# Comparative Study between Intrathecal Isobaric Ropivacaine with Clonidine and Isobaric Ropivacaine with Dexmeditomidine on Haemodynamic Parameters, Onset and Duration of Analgesia in Patients Undergoing Elective Infraumbilical Surgeries: Randomized Double-Blind Study

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## ABSTRACT

**INTRODUCTION**

There is a limited number of studies that have compared the effectiveness of dexmedetomidine and clonidine as additional substances to ropivacaine 0.5% in spinal anesthesia. The aim of present randomized control trial is to compare between intrathecal isobaric ropivacaine with clonidine and isobaric ropivacaine with dexmeditomidine in patients undergoing elective infraumbilical surgeries.

**MATERIAL AND METHODS**

The present randomized double blind control study was conducted at Department of Anesthesia, Shridevi Institute of Medical Sciences and Research Hospital, Sira road, Tumkur. Among 50 patients who underwent infraumbilical surgeries during the study period of one year. Patients were divided into two groups of 25 each on the basis of adjuvant given. Effect on motor and sensory blocakage as well as on haemodynamic parameters were noted.

**RESULTS**

That all the two groups are comparable regarding mean values of age, weight, height and BMI (P>0.05) was statistically insignificant with P value 0.98. Time to reach T10 level was statistically not significant with p value. Time to reach motor onset was statistically not significant with p value 0.23. Total duration of sensory block was 395.23±59.8 in group RD and 629.21±32.1 in group RC and results were significant wit p value 0.000 whereas total duration of motor block was 545.21±21.2 and in group RC was 601.23±20.4 and results were significant with p value 0.000. Comparison of heart rate was statistically significant when compared between group RD and group RC. Similarly, there were statistically significant variation in the mean arterial pressures, SBP and DBP between both the groups at various time intervals.

**CONCLUSION**

Intrathecal isobaric dexmedetomidine demonstrated greater anesthetic effects in terms of the duration of sensory blockade, motor blockade, and haemodynamic parameters when compared to isobaric clonidine.



**KEYWORDS:** Clonidine, dexmeditomidine,infraumbilical surgeries, intrathecal, randomized controlled trial, ropivacaine.

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## INTRODUCTION

Pain is regarded as one of the most unpleasant stimuli that a living organism may experience. Among the most excruciating instances of pain are surgical procedures.[1] Due to advancements in the field of anesthesia, many procedures are currently employed to relieve pain during the peri-operative period. Intrathecal anesthesia has superseded general anesthesia as the primary approach for administering anesthesia in lower abdomen and lower limb procedures due to its cost-effectiveness and ease of administration.[2] Local anesthetics are the most often utilized substances for spinal anesthesia.

Ropivacaine, an amide local anesthetic, was licensed by the Food and Drug Administration (FDA) in 1997. However, it has been widely used in India since 2009. Ropivacaine is known for its high pKa and low lipid solubility, which has contributed to its appeal as an intrathecal agent. Due to its lower cardiotoxicity and higher threshold for central nervous system (CNS) toxicity, it is regarded a viable option as a long-acting local anesthetic compared to bupivacaine.[3] The intrathecal administration of ropivacaine has been infrequently described.[4] According to reports, injecting plain (glucose-free) ropivacaine into the spinal canal at doses of 15 and 22.5 mg resulted in a sensory block of varying degrees. Some patients required general anesthesia due to insufficient spread of the block.[5,6]

Clonidine, a specific partial α2 - adrenergic agonist, is currently undergoing thorough evaluation as a supplement to intrathecal local anesthetics. It has been shown to be a powerful pain reliever without any adverse effects associated to opioids.[7] It is recognized to enhance both the sensory and motor suppression caused by topical anesthetics. Intrathecal clonidine has been utilized as a supplementary agent to local anesthetics in diverse surgical interventions, with no notable adverse effects of clinical significance. Prior research has documented the utilization of clonidine within a broad spectrum (15—150 mcg).[8]

Dexmedetomidine is a recently developed medicine that specifically targets α2 adrenoceptors. It has received approval from

the Food and medicine Administration (FDA) for use as an intravenous sedative and analgesic in intubated patients in intensive care units. The α2:α1 selectivity of this compound is eight times greater than that of Clonidine.[9] The aim of present randomized control trial is to compare between intrathecal isobaric ropivacaine with clonidine and isobaric ropivacaine with dexmeditomidine in patients undergoing elective infraumbilical surgeries.

**MATERIAL AND METHODS**

The present randomized double blind control study was conducted atDepartment of Anesthesia, Shridevi Institute of Medical Sciences and Research Hospital, Sira road, Tumkur. Among patients who underwent infraumbilical surgeries during the study period of one year. Ethical clearance was taken from institutional ethics committee before commencement of study. Patients were asked to sign an informed consent form after explaining them the complete procedure.

Stratified random sampling using computer generated and on numbers. Patients satisfying the eligibility criteria will be enrolled into the study after obtaining written informed consent and randomised into two study groups.

**Inclusion Criteria**

1. Patient of either gender aged between 18 to 60 years.
2. Patient with ASA (American Society of anaesthesiologists) grade I and grade II
3. Patient with BMI (body mass index) of 18kg /$m^2$ to 30kg/$m^2$.

**Exclusion Criteria**

1. Patient with severe bronchopulmonary, cardiovascular and neuromuscular diseases, bleeding disorders, spine deformity and local sepsis.
2. Patient allergic to either of the drugs (ropivacaine).
3. Patient refusal.

Sample size was calculated considering the time of onset and duration of sensory and motor blockade (time in minutes) i.e. 50 patients

$n=2(Z_{\alpha/2}+Z_{\beta})^2*\sigma^2/\delta^2$

Where:

$n$=requiredsamplesizepergroup

$Z_{\alpha/2}$=Z-value for the desired level of significance (usually 1.96 for a 2-sidedtestatα= 0.05)

$Z_{\beta}$=Z-value for the desired power (typically 0.84 for 80% power or 1.28 for 90% power)

$\sigma$=standarddeviationoftheoutcomemeasure

$\delta$=minimumclinicallysignificantdif ferencetobedetectedbetweenthe groups

Standard deviation ($\sigma$) = 3.23

Minimumclinicallysignificantdifference($\delta$)=2.5

$Z_{\alpha/2}$=1.96(foratwo-sidedtestatα=0.05)

$Z_{\beta}$=0.84(for80%power)

Group RD-(n=25) Patient received INJ. ROPIVACAINE 0.5% Isobaric 3ml and INJ.DEXMEDITOMIDINE5mcg.

Group RC -(n=25) Patient received INJ. ROPIVACAINE 0.5% ISOBARIC 3ml and INJ. CLONIDINE 30mcg.

After thorough pre-anesthetic check -up with detailed clinical history general and systemic examination,all patients were kept nil peroral for 6 hours. Written and informed consent was obtained from patient and patient attenders.

Spinal anesthesia is planned to be performed in sitting position at L3-L4 level using 25-gaugeQuinckeneedle.3mlof0.5%Isobaricropivacainewithdexmedetomidine5mcgand3mlof 0.5% isobaric Ropivacaine with clonidine 30mcg was injected intrathecally to Group RD and Group RC respectively .

Sensory and motor block was assessed every minute until the maximal level of block is achieved, thereafter every 2mins for first 10mins and 15 minutes for first 1 hr., every 30mins intraoperativelyandhourlypost-operativelyuntilcompleterecedeofspinalanesthesia.Thehighest dermatomal level of sensory blockade and recovery time of both sensory and motor blockade will be recorded. Sensory

blockade was assessed by pin prick test at each dermatomal level.

Motorblock was assessed using modified Bromagescale.
Modified Bromagescale

| Grade | Criteria | DegreeofBlock |
|---|---|---|
| 0 | Freemovementoflegsandfeet | Nil (0%) |
| 1 | Kneeflexiondecreasebutfullflexionoffeetandankle | Partial (33%) |
| 11 | Unabletoflexknees, flexionofankleandfeetpresent | Partial (66%) |
| 111 | Unableto flex kneeorankleormoveToes | Completeparalysis(100%) |

Patient's Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure, Mean Arterial Pressure and saturation was recorded afterspinal anesthesia every 2 minutes for first 10mins , 15minutes till first hour, thereafter every 30 minutes intraoperatively and every hour postoperativelyuntil completeregressionofmotorandsensoryblockade.Incaseofbradycardia,Inj Atropine 0.6mgiv was administered.

The software SPSS version 25 was utilized. Statistical procedures such as the Kruskal-Wallis test and one-way ANOVA were employed. If the p-value is less than 0.05, it signifies statistical significance.

**RESULTS**

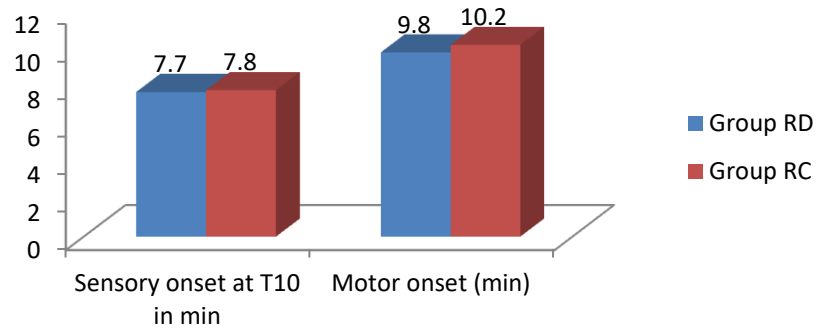
That all the three groups are comparable regarding mean values of age, weight, height and BMI (P>0.05) was statistically insignificant with as shown in table 1.



| Characteristics | Group RD | Group RC | P value |
|---|---|---|---|
| Age (years) | 40.5±11.3 | 38.9±10.2 | 0.28 |
| Height (cm) | 162.3±3.8 | 163.4±2.3 | 0.54 |
| Weight (kg) | 58.7±6.5 | 60.4±6.8 | 0.46 |
| BMI | 28.45±2.6 | 29.38±4.7 | 0.57 |
| ***Table 1: Baseline characteristics of patients*** | | | |

Time to reach T10 level was statistically not significant with p value 0.65. Time to reach motor onset was statistically not significant with p value 0.23as shown in table 2 and graph 1.

| Intraoperative variable | Group RD | Group RC | P value |
|---|---|---|---|
| Sensory onset at T10 in min | 7.7±1.3 | 7.8±1.2 | 0.65 |
| Motor onset (min) | 9.8±1.8 | 10.2±1.5 | 0.23 |
| ***Table 2: Comparison of intraoperative variables*** | | | |

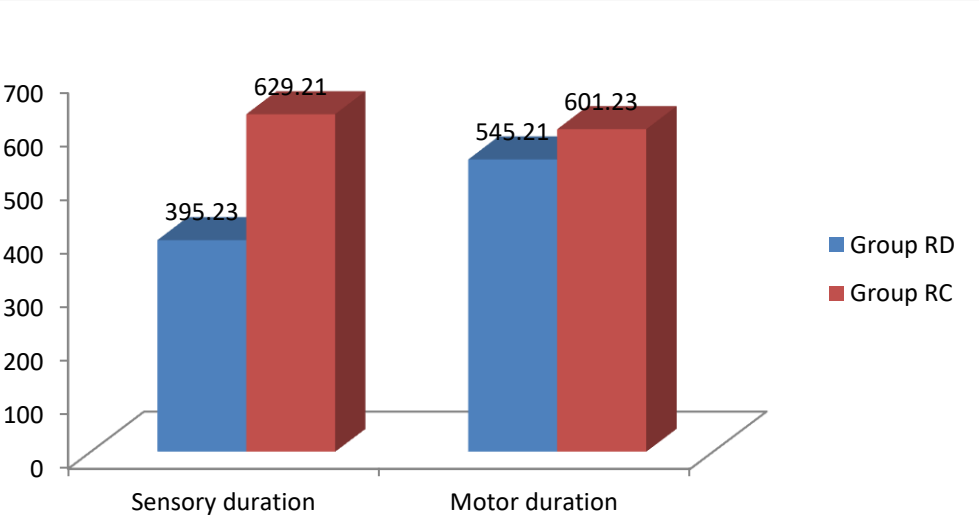



***Graph 1: Comparison of intraoperative variables***

Total duration of sensory block was 395.23±59.8 in group I and 629.21±32.1 in group II and results were significant wit p value 0.000 whereas total duration of motor block was 545.21±21.2 and in group II was 601.23±20.4 and results were significant with p value 0.000 as shown in table 3 and graph 2.

| Duration | Group RD | Group RC | P value |
|---|---|---|---|
| Sensory duration | 395.23±59.8 | 629.21±32.1 | 0.000 |
| Motor duration | 545.21±21.2 | 601.23±20.4 | 0.000 |

***Table 3: Comparison of total duration of sensory and motor block***




***Graph 2: Comparison of total duration of sensory and motor block***



Haemodynamic parameters basal Heart Rate (HR), systolic blood pressure, diastolic blood pressure and Mean Arterial Pressure (MAP) were found to be comparable in three group of patients. Heart rate was found to be lower in group II patients from the 1st minute post spinal to the end of surgery which was statistically significant. Similarly, there were statistically significant variation in the mean arterial pressures between both the groups at various time intervals as shown in table 4.

| TIME | Heart Rate | | Systolic Blood Pressure | | Diastolic Blood Pressure | | Mean Arterial Pressure | |
|---|---|---|---|---|---|---|---|---|
| | RD | RC | RD | RC | RD | RC | RD | RC |
| Baseline | 90.86±5.4 | 91.88±1.7 | 130.23±3.8 | 131.23±2.8 | 89.32±5.4 | 90.34±3.9 | 86.4±3.2 | 89.45±2.0 |
| 0Min | 90.84±5.2 | 91.76±1.5 | 131.33±5.3 | 132.13±1.3 | 90.12±4.4 | 91.34±4.9 | 85.4±1.2 | 89.35±1.0 |
| 2Min | 91.78±2.1 | 88.43±2.2 | 130.23±3.8 | 131.23±2.8 | 89.32±5.4 | 90.34±3.9 | 80.5±4.5 | 87.23±4.3 |
| 4Min | 88.28±1.1 | 87.33±1.2 | 130.23±3.8 | 131.23±2.8 | 89.32±5.4 | 90.34±3.9 | 78.23±1.4 | 78.13±2.3 |
| 6Min | 85.58±2.0 | 80.43±5.3 | 130.23±3.8 | 131.23±2.8 | 89.32±5.4 | 90.34±3.9 | 74.21±1.0 | 73.10±3.3 |
| 8Min | 82.13±1.1 | 75.13±1.2 | 130.23±3.8 | 131.23±2.8 | 89.32±5.4 | 90.34±3.9 | 72.17±1.5 | 67.23±4.3 |
| 10Min | 80.2±3.2 | 70.4±4.7 | 123.13±2.8 | 124.03±2.6 | 83.22±6.4 | 84.14±2.4 | 70.2±4.5 | 80.1±4.2 |
| 15Min | 77.2±4.3 | 75.6±3.1 | 122.13±3.2 | 121.23±1.3 | 82.13±6.4 | 82.10±4.1 | 79.45±6.1 | 81.20±2.7 |
| 30Min | 79.23±2.1 | 75.12±2.4 | 121.03±4.3 | 121.44±3.5 | 82.34±5.4 | 82.45±4.9 | 77.32±2.6 | 80.1±2.6 |
| 45Min | 78.21±1.4 | 76.87±1.8 | 130.23±3.8 | 131.23±2.8 | 89.32±5.4 | 90.34±3.9 | 73.25±2.4 | 79.13±0.3 |
| 1Hour | 76.89±2.4 | 77.65±2.1 | 120.45±1.8 | 120.25±2.9 | 81.25±5.3 | 81.24±3.9 | 72.63±5.4 | 78.76±2.3 |
| 1hour30mins | 77.34±2.0 | 79.23±2.3 | 130.23±3.8 | 131.23±2.8 | 89.32±5.4 | 90.34±3.9 | 80.25±1.3 | 80.13±5.3 |
| 2hr | 80.0±5.0 | 84.5±2.1 | 120.19±2.8 | 120.23±2.6 | 80.42±7.4 | 80.28±1.9 | 84.56±34.6 | 82.14±2.5 |
| 3hr | 81.0±3.6 | 85.5±2.1 | 120.13±1.8 | 120.03±2.5 | 81.24±5.5 | 81.45±1.9 | 85.23±2.6 | 82.03±1.2 |
| 4hr | 82.1±2.5 | 85.4±1.5 | 121.13±1.8 | 121.34±7.5 | 81.13±2.5 | 81.55±1.0 | 85.45±2.1 | 81.03±1.3 |
| 5hr | 82.1±3.1 | 86.7±2.0 | 121.45±6.8 | 121.04±2.6 | 82.14±4.5 | 82.65±2.0 | 86.76±4.3 | 82.14±2.1 |
| 6hr | 83.3±3.2 | 85.5±2.4 | 122.63±0.8 | 122.05±3.5 | 82.37±4.5 | 82.45±5.3 | 86.78±5.4 | 80.04±1.3 |
| 7hr | 83.4±4.9 | 85.3±2.4 | 122.03±2.7 | 122.33±1.5 | 83.14±6.5 | 83.15±5.2 | 87.25±4.4 | 84.24±3.2 |
| 8hr | 85.5±5.1 | 85.2±5.0 | 123.23±1.5 | 123.24±1.5 | 83.74±4.5 | 83.15±2.9 | 86.34±1.4 | 82.04±1.5 |

***Table 4: Comparison of haemodynamic parameters***



**DISCUSSION**

Ropivacaine is an amide local anesthetic that is less harmful to the central nervous system and cardiovascular system. It also allows for quick restoration of motor function. As a result, it is currently considered a viable substitute for bupivacaine. In prior investigations, the administration of simple ropivacaine through intrathecal injection resulted in a sensory block of varying magnitude. Additionally, a significant number of patients required general anesthesia in order to undergo surgery.[10]

Hyperbaric ropivacaine provides a more consistent and dependable sensory and motor block, with a quicker onset compared to a simple solution. As commercial hyperbaric ropivacaine preparations are not currently accessible, researchers are exploring the use of adjuvants added to isobaric solutions to address the limitations of plain ropivacaine. The impact of including fentanyl, clonidine, and dexmedetomidine on the sensory and motor block properties of pure ropivacaine has been investigated.[11]

The current study found that the average duration of operation was similar among patients in the two groups. Kujur S et al conducted a comparable study.[12] They supplemented ropivacaine, which was administered intrathecally, with clonidine and dexmedetomidine as adjuvants. The researchers examined this phenomenon in individuals who underwent lower limb procedures in the orthopedics department. Additionally, they yielded comparable outcomes in regards to the average duration of operation for the patients. Suthar O et al conducted a comparable trial in which they administered Clonidine and Dexmedetomidine as adjuvants to intrathecalropivacaine.[13] The researchers examined this phenomenon in individuals who undergone lower limb surgery. Furthermore,

they indicated that the mean duration of operation for patients in all three groups was similar.

ParmarNK et al conducted a research on individuals who were undergoing vaginal hysterectomy.[14] An adjuvant, dexmedetomidine, was used in the intrathecalropivacaine. Additionally, it was observed that the patients in both groups attained a similar level of peak sensory block. Oztin C et al conducted a study on women who were undergoing cesarean section.[15] Clonidine was included as an adjuvant to intrathecalropivacaine.

Additionally, they observed that there was no statistically significant difference between the two groups in terms of attaining sensory blackout. The period of time between administering the intrathecal medication and reaching motor block level 4 is referred to as the onset of motor block. The author noted that the duration was 9.8±1.4 minutes in group R, 10±1.4 minutes in group RC, and 10.5±1.5 minutes in group RD. The author did not find these differences to be statistically significant. ParmarNK et al. found that the duration of time in group R was 5.46±0.91 minutes, whereas in group D it was 5.54±0.85 minutes. The p-value for the difference between the two groups was 0.60. The duration of the present study was greater in comparison to the study conducted by ParmarNK et al.[14]

No other negative symptoms, such as shivering, vomiting, itching, or respiratory depression, were observed in any of the patients in either group. The combination of clonidine anddexmedetomidine with ropivacaine increased the duration of sensory anesthesia in this investigation, without affecting the start of sensory or motor blockade, or causing any alterations in hemodynamics.[16-22]

Limitations- Exercising utmost care is necessary during the medicine preparation process to avoid any form of contamination. The precise density of the drug could not be determined. However, the specific gravity of the manufactured medication was measured and found to be similar to the specific gravity of the solution indicated in the accessible literature. Furthermore, the total volume of the medicine delivered intrathecally varies when adjuvants are added.

## CONCLUSION

Our findings indicate that the addition of dexmedetomidine as an adjuvant to isobaric ropivacaine is more effective than clonidine in terms of prolonging the duration of sensory blockade, motor blockade, and analgesia. Administering dexmedetomidineisobarically, together with \ropivacaine, leads to a substantial increase in the duration of pain relief while reducing the occurrence of adverse effects. Furthermore, the administration of a low dosage of clonidine and dexmedetomidine did not result in any notable alterations in the cardiovascular system or adverse effects, thereby establishing their safety as intrathecal adjuvants.



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