.75% with alpha 2 agonists. Variables like block characteristics, hemodynamics, sensory and motor recovery, side effects are analysed. **Materials**: With Institutional ethical committee clearance, clinical Study conducted at R.L.J.H, Kolar. After obtaining informed written consent,90 patients of(American Society of Anaesthesiologists) ASA Grade I and II in age group 18 to 55 years, of either sex, posted for elective lower abdominal and lower-limb surgeries were selected. **Methods:**Patients were randomly allocated into 3 groups of 30 each.Epidural block was administered.Patients in group“R” received 19ml 0.75% ropivacaine with 1ml of normal saline. Group “RC” patients received 19ml 0.75% ropivacaine with 75microgram(mcg) clonidine while patients in group “RD” received 19ml0.75% ropivacaine with 75 mcg dexmedetomidine. Block characteristics like onset of analgesia, maximum level of sensory blockade, complete motor blockade, hemodynamics, time to two segment regression, time for rescue analgesia, time to complete motor recovery, side effects were analysed. **Results:** Results showed that onset of blockade is faster when additives are added like clonidine and dexmedetomidine. Time for two segment regression was 30-35minutes earlier in Group “RC”.(R<RC<RD). Time for rescue analgesia was longer in “RD” group(R<RC<RD). Group RC had mild sedation, group RD had moderate sedation with better analgesic profile when compared to other groups, except for incidence of bradycardia. **Conclusion**: Addition of alpha 2 agonists fastens the onset of action,better analgesia with dexmedetomidine ,insignificant incidence of sideeffects.

**Key Words:** epidural anaesthesia, ropivacaine, clonidine, dexmedetomidine.

## INTRODUCTION

Central neuraxial blockade in the form of epidural is very popular for lower abdominal and lower limb surgeries as these techniques avoids the disadvantages associated with general anaesthesia like airway manipulation, poly pharmacy and other untoward effects like postoperative nausea, vomiting, need for supplemental intravenous analgesics.

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 long duration.[1]

An ideal local anaesthetic in the epidural space should provide quick 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.[2]

Even though bupivacaine is popularly used in epidural space, the fear of inadvertent injection of the drug intravascularly resulting in cardiac arrest which is difficult to resuscitate is a major problem. Ropivacaine, the recently introduced long acting amide local anaesthetic derived from Bupivacaine is claimed to have lesser cardiovascular side effects due to it being the S-enantiomer. It is said to be better in its cardiovascular profile as patient can be revived from cardiovascular side effects ofropivacaine than when it occurs with bupivacaine.[4]

Because ropivacaine has to be given in larger doses to achieve the analgesic and anaesthetic effects, the addition of adjuvants like α-2 agonists, clonidine and dexmedetomidine can decrease the dose requirement and permit use of more diluted solutions for better analgesia and prevent side effects associated with larger doses of ropivacaine.[3,5]

The present study has been taken up to compare epidural ropivacaine 0.75% alone with ropivacaine plus clonidine and ropivacaine plus dexmedetomidine for lower abdominal and lower limb surgeries with respect to onset of analgesia, time to maximum sensory and complete motor blockade. time to two segment regression and complete recovery of motor blockade and duration of analgesia and monitoring of hemodynamics [Heart Rate (HR),

Mean Arterial Pressure (MAP), Saturation ($SpO_2$)]·

## MATERIALS AND METHODS

After obtaining the Institution ethical committee approval and written consent from the patients of a either sex, 90 patients of ASA I and II of age group between 18 -55 years undergoing lower abdominal and lower limb surgerieswere selected for study.

Patients physically dependent on narcotics, history of drug allergy to local anaesthetics, dexmedetomidine, clonidine, gross spinal abnormality, localized skin sepsis, hemorrhagic diathesis, head injury, hypertension, diabetic mellitus, cardiac, pulmonary, hepatic,renal disorders, peripheral neuropathy,psychiatric diseases were excluded from the study.

A prospective double blind randomized clinical study was carried out on all these patients. Patients were randomly divided into three groups of 30 each using computer generated random numbers.

Group “R”- Ropivacaine plus normal saline.
Group “RC” - Ropivacaine plus clonidine group.
Group “RD” - Ropivacaine plus dexmedetomidine group.
Patients were visited on the previous day of the surgery, a detailed clinical history was taken, General and Systemic examinations were done.The patients were explained about the epidural technique with catheter in situ, its advantages and disadvantages.

On the day of surgery in the pre-operative room, an intravenous line was secured and the patients were preloaded with 15 ml/kg Ringer’s lactate, 30 minutes prior to epidural anaesthesia. On the OT table, patient basal pulse rate and blood pressure, respiratory rate, $SpO_2$ were recorded.

The subjects were given epidural block in sitting position in $L_{2-3}$ or $L_{3-4}$ space with 18 gauge Touhy needle and epidural space localized and confirmed by loss of resistance technique. Epidural catheter was secured 3-5 cm into the epidural space.[11]

3ml of 2% lignocaine with adrenaline 1:2,00,000 was injected through the catheter as a test dose and observed for any intravascular or intra-thecal injection. After confirming correct placement of the catheter, epidural anaesthesia was activated with 19ml of 0.75% ropivacaine with 1ml of normal saline in Group “R”, group “RC” received 19ml of 0.75% ropivacaine

with 1ml of clonidine (75µgm made up to 1ml with normal saline), while group "RD" received 19ml of 0.75%ropivacaine with 1ml of dexmedetomidine (75 µgm made up to 1ml with normal saline).

Surgical procedure was initiated after establishment of adequate surgical analgesic effect with level of upto $T_6$-$T_7$ dermatome.The bilateral pin prick method was used to evaluate and check the sensory level while the Modified Bromage scale was used to measure motor blockade.

**Modified BromageScale(**Grade 0 - Full flexion of knees and feet,Grade 1 - Just able to flex knees, full flexion of feet,Grade 2 - Unable to flex knees, but some flexion of feet possible. Grade3 - Unable to move legs or feet).[14]

Standard monitoring was carried out in the form of pulse oximetry, ECG and non invasive arterial blood pressure.Patients were observed for hypotension, bradycardia and otheradverse effects such as anxiety, nausea, vomiting, pruritus,urinary retention, shivering, etc., recorded and the need foradditional medications were attended.

Sedation assessed by four point score described by Cherniket al.Grade 0 – patient wide awake.

Grade 1 – patient is sleeping comfortably, but responding to verbal commands,Grade 2 – deep sleep but arousable,Grade 3 – deep sleep, unarousable.Saturation were recorded every 5mins for first 20 mins, then every 15 minsintraoperatively.[12]

Post operative pain was assessed by Visual Analogue Scale (VAS). Duration of analgesia was assessed by VAS scores, more than 4 is considered for requirement of rescue analgesia.The onset of pain was managed with top up doses of 8ml of 0.75% ropivacaine plus 50 µgm of fentanyl through epidural catheter.At the end of the surgery, the vitals were recorded and sedation assessed.

Descriptive and inferential statistical analysis has been carriedout in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance.

Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Post-hoc Tukey test has been used to find the pairwise significance and Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

**Statistical software:** The Statistical software SPSS 15.0 was used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc**.**

## RESULTS

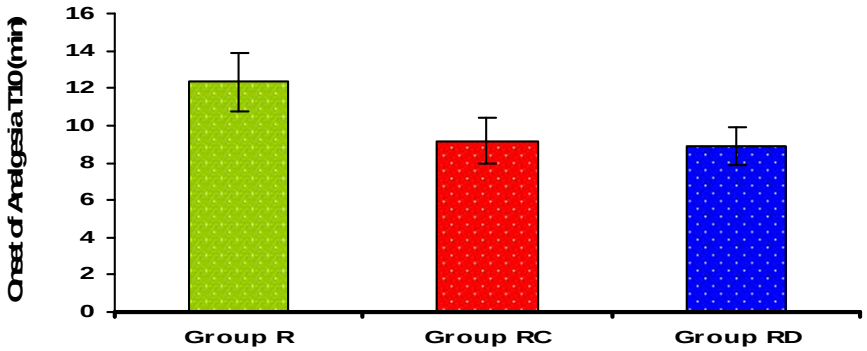
**Table1 : The demographic profile of patients of all 3 groups.**

| Demographic characteristics | Group R | Group RC | Group RD | P value |
|---|---|---|---|---|
| **Age (yrs)** | 24.87±7.91 | 36.20±7.93 | 36.47±9.04 | 0.728 |
| **Height (cms)** | 169.83±4.00 | 171.27±4.17 | 170.80±4.40 | 0.405 |
| **Weight (kgs)** | 63.07±7.03 | 64.63±9.08 | 59.70±5.93 | 0.037 |
| **ASA I/II** | 28/2 | 26/4 | 28/2 | 0.578 |

The three groups were comparable with regard to demographic data as shown in table1. There was no statistically significant variation between the three groups with respect to age, gender, height, weight, ASA grading( p>0.05).

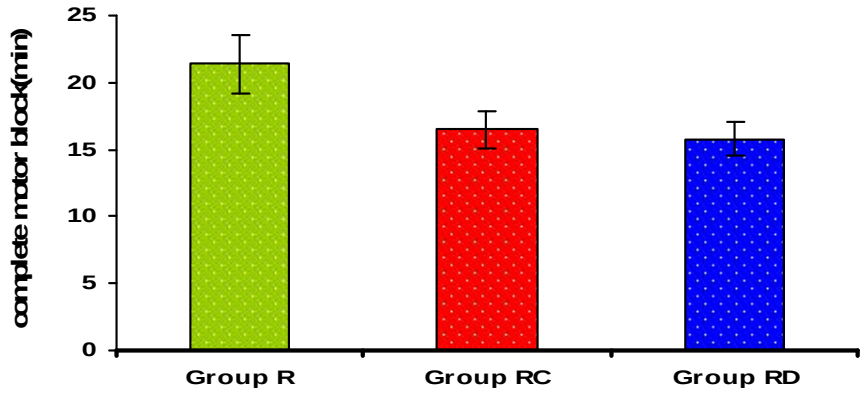
**Table 2: Comparison of block characteristics.**

| Variables | Group R | Group RC | Group RD | Overall P value | Significance | | |
|---|---|---|---|---|---|---|---|
| | | | | | Group R-Group RC | Group R-Group RD | Group RC-Group RD |
| **Onset of Analgesia T10 (min)** | 12.33±1.56 | 9.17±1.21 | 8.90±0.99 | <0.001** | <0.001** | <0.001** | 0.699 |
| **time to attain maximum sensory level(min)** | 16.00±1.78 | 13.63±1.96 | 13.03±1.33 | <0.001** | <0.001** | <0.001** | 0.366 |
| **complete motor block(min)** | 21.37±2.13 | 16.47±1.38 | 15.77±1.25 | <0.001** | <0.001** | <0.001** | 0.226 |




**Graph 1:Comparison of onset of analgesia between three groups.**

In our study the mean onset of analgesia in Group R was 12.33±1.56, in Group RC was 9.17±1.21 and in Group RD was 8.90±0.99, the mean time to attain maximum sensory level T6-T7 was 16.00±1.78 in Group R, 13.63±1.96 in Group RC and 13.03±1.33 in Group RD.

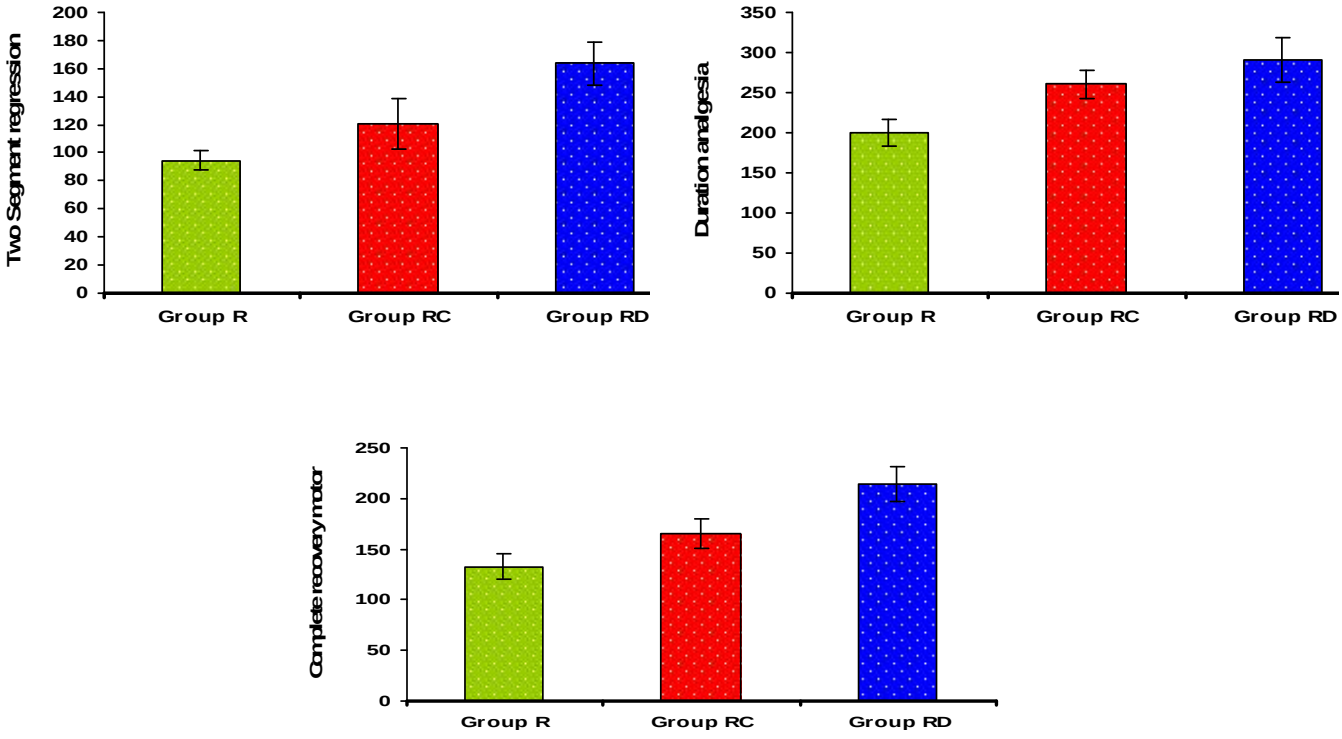



**Graph 2 : Comparison of complete motor blockade between three groups.**

**Mean time to complete motor blockade in Group R was 21.37±2.13min, group RC was 16.47±1.38min and in Group RD was 15.77±1.25min.**

**Table 3: Comparison of Study variables of three groups.**

| variables | Group R | Group RC | Group RD | Overall P value | Significance | | |
|---|---|---|---|---|---|---|---|
| | | | | | Group R-Group RC | Group R-Group RD | Group RC-Group RD |
| Two Segment regression(min) | 94.57±6.98 | 120.63±17.59 | 163.67±15.20 | <0.001** | <0.001** | <0.001** | <0.001** |
| Duration of analgesia (min) | 200.33±17.07 | 261.00±17.68 | 291.33±27.79 | <0.001** | <0.001** | 5.530 | 5.530 |
| Complete recovery of motor block (min) | 132.37±12.59 | 165.63±14.73 | 213.83±17.30 | <0.001** | <0.001** | 3.873 | 3.873 |




**Graph 3,4,5: Comparison of two segment regression, duration of analgesia, complete motor recovery between three groups respectively.**

In our study mean time to two segment regression(in min) was 94.57±6.98 in Group R, 120.63±17.59 in Group RC and 163.67±15.20 in Group RD, mean Duration of analgesia (in

min) was 200.33±17.07 in Group R, 261.07±17.68 in Group RF and 291.33±27.79in Group RD, mean time to complete motor recovery (in min) was 132.37±12.59 in Group R, 165.63±14.73 in Group RC and 213.83±17.3 in Group RD.

**Table 4: Comparison of Sedation score in three groups studied**

| Sedation score | Group R | | Group RC | | Group RD | |
|---|---|---|---|---|---|---|
| | No | % | No | % | No | % |
| 0 | 26 | 86.7 | 2 | 6.7 | 0 | 0.0 |
| 1 | 4 | 13.3 | 27 | 90.0 | 15 | 50.0 |
| 2 | 0 | 0.0 | 1 | 3.3 | 15 | 50.0 |
| Total | 30 | 100.0 | 30 | 100.0 | 30 | 100.0 |

P=<0.001**

Sedation score of 1 was observed in 13.3% patients in Group R, where as 90% patients in Group RC also showed score of 1. In Group RD 50% patients showed a score of 1 and 50% patients showed score of 2. It is clear that sedation was more in Group RD in comparison to other two groups.

**Table 5: Comparison of Side effects in three groups studied**

| Side effects | Group R (n=30) | | Group RC (n=30) | | Group RD (n=30) | |
|---|---|---|---|---|---|---|
| | No | % | No | % | No | % |
| Nil | 30 | 100.0 | 21 | 70.0 | 19 | 63.3 |
| Yes | 0 | 0.0 | 9 | 30.0 | 11 | 36.7 |
| Bradycardia | 0 | 0.0 | 4 | 13.3 | 10 | 33.3 |
| Dry mouth | 0 | 0.0 | 2 | 6.7 | 0 | 0.0 |
| Headache | 0 | 0.0 | 1 | 3.3 | 0 | 0.0 |
| Nausea vomiting | 0 | 0.0 | 1 | 3.3 | 0 | 0.0 |
| Shivering | 0 | 0.0 | 1 | 3.3 | 1 | 3.3 |
| Respiratory depression | 0 | 0.0 | 0 | 0.0 | 0 | 0 |

Side effects are significantly more in Group RC and Group RD withP=0.001**

## DISCUSSION

Among the local amide anaesthetic agent, ropivacaine is new local anaesthetic which is popular in the conduct of epidural anaesthesia. Recently there are numerous studies recently on the use of epidural ropivacaine for lower abdominal surgeries. However the addition of adjuvants to Ropivacaine during epidural are studied to less extent. Though ropivacaine is

slightly less potent when compared to bupivacaine, its pharmacological profile is almost comparable to the latter. Various studies and literary evidence have concluded that cardio toxicity of ropivacaine is far less than that of bupivacaine.[9]

In our study we used epidural ropivacaine 0.75% alone with ropivacaine plus clonidine and ropivacaine plus dexmedetomidine for lower abdominal and lower limb surgeries.

Clonidine augments the action of local anesthetics in regional blockade by interrupting the neural transmission of painful stimuli in Aδ and C fibres as well as augments the blockade of local anaesthetic agents by increasing the conductance of $K^+$ ions in nerve fibres. It also exerts vasoconstriction effect on smooth muscles, which results in a decreased absorption of the local anaesthetic agent and eventually prolongs the duration of analgesia.[12]

Dexmedetomidine appears to exert analgesic effects at the spinal cord level and at supraspinal sites. However there has been a considerable debate as to whether its analgesic effects are primary or simply opioid sparing. In comparison with hypnotic agents such as propofol or postoperative opioids used alone, Dexmedetomidine significantly decreases opioid requirement.[15]

Keeping all these pharmacological interactions in mind we have used clonidine and dexmedetomidine as an adjuvant not just covering the operative period, but also for post-operative period as well.

**Onset of analgesia (T10)**

Onset of anaesthesia was faster in group RD and Group RC when compared to Group R($p<0.001$), with no statistically significant variation in between Group RC and Group RD($p=0.699$).

In a study, they found that onset of analgesia was shorter in RD group along with prolonged duration of analgesia when compared to RC group with mean onset of 8.52±2.36 and in RC group was 9.72±3.44.[5]

**Time to attain maximum sensory level (min)**

This shows that time to attain maximum sensory level of T6-T7 was faster in Group RD when compared to Group R($p<0.001$) and Group RC($p<0.366$) which are statistically significant.

Similar results were obtained in studies, time to attain maximum sensory level with RD group was 13.14±3.96 and with RC group was 15.80±4.86.[13]

**Time to complete motor blockade**

In our study it was found that establishment of complete motor blockade was faster in Group RD when compared to Group R($p<0.001$) and Group RC($p<0.001$) which are statistically significant.

In a similar study, time to attain complete motor block level with RD group was 17.24±3.96 and with RC group was 19.52±4.06. this shows that addition of dexmedetomidine hastens the maximum motor block compared to clonidine.[5,13]

**Two segment regression, duration of analgesia and recovery of motor blockade**

In our study it shows that two segment regression was prolonged in Group RD when compared to other two groups with statistically significant difference.Duration of analgesia was significantly longer in Group RD when compared to Group R($p<0.001$), also there was significantly longer duration in Group RC when compared to Group R($p<0.001$). Time to complete motor recovery was significantly longer in Group RD when compared to Group R($P<0.001$) and Group RC($p<0.001$). While significance was observed between Group RC and Group R($P<0.001$). However from this it is observed that addition of additives like clonidine and dexmedetomidine intensifies the motor blockade.

Our results are in correlation with other studies conducted by where it is seen that addition of clonidine increases the duration of analgesia, has dose sparing effect when added to ropivacaine.[19]

**Sedation:** In Group RD 50% patients showed a score of 1 and 50% patients showed score of 2. It is clear that sedation was more in Group RD in comparison to other two groups.

**Side effects:** In our study Bradycardia was observed in 13.3% of patients in Group RC and 33.3% of patients of group RD, whereas none of the patients in Group R had bradycardia.

## CONCLUSION

The present study concludes that

1. Onset of anaesthesia was faster when additives like clonidine and dexmedetomidine are added to ropivacaine.

2. Maximum level of blockade achieved remains same. Time to attain maximum sensory level of T6-T7 and maximum motor blockade was faster when dexmedetomidine was used as additive when compared with clonidine.
3. Two segment regression, recovery of motor blockade were prolonged and duration of analgesia was prolonged with dexmedetomidinewhen compared to clonidine was used as an additive to ropivacaine delaying the need for rescue analgesia.
4. Epidural administration of clonidine 75µg and dexmedetomidine 75µg as additive to ropivacaine was associated with side effects like bradycardia and hypotension which were not imposing a major problem in hemodynamic profile.
5. Sedation was associated with epidural administration of both clonidine and dexmedetomidine but was more with dexmedetomidine.

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