RESEARCH ARTICLE

A Comparative Study of Epidural 0.75% Ropivacaine with Dexmedetomidine and 0.75% Ropivacaine Alone in Infra Umbilical Surgeries

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ABSTRACT

Background: Different adjuvants are currently being employed alongside local anesthetics to extend the duration of pain relief during and after epidural block procedures for infra-umbilical surgeries. Dexmedetomidine is a recently popular neuroaxial adjuvant that acts as an extremely specific α2 adrenergic agonist. The purpose of this research is to evaluate and contrast the impacts of combining epidural giving of 0.75% ropivacaine with dexmedetomidine to the effects of using 0.75% ropivacaine alone. The focus was on evaluating the cardiovascular, sedative with analgesics potentiating The facets of these treatments.

Methods: The research was randomized and studied in a double-blind, prospective fashion. It comprised 50 patients from the The individuals included in this study were classified as undertaking lower limb procedures were those who met the following criteria: Female, the age from 20 to 65, and holding American Society of Anesthesiologists Grades I and II. Informed agreement was given before the start of the study. Randomly, participants were divided into two groups, each consisting of 25 individuals. A 15 mL ropivacaine solution containing 0.75% was utilized to administrate epidural anesthesia to a group I (n = 25). In contrast, group II (n = 25) received the same 15 mL ropivacaine solution supplemented with 0.6 µg/kg of dexmedetomidine. The study compared two groups in terms of their hemodynamic changes and block characteristics. These characteristics included the time it took for analgesia to start at T10, the peak level of sensory perception analgesia achieved, the time it took for the sensory and motor block to reach their maximum levels, the time it took for the block to regress at the dermatome S1, and the time required to administer the initial quantity rescue effort analgesics to be administered within a 24-hour period.

Results: Sedation score (p = 0.001), motor block intensity (p 0.001), and onset of action (p 0.001) were all significantly greater in the dexmedetomidine group. Additionally, motor block duration (p 0.001) was significantly longer. No significant differences were observed in the occurrence of maximal pain relief, low BP, or slow HR ($p > 0.05$), according to the study. There was a negligible and comparable occurrence of adverse effects (such as vertigo, tremor, and SpO2<90%) across all categories ($p > 0.05$).

Conclusion: The research revealed noteworthy distinctions commencing with the inhibition of neural functions differs between the dexmedetomidine and ropivacaine groups, with dexmedetomidine producing more intense sustained motor block and sensory block. Both groups had greater sedation scores.

Keywords: Epidural, Infra-umbilical surgeries, Sensory block, Ropivacaine, Motor block, Dexmedetomidine.

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INTRODUCTION

For surgical procedures involving the lower abdomen and lower leg, intrathecal and epidural anesthesia are the most frequently utilized regional anesthetic techniques. The subarachnoid block, alternatively referred to as intrathecal anesthesia, possesses several limitations, including the short duration of anesthesia, the inability to extend anesthesia for longer surgeries, The prompt initiation of sympathetic blocking and the abbreviated duration of analgesia after the procedure.[1] Epidural anesthesia is currently the dominant form of Procedures requiring anesthesia for the lower abdomen and lower extremities.[2] In the context of epidural anesthesia,

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various local anesthetics are employed, with lidocaine and bupivacaine being the most prevalent in India.[3] Lidocaine is limited by its moderate duration of effect, whereas bupivacaine, Although it has a long-lasting impact, there is a greater risk of deadly cardiac toxicity if it is mistakenly injected into a blood vessel. This can result in severe cardiovascular collapse and toxicity to the central nervous system.[4]

As a consequence, researchers have been looking for medications that have the same blocking capabilities analogous to bupivacaine, albeit approaching a superior standard of safety. Ropivacaine and levo bupivacaine are two recently developed amide local anesthetics that have a greater safety margin and possess all the benefits of bupivacaine. Ropivacaine, a recently introduced local anesthetic, appears to be a valuable option for epidural anesthesia due to its ability to provide the same advantages as bupivacaine while having reduced cardiotoxicity.[5]

An examination of the pharmacokinetics of ropivacaine and bupivacaine.[6-9] Richard Arthur *et al.*[10] discovered that ropivacaine was found to be less potent compared to the direct administration of bupivacaine in an isolated vagus nerve in preparation. However, ropivacaine demonstrated a greater ability to block both A and C fibers compared to bupivacaine. Furthermore, a discrepancy has been identified between the lipid solubility of bupivacaine (3.9) and ropivacaine (2.9).[11] Therefore, we chose ropivacaine as the medication for our investigation.

Dexmedetomidine is a potent agonist that specifically targets the alpha two adrenergic receptors, exhibiting a binding affinity that is clonalidine is a factor of eight. As demonstrated by numerous investigations, clonidine dosage given in the epidural route is 1.5 to 2 times more than that of dexmedetomidine. Dexmedetomidine is utilized to reduce the amount of anesthetic and analgesic needed due to its analgesic properties and ability to enhance the effects of local anesthesia. An excellent comparison would be to evaluate the use of In lower limb and lower abdominal procedures 0.75% ropivacaine in combination with dexmedetomidine is superior to 0.75% ropivacaine alone.

In the context of anesthetic epidural, 0.75% for dexmedetomidine and ropivacaine infra umbilical interventions are investigated for their combined effect. Our primary objective is to examine the effects on vital signs such as dermatomal analgesia, potential adverse effects, alterations in hemodynamics, the initiation and the temporal extent of motor and sensory impairment.

MATERIALS AND METHODS

The study design incorporated a prospective, randomized, double-blind comparative trial that was conducted at VMKVMCH in Salem. About 50 adult patients representing both sexes were classified into two distinct groups, designated group I and II, for the purpose of conducting infra-umbilical operations while under epidural anesthesia. Fifty patients, classified as ASA classes I and II, were enrolled in the study. Surgical procedures involving the lower abdomen and lower extremities were planned for all of them as elective measures. A computer-generated randomization number was utilized to 25 patients per group.

Group 1 consisted of 25 participants who were administered 15 mL of 0.75% ropivacaine. The specific type of ropivacaine used was ropivacaine 0.75% preservative free, which was obtained from Neon Laboratories India Limited in 20 mL ampoules labeled as ROPIN 0.75%.

Group 2 (n = 25) received a solution containing 15 mL of ropivacaine at 0.75% and dexmedetomidine at 0.6 g/kg.

Adult patients, aged 18 to 60, of both sexes, who are classified as class I or II ASA are incorporated into the research and are scheduled for elective procedures involving the lower abdomen and lower limbs. The patients must weigh more than 50 kg and have a height between 150 and 180 cm. The study excludes patients who decline regional anesthetic, are pregnant or breastfeeding, are scheduled for emergency procedures, or have obesity with a BMI over 30. In addition, patients who have certain medical conditions such as increased pressure within the skull, severe low blood volume, bleeding disorders, local infections, uncontrolled high blood pressure or diabetes, neurological disorders or abnormalities of the spine, heart disease, liver disease, or allergies to local anesthetics and dexmedetomidine are also not included. These criteria guarantee that the attention remains on a certain group of patients while reducing the influence of extraneous factors that could impact the results of the study.

Procedures

Prior to surgery, A standard pre-anesthetic evaluation was performed the evening prior., encompassing various assessments. An exhaustive assessment of general information regarding the patient's medical history and well-being was incorporated in this evaluation, as well as an examination of the airway using the Mallampatti grading system. In addition, the patient's nutritional state, height, and weight were documented, and a comprehensive assessment comprising the examination of the CVS, RS and CNS was undertaken. Special attention was given to examining the spine. Moreover, comprehensive examinations were conducted on all patients, encompassing evaluation of random blood sugar, assessment of blood urea, estimation of hemoglobin, evaluation of hemorrhage time and clotting time, and evaluation of serum creatinine. Furthermore, a conventional 12-lead electrocardiogram was performed as a component of the pre-operative assessment routine to guarantee a thorough examination of the patient before surgery.

Technique

Patients were, prior to surgery, administered alprazolam and the drug ranitidine as premedication. The subjects' PR and baseline BP were meticulously monitored. After the administration of local anesthetic, a peripheral intravenous line was inserted into one of the upper limbs, and 500 mL of Ringer lactate solutions were utilized administered. A multi-parameter monitor was used to connect non-invasive measurements of

Mean arterial pressure, HR, oxygen saturation, BP, and a continuous electrocardiogram are all monitored. A test dosage of a 1:100,000 solution of catheter insertion was utilized to introduce 2% lignocaine to adrenaline into the epidural space.

Outcome Measures

The patients underwent assessments regarding motor and sensory inhibition at the conclusion of every minute and were repositioned into a supine posture. After the surgery, the vital signs were monitored every 15 minutes, and any negative Nausea, regurgitation, pruritus, and trembling were among the detrimental effects documented.

Statistical Analysis

SPSS version 21.0 was employed to conduct the statistical analysis. Range, standard deviation, and mean and proportion were precisely calculated in order to derive the descriptive statistics. The significance of the inferential statistics was assessed using a t-test and chi-square test. A threshold for significance will be established at a *p-value* below 0.05.

Blinding

Group assignment will remain concealed from both patients and the anesthesiologist who is tasked with administering the research solution. An unbiased anesthesiologist unequivocally affiliated with the undertaking will administer the solution preparation.

Ethical Considerations

The research was granted ethical clearance by the institutional ethics committee on January 30, 2020, under the designation VMC&H/IEC/20/28. Each participant shall be required to provide written informed consent.

RESULTS

Patients in both groups have 25 members each. Group 1 has more members under 30 and over 50, while group 2 has more members aged 31 to 40. Both groups have equal individuals aged 41 to 50. Overall, most members are aged 51 to 60 (44%). Both groups have a high proportion of males: 80% in group 1 and 84% in group 2. Overall, 82% of the sample are male. No significant difference was found *p-value*, which serves as an indicator, between the categories. of 0.713 from the Pearson Chi-square test. The American Society of Anaesthesiologists (ASA) patient classifications do not differ significantly between the categories.

Group 1 experiences sensory blockade on average in 20.400 + 1.528 minutes, while group 2 experiences it on average in 8.560 + 1.417 minutes, as shown in Table 1. The distinction among the following categories has statistical significance (p = 0.000). Group 1, consisting of 24,600+1.00 minutes, experiences the average initiation of motor obstruction time of 13.200+1.915 minutes. An observed disparity (p = 0.000) is statistically significant in the categories. Group 2 experiences a maximal level of sensory blockade in an average of 4.000+0.000 minutes, which is an increase of 0.000 minutes per participant. In contrast, the two categories do not differ significantly (p >0.05). Furthermore, the study reveals group 2 exhibits motor blocks of greater intensity. A statistically noteworthy difference (p >0.05) exists in between the dichotomies.

Table 1: Independent t-test to compare the two groups (n = 25 per group)

Parameters	*Group I*	*Group II*	*t*	*p-value*
	Mean ± SD	*Mean ± SD*		
Age (years)	45.68 ± 12.11	45.32 ± 10.25	0.113	0.91
Sex	1.200 ± 0.408	1.160 ± 0.374	0.361	0.72
Weight (Kgs.)	63.52 ± 5.88	63.72 ± 5.98	-0.119	0.906
height in cms	164.64 ± 6.92	165.28 ± 8.02	-0.302	0.764
ASA (1,2)	1.240 ± 0.436	1.240 ± 0.436	0	1
duration of surgery (mins)	110.8 ± 10.38	132.2 ± 17.08	-5.353	<0.001
Onset of sensory block to T10 derma	20.400 ± 1.528	8.560 ± 1.417	28.42	<0.001
Onset of motor block -modified Bromage scale grade 1 (mins)	24.6 ± 1	13.2 ± 1.92	26.386	<0.001
Maximum dermatomal level	4.000 ± 0.000	3.880 ± 0.332	1.809	0.083
Grade/ intensity of motor block	2.000 ± 0.000a	4.000 ± 0.000a		
Sedation score	1.000 ± 0.000a	3.000 ± 0.000a		
Modified Bromage scale grade 0 (minutes) motor blockade duration	236.8 ± 16	331.6 ± 28.38	-14.547	<0.001
Duration of sensory blockade (mins)	276.8 ± 16	411.6 ± 35.08	-17.48	<0.001

In comparison to group 2, the average duration to attain a maximal sedation score is 3.000 + 0.000a minutes in group 1. A noteworthy disparity exists between the two cohorts (p <0.05). Group 1 has an average motor blockade duration of 236.8 ± 16 minutes, while group 2 has an average of 331.6 ± 28.38 minutes. One notable distinction among the groups is (p = 0.001) are statistically significant. As both groups have zero standard deviations, adverse reactions such as vertigo, vomiting, pruritus, and trembling cannot be calculated.

Table 2 shows that group 1 consistently has significantly higher mean arterial pressure (MAP) compared to group 2 at all time points from baseline to 120 minutes. All differences are highly significant, with *p-value*s <0.001 at each interval.

Table 2: Different time intervals of MAP in two distinct populations (n = 25 per group)

Mean Arterial pressure	*Group I*	*Group II*	*t*	*p-value*
	Mean ± SD	*Mean ± SD*		
Baseline MAP @ 0 minute	95.32 ± 2.77	85.64 ± 6.64	6.73	<0.001
MAP @ 10 minutes	94.84 ± 1.18	84.24 ± 6.63	7.872	<0.001
MAP @ 20 minutes	92.92 ± 4.27	80.04 ± 4.68	10.168	<0.001
MAP @ 30 minutes	91.28 ± 4.01	78.96 ± 4.19	10.63	<0.001
MAP @ 40 minutes	90.36 ± 4.15	81.68 ± 4.77	6.865	<0.001
MAP @ 50 minutes	89.68 ± 4.38	80.56 ± 5.7	6.345	<0.001
MAP @ 60 minutes	88.92 ± 3.88	79.96 ± 5.79	6.425	<0.001
MAP @ 75 minutes	88.12 ± 3.07	79.88 ± 5.04	6.984	<0.001
MAP @ 90 minutes	86.4 ± 3.91	79.04 ± 5.47	5.478	<0.001
MAP @ 105 minutes	85.36 ± 3.01	79.76 ± 4.74	4.988	<0.001
MAP @ 120 minutes	83.88 ± 2.91	79 ± 4.24	4.745	<0.001

The SpO_2 levels between both groups consistently show SpO_2 levels of 100% at all time points, except for a minor difference at baseline, where group 1 has a mean SpO_2 of 100% and group 2 has 99.84%. This difference at baseline is not statistically significant (t = 1.693, $p = 0.103$). At all subsequent time intervals (10–120 minutes), both groups maintain SpO_2 levels of 100%, with no significant differences between them, indicating that SpO_2 levels remain stable and identical across both groups throughout the observation period.

DISCUSSION

Dexetomidine has been the subject of investigation by a multitude of authors as a local anesthetic adjuvant to epidural.[12] Insufficient research has been conducted in India to compare ropivacaine and dexmedetomidine as epidural anesthetics. By replacing the pipecoloxylidine group IV with a three-carbon side chain, ropivacaine exhibits a reduced lipophilic nature in comparison to bupivacaine.[4]

A higher incidence of inadequate motor blockade during surgery was observed in patients administered 0.5% ropivacaine compared to that administered bupivacaine, as reported by Casati *et al.*[13]

At T10, the average onset time for group 1 received sensory analgesia was 20.400+1.528 minutes, while in group 2 it was 8.560+1.417 minutes with $p < 0.001$ in this finding.

Saravia, Sabbag, *et al.* found that there was between the control and dexmedetomidine groups.[14] Following 24.6 ± 1 minutes, motor blockade commenced in group 1, whereas it commenced 13.2 ± 1.92 minutes later in group 2. Statistically speaking, it is noteworthy. Saravia, Sabbag, *et al.* found that there was no significant motor block between the control and dexmedetomidine groups.[14]

Statistically speaking, At T10, 8.52 ± 2.36 minutes passed before an anesthetic sensation was produced. According to a study by Bajwa SJ, Bajwa SK, Kaur J *et al*., the ropivacaine + dexmedetomidine group achieved a time reduction of 9.72 ± 3.44 minutes compared with the ropivacaine + clonidine group.[15] This finding is consistent with our own investigation.

Maximum sensory blockage was observed in group 2 (n = 5) at T4, whereas it was T5 in group 1. In both cohorts (T12-T4), the block range was extremely broad. The maximal In contrast to the T5–T7 locations reported for group RF, the degree of sensory blockage was detected at T4–6 in group RD.[16] This finding aligns with our own research.

The Ropivacaine + dexmedetomidine group exhibited a prolonged in our study compared to the Ropivacaine-only group in terms of duration of loss of sensory perception. The duration changes from 276.8 ± 16 minutes in the ropivacaine group to 411.6 ± 35.08 minutes in the ropivacaine + Dexmedetomidine group. The observed outcome possesses robust statistical significance ($p < 0.001$). Comparatively, comparing group RF to group RD, the average duration of analgesia was 242.16 ± 23.86 minutes *versus* 366.62 ± 24.42 minutes for group RF. This finding matches with other study's findings of Bajwa *et al.*[16] Ashok AG *et al.*[17] Kumar AB *et al.*[18] Ganesan A *et al.*[19] and Kumar DP*et al.*[20] have reported results comparable to those of the current study.

Four dexmedetomidine-treated patients who experienced bradycardia were administered 0.6 mg of atropine. The administration of intravenous fluids and injection mephentermine was performed on four patients in group I, while seven patients in group II exhibited significant hypotension.

CONCLUSION

Ropivacaine and dexmedetomidine are concurrent in terms of the initiation of impairment of both sensory and motor functions groups differed significantly, according to the study. The administration of greater motor inhibition was observed with ropivacaine and dexmedetomidine, extended duration of sensory block, and elevated sedative scores. The absence of adverse effects indicates that dexmedetomidine and ropivacaine may function as effective and risk-free agents for epidural blockade during Interventions that target the lower extremities and lower abdomen.

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