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A Comparative study of Epidural Ropivacaine (0.75%) with Ropivacaine (0.75%) plus Clonidine for lower abdominal and lower limb surgeries.

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Conflicts of Interest: Nil

Abstract

Background: Epidural anaesthesia is one of the most common regional anaesthetic techniques used for lower abdominal and lower limb surgeries. Epidural anaesthesia provides effective surgical anaesthesia and can also achieve the extended duration of surgical needs, provides prolonged postoperative analgesia, lowers the incidence of hemodynamic changes. The quality and duration of analgesia is improved when a local anaesthetic is combined with alpha-2 adrenergic agonist as neuraxial adjuvants.

Aim: The aim of our study is to compare the effect of Clonidine when used as an adjuvant to epidural Ropivacaine in lower abdominal and lower limb surgeries.

Materials and Methods: A prospective randomized double blinded study was conducted in 60 patients of either sex between the ages of 20 and 60 years of (American Society of Anaesthesiologists) ASA I/II grade who underwent lower abdominal and lower limb surgeries. The patients were randomly allocated into two groups; Ropivacaine (R) and Ropivacaine + Clonidine (RC) and comprising of 30 patients each.Group R received 15 ml of Ropivacaine (0.75%) and group RC received 15 ml of Ropivacaine(0.75%) with Clonidine 75 µg epidurally. Onset of sensory analgesia using bilateral pin-prick method, onset of motor blockade using Bromage scale, time to two dermatome regression of sensory level, time to first demand for analgesia, intra operative hemodynamic parameters and complications were observed. Statistical analysis was done by chi-square test for qualitative data and unpaired student t-test for quantitative data using statistical package for social science (SPSS) version 19 for windows and value of $P < 0.05$ was considered significant and $P < 0.001$ as highly significant.

Results: The demographic profile and cardio-respiratory parameters were comparable and statistically non-significant in both the groups. The side effect profile was also comparable with a little higher incidence of nausea and dry mouth in both the groups which was again a non-significant entity ($P > 0.05$) . Clonidine group(RC) had rapid onset of sensory and motor blockade ($p<0.05$), prolonged duration of sensory and motor block ($p<0.05$) and postoperative analgesia ($p<0.05$).

Conclusion: Clonidine provided early onset and long duration of sensory analgesia and motor blockade, longer post-operative analgesia when used as. neuraxial adjuvant to epidural Ropivacaine

Key words: Clonidine , Epidural block, , Ropivacaine

Introduction

Intrathecal anaesthesia and epidural anaesthesia are the most popular regional anaesthesia techniques used for lower limb, lower abdominal surgeries. The advantage of epidural anaesthesia being it [1,2], provides prolonged postoperative analgesia; reduces the incidence of hemodynamic changes.

Recently Ropivacaine has been introduced as a new amide which has all advantages of Bupivacaine with less cardiac toxicity [3], it appear that it may be an ideal local anaesthetic for epidural anaesthesia[4].

Intraoperative hemodynamic stability, sedation, and an ability to provide smooth and prolonged postoperative analgesia are the main desirable qualities of an adjuvant in neuraxial anaesthesia[5].

The quality and duration of analgesia is improved when a local anaesthetic is combined with alpha2-agonist. Both Clonidine and Dexmedetomidine are alpha2 adrenergic agonist which have analgesic properties and potentiate local anaesthetic effect [6-8].

Neuraxial Clonidine enhances the action of local anaesthetic, increases the intensity and duration of analgesia. It has sedative properties while side-effects are hypotension, Bradycardia [9-11].

The purpose of this study was to compare sensory and motor characteristics, hemodynamic and analgesia potentiating effect of epidurally administered Clonidine when combined with Ropivacaine (0.75%).

Methods and Materials

After approval from institutional ethical committee and informed written consent of patients, present study was conducted in 60 patients of either sex belonging to ASA grade I or II between age group of 20 to 60 years undergoing lower abdominal and lower limb surgeries satisfying inclusion criteria: Patient age 20 – 60 yrs, ASA Grade I or II, Patient wt 40- 80 kg.

In this prospective randomized controlled study, patients were divided into two different groups (Each group include 30 patients). Exclusion criteria were Patient's refusal , Hypersensitivity to drugs used in our study, local Infection, Coagulation abnormalities, Significant neurological disease with sensory or motor deficit, History of psychiatric disease which is excluded by pe-operative history and basic investigation.

All basic laboratory investigations includes complete haemogram, bleeding time, clotting time, blood sugar, renal function test, urine routine and micro, serology etc. ECG and chest radiogram were asked for and reviewed in indicated patients.

All patients were kept nil by mouth for 6 hrs prior to anaesthesia. In morning of day of surgery, base line vital parameters were noted. Intravenous line was secured with all aseptic and antiseptic precautions and monitoring devices were attached which included heart rate, electrocardiograph (ECG), pulse oximetry (SpO2), non-invasive blood pressure (NIBP), respiratory rate and the baseline parameters were recorded. Inj. Ringer's lactate (RL) 500ml started. Inj. Glycopyrrolate 0.2 mg intramuscular was given as premedication half an hour before surgery in pre-anaesthetic room.

In the operation theatre, Inj. Ondansetron 4 mg given intravenously and baseline parameters were recorded and second pint of RL was started. In sitting position, epidural catheter was inserted through 18 gauge Tuohy needle into the epidural space at L_{2-3} intervertebral space using loss of resistance to air technique, epidural catheter was secured 3−4 cm into epidural space with all aseptic and antiseptic precautions. Test dose was given with 3 ml of Inj. 2% Lignocaine with Inj. Adrenaline (5mcg/ml) to exclude accidental intravascular or subarachnoid catheter position.

60 patients were allocated by computer generated randomization in 2 equal groups in

double blinded manner by an investigator with no clinical involvement in the trial. Even numbered patients received15 ml Ropivacaine(0.75%) – group R. Odd numbered patients received 15 ml Ropivacaine(0.75%) plus 75 µg Clonidine-group RC. Drug solutions were prepared by an anaesthesiologist who was blinded to the nature of the study in 20ml syringe.The patient were unaware about their study groups.The anaesthesiologist giving the epidural block as well as the observer who monitored the parameters were both blinded to the study drug. Both groups had received drugs epidurally, after 4 – 6 minutes of test dose according to their groups. The bilateral pin-prick method was used to evaluate and check the sensory level while a modified bromage scale (0 = no block, 1 = inability to raise extended leg, 2 = inability to flex knee and 3 = inability to flex ankle and foot) was used to measure the motor blockade effect after the epidural administration of the drugs. Surgical position was made approximately 25−30 minutes after administration of drugs in every patient with complete establishment of sensory and motor block. The following block characteristics were observed and recorded: initial period of onset of analgesia and motor blockade(modified bromage scale 1), the complete establishment of motor blockade(modified bromage scale 3), the time to two segment regression of analgesic level, total duration of analgesia(time to first feeling of pain). Onset of sensory analgesia was defined as the time taken to achieve loss of pin-prick sensation at T10 dermatome level from the end of injection of the study drug. Duration of analgesia was defined as the time taken from the onset of sensory block at T10 to the time of pain sensation at the surgical site with a visual analogue scale score of >3. Time to two dermatome regression was defined as the time interval from the sensory block at the highest dermatome to the regression of sensory blockade by two dermatomes. The sensory level was assessed every 15 min after 2 hour of epidural bolus injection till 2 dermatome regression of sensory level was observed. The time to motor blockade was defined as the time interval from the administration of epidural study drug to the achievement of grade 3 motor blockade in the lower limbs. The assessment for motor block was done every 3 min after administration of study drug till a block of Bromage grade 3 motor blockade was achieved.

When the anaesthetic effects of epidural blockade is inadequate to perform surgery satisfactorily, spinal anaesthesia was given with Inj. Bupivacaine Heavy (0.5%) according to weight and height and all these patients were excluded from our study.

After giving epidural anaesthesia, pulse rate, blood pressure, respiratory rate , Spo_2 were noted continuously and recordings were made every 5 min until 30 min, and at 10 min interval thereafter up to 60 min and then at 15 min interval for next hour and finally at 30 min in the third hour. If Hypotension occurs [B.P. < 90 mmHg systolic] then injection Mephentermine 9mg IV was given. If bradycardia occurs [pulse < 60 beats/min] then injection Atropine 0.3 mg IV was given.

Patients were also monitored for complications like nausea, vomiting, bradycardia, hypotension, dry mouth, shivering, respiratory depression, headache, dizziness, urinary retention etc. during intraoperative period. All patients were shifted to recovery room at the end of surgery and monitored. When there was a reversal of epidural block observed patients were shifted to ward. When VAS ≥ 5, first dose of post-operative analgesia was given in the form of Inj. Tramadol 1mg/kg + Inj. Bupivacaine 0.0625% (8ml) through epidural catheter. Then subsequent doses of post-operative analgesia were given with same drugs when VAS ≥ 5 through epidural catheter and it was removed after 24 hours of insertion.

Sample size was determined with the help of Open-Epi software version 3. Power (1-beta % chance of detecting) was considered 95% that means <5% chance of a false-negative conclusion. The ratio of sample size (group2/group1) was considered 1. By putting the mean and standard deviation value in Open-Epi software version 3, sample size was calculated which 50 were (25 in each group). I had taken total sample size 60(30 in each group) which was more than 50 calculated from reference study, which was essential for more significance of data.

Assumptions were that both the combinations of drugs in both groups(R and RC) were equivalent in the duration of sensory analgesia.

The statistical analysis was done by unpaired student t-test for quantitative data and chi-square test for qualitative data. In the present study, the data collected were entered into a master chart and statistical tables were prepared. In order to compare the quantitative data, mean and standard deviation were computed. The equality of the mean value of the two groups were tested by applying Unpaired student's 't' test. All statistical calculations P Value < 0.05 statistically 'significant.'

P Value > 0.05 statistically 'not significant.'

The all data were analysed using SPSS version 19 and Microsoft Excel 2013 (IBM). P value was calculated and interpreted as-

Value of P < 0.05 statistically significant and P < 0.0001 as highly significant.

Results

The present study was conducted in 60 patients of either sex belonging to ASA Grade I or II in age group of 20 to 60 years. Patients undergoing lower abdominal and lower limb surgeries under epidural anaesthesia were selected for this study. Patients were randomly divided into two groups: R and RC receiving Ropivacaine(0.75%) and Ropivacaine (0.75%) plus Clonidine respectively (30 patients in each group).The statistical analysis was done by Unpaired student's 't' test for quantitative data and chi-square test for qualitative data.

Both groups were comparable for demographic profile as there was no significant difference between the two groups in respect to age and sex distribution [figure 1], and weight characteristics. Mean duration of surgery was comparable in both the groups and statistically non-significant (P > 0.05) [table 1].

Table - 1: The Demographic Profile of Patients of Both Study Groups.

Particulars	Group RC	Group R	P value	Significant
	Mean± SD	Mean± SD		
Age (years)	46.30±12.1	47.86±9.30	0.5777	Not Significant
Weight (kg)	55.33±5.61	55.53±6.34	0.8975	Not Significant
Duration of surgery (minutes)	112± 30.91	102± 21.35	0.1502	Not Significant

In Group RC 20% of the patients were male and 80% of the patients were female. In Group R 23.33% of the patients were male and 76.67% of the patients were female [figure1].

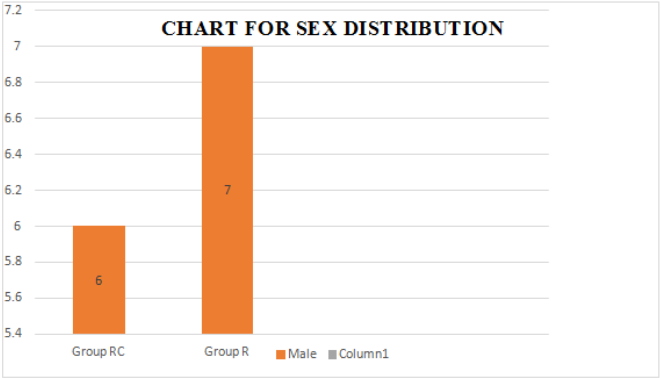

Figure 1: chart for sex distribution of both study groups.

There is a significant difference in the block characteristics between the two groups.

The onset and duration of sensory blockade was found to be earlier and prolonged respectively in Group RC than in

Group R, which was statistically significant. Thus, Clonidine provided early onset and prolonged duration of sensory blockade when used as a neuraxial adjuvants, which was statistically significant[table 2].

Table – 2: Comparison of Sensory Blockade of Both Study Groups.

Particulars	Group RC (MEAN ± SD)	Group R (MEAN ± SD)	P value	Significant
Sensory block at T_{10} level (second)	525.66 ±90.57	615 ± 97.21	0.0005	Highly Significant
Time to two segment dermatomal regression (minutes)	137.16 ± 12.88	126.76 ± 12.44	0.0022	Significant

We found significant difference between the two groups in terms of onset of motor blockade [table 3].

Table – 3: Comparison of Motor Blockade of Both Study Groups.

Particulars(min)	Group RC (MEAN±SD)	Group R (MEAN±SD)	P value	Significant
Time of onset of motor blockade (modified bromage 1 in second)	522±156.38	603.33±125.14	0.0300	Significant
Time to complete motor blockade(modified bromage3 in minutes)	23.76±4.56	26.70±5.81	0.0333	Significant

Though there was significant decrease in Heart rate[figure 2] by approximately 20% between 30 and 45 minutes of epidural injection in both groups, there was no significant difference in the fall in Heart rate between two groups (P>0.05).

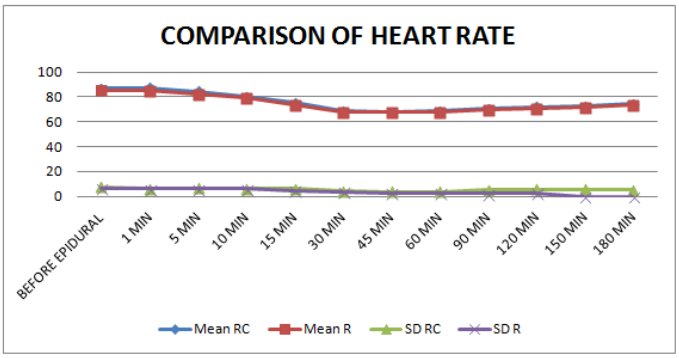

Figure 2: comparison of heart rate in both study groups over time.

We also found significant fall in mean arterial pressure [figure3] by approximately 15% between 30 and 45 min in both groups, however there was no significant difference in the occurrence of hypotension between the two groups (P > 0.05).

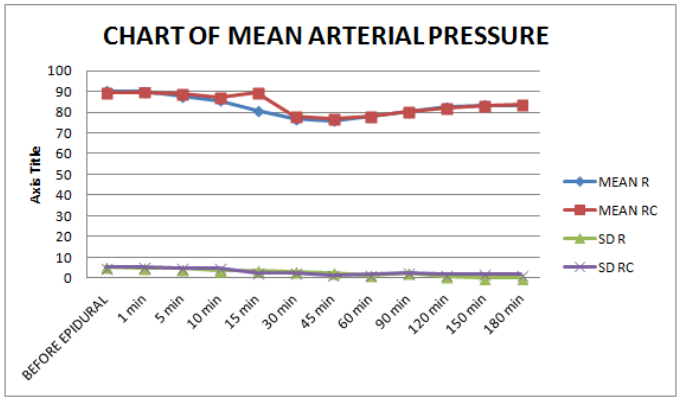

Figure 3: comparison of mean arterial pressure of both study groups over time.

Clonidine provided a smooth and prolonged post-operative analgesia when used as a neuraxial adjuvant [table 4].

TABLE – 4: Comparison of Total Duration of Analgesia of Both Study Groups

Particulars	Group RC Mean ± SD	Group R Mean ± SD	P value	Significant
First feeling of pain (min)	344±24.94	311±28.20	0.0001	Highly Significant

The comparative incidence of various side effects in both the groups were observed in the intra-op and post-op period. There was slight higher incidence of nausea in

both groups but statistically non-significant. The incidence of other side effects like dry mouth, vomiting, headache, shivering and dizziness were comparable in both the groups and statistically non-significant. We did not observe the respiratory depression in any patient from either group.

Discussion

Epidural anaesthesia is considered as a gold standard technique as it provides complete and dynamic anaesthesia. The benefits include suppression of stress response by sympatholysis, stable haemodynamics with reduction in cardiac morbidity, reduction in pulmonary complications due to active physiotherapy and early mobilization, reduced blood loss and decrease in thromboembolic complications following surgery [12].

The addition of adjuvants like α_2-agonists provide [13] the rapid establishment of both sensory and motor blockade, prolonged duration of analgesia into the post-operative period, dose-sparing action of local anaesthetics and stable cardiovascular parameters makes these agents a very effective adjuvant in regional anaesthesia [14-18].

Motor blockade tends to be denser with α2-agonists. It is also devoid of respiratory depression, pruritus, nausea, and vomiting [19].

The present study was undertaken to evaluate the effect of Clonidine as an adjuvant to epidural Ropivacaine in patients undergoing lower abdominal and lower limb surgeries.

Patients were randomly divided in two groups according to inclusion criteria and they received drugs epidurally according to their groups.

In our study, mean age, weight, sex distribution and duration of surgery, hemodynamic parameters were comparable among both the groups (P>0.05).

The onset of sensory blockade at T_{10} was found to be earlier in Group RC(525.66 ± 90.5 seconds) than in Group R(615 ± 97.21 seconds) which was statistically **highly significant (P<0.001).**This finding was consistent with the previous observations made by **Bajwa et al [20],** who found that the onset of sensory analgesia at T10 was faster in the group RC receiving Clonidine an adjuvant (8.64 ± 2.56 min) when compared with patients receiving Ropivacaine alone (11.36 ± 3.30min) and this was also associated with a faster and higher level of sensory blockade, which supported our findings.

The mean time for two segment regression was **significantly** prolonged **(P<0.05)** in Group RC (137.16 ± 12.88min) as compared to Group R (126.76 ± 12.44min)**.** Thus, time for two segment regression was markedly prolonged when Clonidine used as an adjuvant. This finding was consistent with the previous observations made by **Bajwa et al[20],** who found that time for two segment regression was more in the groups receiving clonidine(136.46±8.12min)as an adjuvant when compared with groups receiving Ropivacaine alone(128.08±7.54min).

Motor block was assessed by modified bromage scale. In our study, time of onset of motor blockade (modified bromage scale 1) was 522±156.38 seconds in Group RC while 603.33±125.14 seconds in Group R. Time of complete motor blockade (modified bromage scale3) was earlier in Group RC which was 23.76 ± 4.56 minutes as compared to 26.70±5.81 minutes in Group R. So, the differences in onset of complete motor blockade between the groups were statistically **significant (P<0.05)**. Our finding is consistent with previous observations done by **Bajwa et al[20],** who found that patients receiving Clonidine as adjuvant (17.34 ± 4.48 min) achieved grade 3 motor blockade in less time than those receiving Ropivacaine alone (21.70 ± 4.20 min).

We have observed, decrease in heart rate from baseline to end of surgery in both the groups but there was significant

fall approximately by 20% in 30 - 45 minutes after epidural injection in both the groups. However there was no significant difference in fall in heart rate between two groups (p>0.05). There was significant fall in mean arterial pressure approximately by 15% in 30-45min after epidural injection. However this change was not statistically significant between two groups (P> 0.05). Thereafter, the heart rate remained stable with hardly any fluctuation in either of the groups which is statistically nonsignificant (*P* > 0.05). Only one patients in R group and two patients in RC group had incidence of bradycardia with heart rate of <55 beats/minute and atropine had to be given in bolus doses of 0.3 mg

Similar observations were observed by **Bajwa *et al* [20],** But after 20 minutes of anesthetic dose, maternal heart rate kept on increasing in the R group but got stable in RC group and started decreasing thereafter which was statistically significant (P < 0.05). This can be possibly due to the higher dose of clonidine. The difference in the heart rate remained significant till regression of anesthetic effect in both the groups until 2 hours. Thereafter, the heart rate remained stable with hardly any fluctuation in either of the groups which is statistically nonsignificant (P > 0.05). Only two patients in R group and four patients in RC group had incidence of bradycardia with heart rate of <55 beats/minute and atropine had to be given in bolus doses of 0.3 mg. The mean arterial pressure showed statistically significant difference (P < 0.05) in both the groups which coincided with the increasing sensory blockade in both the groups. This can be possibly due to the hypotensive action of higher dose of clonidine in the RC group. But once the sensory and motor blocks were completely established, there was no significant difference of systolic BP in either of the groups (P > 0.05).

The difference in total duration of analgesia was **highly significant** between the two groups (**P<0.001).** Thus postoperative analgesia (time for first feeling of pain) was significantly prolonged in Group RC (344±24.94 minutes) when Cloidine used as an additive with Ropivacaine as compared to Group R (311±28.20 min) where Ropivacaine alone is used. This was found to be consistent with the study done by **Bajwa *et a*[24]** where they found a significantly longer time to first rescue top up in the RC group than the R group.

There was higher incidence of nausea in both groups but not statistically significant.No any complications like dry mouth, vomiting, bradycardia, hypotension, shivering, respiratory depression, headache, dizziness, urinary retention found during intraoperative or postoperative period among both groups.

The study conducted by **Bajwa *et al*[20],** showed a higher incidence of nausea and dry mouth during the postoperative period

Conclusion

From this study, we concluded that Clonidine may be useful as an adjuvant to epidural Ropivacaine because of its early onset and long duration of sensory and motor blockage, longer post-op analgesic effects.

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