Research Article

Efficacy of 10µg Dexmedetomidine versus 75mg Magnesium Sulphate with 0.75% isobaric ropivacaine for spinal anaesthesia in infraumbilical procedures

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ABSTRACT

Introduction and Aim: The use of intrathecal adjuvants extends the block's duration, resulting in a higher success rate and increased patient satisfaction. Additionally, it offers acceptable pain control. Dexmedetomidine may be utilized as an epidural adjuvant with local anesthetic sparing properties. In the same way, magnesium's ability to block the NMDA receptor and calcium channel is crucial for anesthesia. The goal of this study was to determine the optimal combination of dexmedetomidine, ropivacaine, and magnesium sulfate for spinal anesthesia during infraumbilical surgeries.

Materials and methods: Seventy-two participants undergoing infraumbilical surgeries under spinal anesthesia aged between 21 and 60 years were considered. We randomly assigned participants to two groups: DR (isobaric ropivacaine hydrochloride (0.75%) with 10g of dexmedetomidine in 0.5 ml of normal saline) and MR (isobaric ropivacaine (0.75%) with 75 mg of magnesium Sulfate in 0.5 ml of normal saline).

Results: The mean onset duration, total duration of motor block, and total duration of analgesia were statistically significant ($p<0.05$). The mean heart rate, systolic blood pressure, and diastolic blood pressure were statistically not significant from the beginning to the end of the study ($p > 0.05$).

Conclusion: Compared to magnesium Sulfate, dexmedetomidine is a more effective adjunct to intrathecally administered ropivacaine in infraumbilical surgeries.

Keywords: Dexmedetomidine, ropivacaine, Magnesium sulphate, Pain management, motor block, sensory block

INTRODUCTION

Acute postoperative discomfort debilitates the patient by causing emotional and sensory distress and may indicate tissue damage (1). Effective postoperative pain management is crucial for patient comfort, speedy recovery, early mobilization, low cardiac and pulmonary complications, reduced deep-vein thrombosis, and reduced economic burden. Chronic pain and death may arise from poor pain management (2, 3). Many intrathecal adjuvants for local anesthetics increase spinal block quality and duration. Extensive operations and postoperative pain management should extend the duration of the spinal block.

As a very selective α2-adrenergic agonist, dexmedetomidine has many benefits, such as lowering sympathetic tone and the need for anesthetics and opioids. It can also be used before or after general anesthesia (5-8). As a noncompetitive N-methyl D-aspartate (NMDA) antagonist, magnesium Sulfate helps relieve pain by controlling the flow of calcium into cells (9). When it comes to managing chronic pain and pain after surgery, magnesium's antinociceptive effects seem to be significant (10). Controlling the amount of calcium that enters the cell is the primary mechanism responsible for these effects.

Magnesium inhibits calcium influx and non-competitively antagonizes NMDA channels (11). Based on the literature, this study was designed was to designed to assess the dexmedetomidine with ropivacaine and magnesium Sulfate with ropivacaine work for spinal anesthesia in infraumbillical surgeries.

MATERIALS AND METHODS

The Department of Anaesthesiology at the Surabi Institute of Medical Sciences, Siddipet, conducted the present prospective randomized double-blind study from July 2021 to September 2022. We recruited a total of 72 participants undergoing infraumbilical surgeries between 21-60 years of age. We included participants undergoing infraumbilical surgery under spinal anesthesia who belonged to ASA grades I and II and were willing to participate. We excluded participants with coagulative disorders, pregnancy, lactation, cardiovascular disorders, contraindications to study drugs, and those who did not provide consent to participate. Following the institutional ethics committee's approval, we informed the participants about the detailed study procedure and collected their written informed consent.

The people in the study were randomly put into Group DR and given isobaric ropivacaine hydrochloride (0.75%) with 10µg of dexmedetomidine in 0.5 ml of normal saline. Group MR received isobaric ropivacaine (0.75%) with 75 mg of magnesium Sulfate in 0.5 ml of normal saline. We subjected all participants to a detailed preanesthetic evaluation and the necessary laboratory investigations. All participants received Tab. Alprazolam 20.25 mg the night before the surgery. We administered midazolam 0.04 mg/kg and glycopyrrolate 0.2 mg to the participants prior to surgery. Baseline levels of parameters including SBP, DBP, pulse rate, and SPO2 were recorded. The study drugs were injected through L3 and L4 space in lateral decubitus position. We recorded parameters such as SBP, DBP, pulse rate, and SPO2 every 5 minutes until 15 minutes, and then every 15 minutes until the end of the surgery. Details of onset and total duration of sensory block and motor block were recorded. The degree of motor block was assessed by a modified Bromage scale. The collected data was analyzed by SPSS 23.0. Descriptive statistics were used to analyse demographic data. Chi-square test and unpaired student 't' test was used to compare the group. P<0.05 was considered statistically significant outcome.

RESULTS

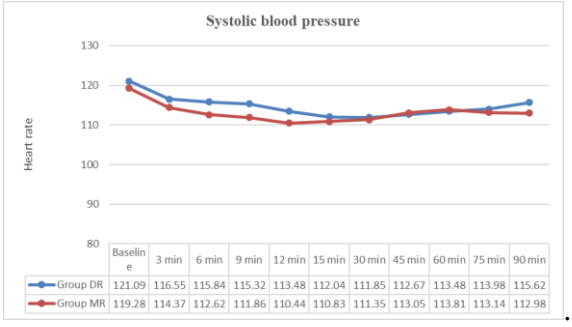
Table 1: Demographic data of study participants

Parameters	Group DR (n=36)	Group MR (n=36)	p-value
Age (In years)	40.36±5.94	41.23±6.32	0.470
Gender (M:F)	20:16	21:15	0.811

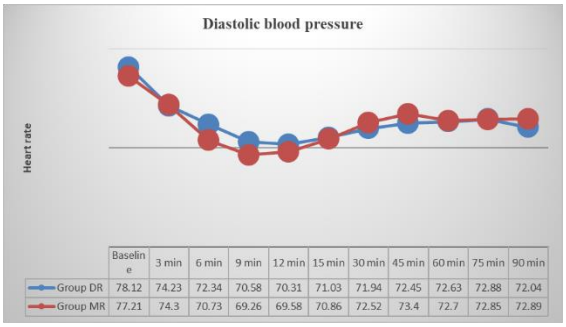
Table 2: Details of sensory and motor block among study groups.

Parameters	Group DR (n=36)	Group MR (n=36)	p-value
Sensory block			
Mean onset duration of sensory block at T10 vertebra level	4.31±1.02	6.29±1.14	0.001
Duration for maximum sensory level achieved	9.05±2.55	12.48±1.610	0.0273
Mean duration of regression to L1	291.37±19.49	217.56±17.02	0.001
Motor block			
Mean onset duration of motor block	8.55±1.27	13.18±2.36	0.0488
Total duration of motor block (In min)	225.38±15.74	174.20±12.24	0.001
Total duration of analgesia	378.49±21.58	230.51±17.96	0.001
Total dose of analgesia	1.31±0.32	2.58±0.87	0.001

Graph 1: Mean heart rate



Graph 2: Mean systolic blood pressure



Graph 3: Mean diastolic blood pressure

Table 3: Postoperative complications observed in two study groups.

Complications	Group DR	Group MR
Vomiting/Nausea	-	-
Hypotension	01	01
Bradycardia	-	-

DISCUSSION

In group DR, the mean age of participants was 40.36 years, and in group MR, it was 41.23 years. The mean difference was statistically not significant ($p > 0.05$) (Table 1). The mean onset duration of sensory block at T10 level was 4.31 min in group DR and 6.29 min in group MR. Group DR achieved the maximum sensory level at T5 level, while group MR achieved it at T6 level. The mean duration for achieving maximum sensory level was 9.05 min in group DR and 12.48 min in group MR ($p<0.05$). Mean onset duration of motor block was 8.55 min and 13.18 min; total duration of motor block was 225.38 min and 174.20 min in group DR and group MR, respectively. The mean total duration of analgesia was 387.49±21.58 and 230.51±17.96 in group DR and group MR, respectively. The mean onset duration, total duration of motor block, and total duration of analgesia were statistically significant ($p<0.05$) (Table 2).

The mean heart rate was comparatively high in group MR from baseline to 90 minutes after surgery compared to group DR (Graph 1). The mean SBP in group DR was 121.09 at baseline, 112.04 at 15 min after procedure, 111.85 at 30 min, 112.67 at 45 min, 113.48 at 60 min, and 115.62 at 90 min. Graph 2 shows that the mean SBP in group MR was 119.28 at baseline, 110.83 at 15 min, 111.35 at 30 min, 113.81 at 45 min, 113.81 at 60 min, and 112.98 at 90 min. The mean DBP was comparatively similar at 3 min (74.23 vs. 74.3), at 15 min (71.03 vs. 70.86), at 60 min (72.63 vs. 72.7), at 75 min (72.88 vs. 72.85), and at 90 min (72.04 vs. 72.89) in group DR and group MR, respectively (Graph 3). The mean heart rate, systolic blood pressure, and diastolic blood pressure were statistically not significant from the beginning to the end of the study ($p > 0.05$). Two study groups each had one case of hypotension, and none of the cases showed symptoms of vomiting, nausea, or bradycardia (Table 3).

Makhni R et al. conducted a prospective randomized double-blind study, randomly assigning 50 individuals aged 20–65 undergoing infraumbilical surgeries to two groups. Group D received an intrathecal injection of ropivacaine with 10µg dexmedetomidine, while group M received an intrathecal injection of ropivacaine with 10µg dexmedetomidine and 57 mg magnesium sulfate. The study found that there were no significant differences in systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate, and oxygen saturation (SPO2) among the two study groups. Compared to magnesium sulfate, the group dexmedetomidine exhibited an earlier onset of sensory and motor block. Researchers also conclude that the combination of ropivacaine and dexmedetomidine outperforms ropivacaine and MgSO4 in promoting a quicker onset of sensory and motor block, as well as providing postoperative analgesia (12). Jehan Ahmed Sayed et al.'s research revealed that concurrently administering dexmedetomidine and magnesium sulfate with bupivacaine caudal block could potentially prolong the duration of the initial analgesic effect (13). The study examined the effects of administering ropivacaine and bupivacaine, both with and without dexmedetomidine, for caudal analgesia. The results showed that the administration of dexmedetomidine greatly extended the duration of analgesia (14, 15).

Srinidhi Srikanth et al. randomly assigned 80 cases undergoing infra-umbilical surgeries to either group R (3 ml ropivacaine with sterile water) or group RM (3 ml hyperbaric ropivacaine with 0.75 ml magnesium sulfate). The results

showed that group R experienced complete motor regression significantly earlier ($p<0.05$), and that group RM experienced a longer duration of sensory block (242.8) than group R (186.6). In both groups, there was no change from the initial hemodynamic value. Throughout the whole surgical procedure in both groups, all hemodynamic parameters were below the clinically acceptable range of ± 20% from baseline (16). Kumar M et al. randomly divided 60 patients between the ages of 18 and 65 into two groups and administered either group A (0.75% ropivacaine with dexmedetomidine) or group B (20 ml of 0.75% ropivacaine with magnesium sulfate). Researchers discovered that group A's initial postoperative analgesic requirement lasted noticeably longer than group B's. At baseline, the research groups' mean arterial pressures were similar ($p > 0.05$). Group A's mean arterial pressure was found to be lower (84.33 ± 4.39) than group B's (88.80 ± 6.16) after 30 minutes after extubation. This difference was statistically significant ($p < 0.05$). After that, group A's mean arterial pressure consistently remained lower than group B's throughout a 24-hour period, and this difference was statistically significant. Group A's heart rate and mean arterial pressure were much lower than those of group B. Additionally, studies have shown that ropivacaine with dexmedetomidine is a safe and efficient analgesic for patients undergoing lumbar spine procedures, providing better pain management than ropivacaine plus magnesium sulfate infiltration (17). Study by Nirmal Kumar M et al. found a strong link ($p<0.05$) between the average amount of time it took for Group D to return to the L1 dermatome, reach a maximum sensory level, and begin sensory block at the T10 level. They came to the conclusion that, in femoral operations, dexmedetomidine is a superior adjuvant to ropivacaine given intrathecally (18). Jain K et al. reviewed 120 cases randomly allocated to intrathecal dexmedetomidine with bupivacaine (group D) and intrathecal bupivacaine with magnesium Sulfate (group M) groups found out significantly faster onset and prolonged duration of sensory and motor block in group D. But duration of analgesia was significantly prolonged in group M (19). Poonam Singh et al. assessed 60 cases managed with dexmedetomidine with ropivacaine (group A) and magnesium Sulfate with ropivacaine found out faster onset of sensory and motor block with prolonged duration of analgesia in dexmedetomidine group (20). Similarly, the present study's findings aligned with the previously mentioned conclusions. The present study has limitations in terms of a fixed drug dosage for comparison and a small sample size. Further large-scale studies are required to assess different doses and local anesthetics as adjuncts in cases undergoing various surgeries.

CONCLUSION

Effective treatment of pain after surgery has always been a significant focus for surgeons and anaesthesiologists. Our findings indicate that dexmedetomidine is a better addition to intrathecally administered ropivacaine in infraumbilical surgeries than magnesium Sulfate. Dexmedetomidine with ropivacaine offers quicker onset of sensory and motor block, achieving a higher level of sensory block, faster onset of the highest level of sensory block, longer duration of analgesia, and improved hemodynamic stability with minimal side effects.

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CONFLICT OF INTEREST: NIL

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