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Research Article

A RANDOMIZED CLINICAL STUDY TO EVALUATE THE EFFECTS OF INTRATHECAL MAGNESIUM SULFATE VERSUS DEXMEDETOMIDINE AS AN ADJUVANT TO HYPERBARIC BUPIVACAINE HYDROCHLORIDE IN SUBARACHNOID BLOCK FOR INFRAUMBILICAL SURGERIES

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ABSTRACT

Objective: The objective is to compare the efficacy of intrathecal magnesium sulfate versus intrathecal dexmedetomidine as an adjuvant to 0.5% hyperbaric bupivacaine in terms of spinal anesthesia characteristics and postoperative analgesia in patients undergoing infra-umbillical surgeries.

Methods: In this randomized clinical trial, hundred adult patients in the age group of 18–65 years, belonging to the American Society of Anesthesiologists grade 1 and 2, posted for infra-umbilical surgeries under subarachnoid block were included. Patients were randomly divided into two groups of 50 each after obtaining Hospital ethical committee approval and Informed consent. Group M (50 patients) was given Inj. Bupivacaine hydrochloride 0.5% (heavy) 15 mg+Inj. Magnesium Sulfate 50 mg (0.1 mL) and Group D (50 patients) were given Inj. Bupivacaine Hydrochloride 0.5% (heavy) 15 mg+Inj. Dexmedetomidine 5 µg (0.1 mL). Hemodynamic parameters, onset, and duration of sensory blockade, time taken to reach the highest dermatomal level (T1) of sensory blockade, time taken to achieve motor blockade (Modified Bromage score 3), duration of sensory analgesia (Regression to L1), time to complete motor block recovery and duration post-operative analgesia were recorded.

Results: Time taken for onset of sensory block, to achieve the highest dermatomal level of sensory blockade, onset of motor block and to achieve Bromage score 3 were less in Group D as compared to that of Group M ($p<0.0001$). The total duration of sensory blockade and motor block was longer in Group D ($p<0.0001$). The Visual Analog Scale score when the patients complained of pain for the 1st time in post-operative period, was significantly lower in Group Das compared to Group M ($p=0.016$). There was no significant difference in the rate of complications such as nausea, vomiting, bradycardia, and hypotension in both the groups.

Conclusion: Intrathecal Dexmedetomidine as an adjuvant to hyperbaric bupivacaine in subarachnoid block significantly quickens the onset of sensory and motor blockade. It also prolongs the duration of sensory block, motor block, and post-operative analgesia.

Keywords: Magnesium sulfate, Dexmedetomidine, Adjuvant, Bupivacaine, Spinal anesthesia.

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INTRODUCTION

Regional anesthesia techniques have been used for a long time to prevent pain associated with surgical interventions. Subarachnoid block is a widely used technique for performing different infraumbilical surgical procedures. Recent developments have led to greater patient satisfaction, accelerated functional recovery, and shortened duration of hospital stay. Many drugs such as morphine, fentanyl, sufentanyl, dexmedetomidine, clonidine, magnesium sulfate ($MgSO_4$), neostigmine, ketamine, midazolam, and epinephrine have been tried alone or in combination with opioids as adjuvants to local anesthetics in subarachnoid block to prolong the duration of analgesia to provide prolonged postoperative analgesia with minimal side effects [1].

Adding magnesium sulfate can significantly improve the quality and increases the duration of spinal anaesthesia [2]. Although magnesium is not a primary analgesic in itself, it enhances the analgesic actions of more established analgesics as an adjuvant agent. It exerts its analgesic action as a noncompetitive N-Methyl-D-aspartate (NMDA) receptor antagonist, blocking ion channels in a voltage-dependent manner when used intrathecally. The addition of magnesium reduces the activation of C-fibers by inhibiting the slow excitatory postsynaptic currents produced by NMDA receptor activation. They abolish hypersensitization by blocking NMDA receptor activation in the dorsal horn by excitatory amino acid transmitters, notably glutamate and aspartate. The binding and dissociation of non-competitive NMDA receptor antagonists are relatively slow, which may explain the continuation of anesthesia into the postoperative period and the reduction of analgesic requirement in the postoperative period. It also decreases the incidence of postoperative shivering [3,4].

Dexmedetomidine is a sedative and co-analgesic drug. Its intrathecal use potentiates the effect of local anesthetics and allows a decreased dose without respiratory depression or hemodynamic instability and thus, it is used for prolonging the duration of sensory, motor blockage, and analgesic effect [5,6].

As very few studies have been conducted using bupivacaine with dexmedetomidine and $MgSO_4$ as adjuvant at the doses we have used, the present study was undertaken with primary aims to compare the hemodynamic stability, onset and duration of sensory and motor block and with secondary aims of postoperative analgesic effect of 5 µg dexmedetomidine and 50 mg of $MgSO_4$ given intrathecally along with 0.5% bupivacaine in infra-umbillical surgeries.

METHODS

This double-blinded, prospective, randomized control trial study was conducted in the Department of Anesthesiology, General Operation

theatre complex, Dhiraj Hospital, Shrimati Bhikhiben Kanjibhai Shah Medical Institute and Research Centre, Piparia, Vadodara from February 2024 to August 2024, after due permission from the Institutional Ethics Committee (SVIEC/ON/MEDI/RP/Dec/23/23), CTRI registration (CTRI/2024/02/062867) and taking written informed consent from the patients.

Patients belonging from 18 to 65 years of age of American Society of Anesthesiologists (ASA) grade 1 and 2, undergoing infra-umbilical surgeries were included in the study. While those who refused were uncooperative, <18 years or >65 years, with hepatic, renal, cardiac, or respiratory problems, local site infections, coagulopathies, and known allergy to magnesium sulfate or dexmedetomidine were excluded from the study.

A total of 100 patients satisfying inclusion criteria were blinded and randomly allocated either to Group M (intrathecal bupivacaine Hydrochloride+Magnesium Sulfate group) or Group D (intrathecal Bupivacaine Hydrochloride+Dexmedetomidine) using computer-generated randomization tables. The anesthetist performing the procedure of subarachnoid blockade was also blinded and was given a prefilled syringe containing the drug of the assigned group:

- Group D (50 patients): Inj. Bupivacaine 0.5% 15 mg (3 mL)+Inj. Dexmedetomidine 5 µg (0.1 mL)
- Group M (50 patients): Inj. Bupivacaine 0.5% 15 mg (3 mL)+Inj. MgS04 50 mg (0.1 mL).

Detailed preoperative history was taken, and physical examination was done on the previous day of surgery. The detailed procedure was explained to the patient, and patients were informed to communicate about the perception of any discomfort or pain during and after surgery according to Visual Analog Scale (VAS) score.

Every patient received standard monitoring in the operation theatre. Wide bore 18 G cannula was secured, and all patients were pre-loaded with Ringer lactate solution 10 mL/kg. Subarachnoid block was standardized with a dural puncture at L3–L4 level using 25 G Quincke Babcock spinal needle in the sitting position and administration of an assigned group of intrathecal drugs. After the establishment of an adequate level of block, surgery was started, and time of the beginning of surgery was noted. Intraoperative bradycardia was treated using injection atropine intravenously, and intraoperative hypotension was treated by using injection ephedrine intravenously.

Parameters to be recorded

Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and pulse oximetry were recorded preoperatively and every 5, 10, 15, 20, 25, 40, 55, 70, 85, 100, and 120 min after giving spinal anesthesia and then every 20 min till the completion of surgery.

The sensory level blockade was tested by pinprick method with 23 Gauge needle, and the quality of the block was noted. At the interval of every 5 min for the first 30 min, the sensory level was evaluated for assessing the highest level of sensory block and the time to achieve the highest level was noted. The total duration of the sensory block was defined as the period from the time of administration of the block to the time of complete regression of the sensory block to S2 dermatome. It was recorded and noted in post-operative period.

Characteristics of motor blockades were assessed by the Modified bromage scale.

Modified bromage scale:

- Grade 0=Full Movement
- Grade 1=Inability to raise extended leg, can bend knee
- Grade 2=Inability to bend the knee, can flex ankle
- Grade 3=No movement, complete paralysis.

Time taken to achieve Bromage scale grade 3 was noted, and the total duration of the motor blockade was recorded.

The duration of spinal anesthesia was defined as the period from spinal injection to the first occasion when the patient complained of pain in the post-operative period. It was recorded in every patient.

VAS score was noted postoperatively when the patient complained of pain for the 1st time. Analgesia in the form of Inj. Tramadol 1 mg/kg was given when VAS score >4.

Perioperative complications like bradycardia (HR <60/min), hypotension (Decrease in MAP >20% from baseline), sedation, nausea, vomiting, dryness of mouth, pruritus, and respiratory depression were noted and managed appropriately.

Statistical method

The sample size of 100 patients, with 50 patients in each group, was determined using MedCalc 12.5 software. Collected data were tabulated for assessment. Numerical/continuous variables were presented as mean and standard deviation, while categorical variables were presented as frequency and percentage. Tests such as unpaired student-t-test and/or analysis of variance were used for numerical variables whenever appropriate for inter-groups comparisons, while the Chi-square test was used for categorical variables. A $p<0.05$ was considered statistically significant, while a value <0.001 was regarded as highly significant.

Table 1: Consolidated standards of reporting trials flowchart

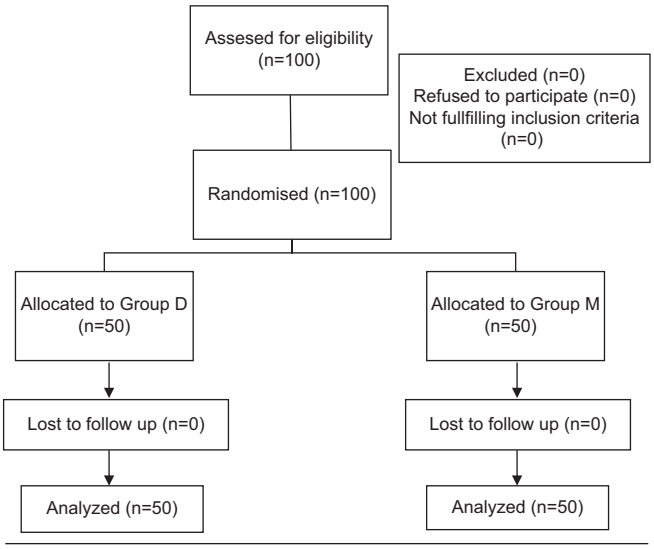

Table 2: Analysis of demographic data

Parameters	Group M Mean±SD	Group D Mean±SD	p-value
Age (years)	37.48±15.13	40.92±14.5	0.216
Weight (kg)	68.66±9.92	66.24±12.49	0.286
Gender (%)			
Male	16 (32.00)	21 (42.00)	0.3
Female	34 (68.00)	29 (58.00)	
ASA grading (%)			
I	9 (30)	14 (47)	0.2882
II	21 (70)	16 (53)	
Type of Surgery (%)			
Abdominal Hysterectomy	21 (42)	17 (34)	0.41
Bilateral inguinal hernia	8 (16)	10 (20)	0.60
Unilateral inguinal hernia	21 (42)	23 (46)	0.68
Total duration of surgery (in hours)	110.4±31.2	118.3±32.87	0.361

Analysis of demographic data expressed in (mean±SD) and percentage proportions. Analysis of variance and Chi-square tests were used as statistical test. $p<0.05$ statistically significant. ASA: American Society of Anesthesiologists, SD: Standard deviation

Table 3: Analysis of heart rate, systolic blood pressure, and diastolic blood pressure

Time	Heart rate (beats/min)			SBP (mm Hg)			DBP (mm Hg)		
	Group M	Group D	p-value	Group M	Group D	p-value	Group M	Group D	p-value
Baseline	84.26±8.57	83.32±7.29	0.319	127.64±7.76	122.78±9.11	0.001	80.76±6.98	81.58±7.09	0.592
5 min	78.06±6.03	79.56±6.28	0.202	115.49±7.69	113.78±7.24	0.169	72.2±6.84	76.1±5.04	0.004
10 min	76.18±5.62	75.52±5.32	0.762	111.38±7.54	109±6.73	0.061	72.72±8.09	73.52±6.14	0.359
15 min	73.56±5.88	72.6±5.87	0.541	107.23±7.47	103.46±7.18	0.006	70.28±6.38	69.54±5.54	0.961
20 min	70.5±5.05	70.8±4.87	0.519	103.72±7.58	100.14±6.68	0.004	68.12±6.11	68.04±3.89	0.873
25 min	67.72±5.03	69.1±4.19	0.078	101.08±6.33	99.04±5.26	0.035	68.98±7.39	67.26±5.9	0.274
40 min	68.36±5.1	68.84±3.92	0.268	103.42±6	100.16±6.19	0.004	70.58±5.87	68.36±5.45	0.088
55 min	70.3±5.23	70.28±3.92	0.767	107.46±6.34	103.94±6.48	0.01	73.88±7.15	71.98±6.46	0.143
70 min	74.88±6.57	73.46±4.78	0.325	111.98±7.82	109.36±7.15	0.067	77.7±8.25	76.16±6.22	0.395
85 min	78.36±6.28	75.96±4.42	0.031	116.74±8.88	113.32±7.72	0.016	81.64±7.94	79.78±5.65	0.028
100 min	81.76±6.67	78.28±5.01	0.002	120.72±8.86	117.18±6.86	0.005	83.5±8.05	80.54±5.95	0.009
120 min	83.78±6.93	80.36±5.53	0.003	125.68±9.44	121.8±7.07	0.001	83.64±8.85	82.06±6.65	0.080
140 min	82.1±7.48	79.54±7.77	0.080	120±10.27	115.24±7.03	0.017	75.14±7.51	76.76±7.76	0.234
160 min	87.68±7.09	79.84±8.23	<0.0001	126±8.55	121±6.25	0.002	81.6±8.09	81±7.2	0.563
180 min	86.9±9.51	79.8±5.95	0.0001	131.2±8.86	126.32±6.3	0.003	83.56±8.19	80.44±7.04	0.018

Analysis of Heart rate, Systolic blood pressure, and diastolic blood pressure expressed as (mean±SD) Analysis of variance was used as a statistical test. p<0.05 statistically significant. SD: Standard deviation.

Ethical considerations

This study was in conformance with institutional ethics committee standards and the Helsinki Declaration. Written informed consent was obtained from all eligible patients. No names or initials were used. The Consolidated Standards of Reporting Trials statement was followed to conduct this single-center, double-blinded, randomized controlled trial with two parallel groups (Table 1).

RESULTS

All patients were able to complete the study without any dropouts.

Demographic data

All patients in both groups were comparable in terms of age, weight, gender, ASA grading, and duration of surgery (p>0.005) (Table 2).

Hemodynamic parameters

There was no significant difference in both the groups in HR till 85 min, but after that, HR was significantly lower in Group D (p>0.05). There was no significant difference in SBP during the surgery until 40 min, but after 40 min, SBP was significantly lower in Group D. DBP in both groups was comparable at most time points (Table 3).

Characteristics of sub-arachnoid blockade

Sensory blockade

Time for onset of sensory block was delayed in Group M, while time taken to achieve highest dermatomal level of sensory blockade was lower in Group D in comparison to Group M. Duration of sensory blockade was lower in Group M in comparison to Group D. The difference was statistically significant (p<0.0001) (Table 4).

Motor blockade

Time for onset of motor block was faster in Group D in comparison to that of Group M. Time to Achieve Bromage score 3 was also lower in Group D. While duration of Motor Block was prolonged in Group D in comparison to Group M. The difference was statistically significant (p<0.0001) (Table 5).

Post-operative observations

The total duration post-operative analgesia was lower in Group M in comparison to Group D (p<0.0001). VAS score at the time of the first instance of pain was recorded. It was significantly lower in Group D as compared to Group M (p=0.016) (Table 6).

Peri-operative complications

The incidence of nausea and vomiting was slightly higher in Group M (12% and 6% respectively) compared to Group D (6% and 4%). However, the difference between the two was not significant. The incidence of bradycardia and hypotension was lower in Group M, but the difference was not statistically significant. Incidence of Itching was insignificantly lower in Group D (2%) in comparison of Group M (4%). Incidence of Shivering was lower in Group M (4%) in comparison with Group D (16%). The difference between the two was statistically significant, as p-value is 0.046 (Table 7).

Table 4: Characteristics of sensory block

Time (min)	Group M	Group D	p-value
Onset of Sensory block	4.68±0.94	3.7±1.11	<0.0001
Time to achieve highest sensory block (T6)	13.42±1.57	10.02±1.51	<0.0001
Duration of sensory block (regression to L1)	209.48±7.22	280.3±6.1	<0.0001

Characteristics of sensory block expressed as mean±SD. Student t-test was used to compare continuous data. p<0.05 statistically significant. SD: Standard deviation

Table 5: Characteristics of motor block

Time (min)	Group M	Group D	p-value
Onset of Motor block	9.26±0.99	4.78±0.95	<0.0001
Time to achieve Bromage Score 3	18.92±2.35	12.26±2.83	<0.0001
Duration of motor block	189.82±10.12	220.52±9.31	<0.0001

Characteristics of motor block expressed as mean±SD. Student t test was used to compare continuous data. p<0.05 statistically significant. SD: Standard deviation

DISCUSSION

Spinal anesthesia has emerged as a favored technique for lower abdominal and lower limb surgeries, offering numerous benefits. Its safety profile, cost-effectiveness, ease of administration, and high patient satisfaction rates make it an attractive option. By avoiding the risks associated with general anesthesia and airway manipulation, spinal anesthesia provides superior surgical conditions.

Various drugs have been tried through intravenous and intrathecal route to prolong the duration of anesthesia, analgesia, and sedation in patients undergoing various surgeries under spinal anesthesia, such as epinephrine, clonidine, dexmedetomidine, fentanyl, morphine, neostigmine, ketamine, midazolam, and magnesium sulfate.

Intrathecal magnesium potentiates the effect of spinal analgesia and avoids the potential side effects of larger doses of intravenous magnesium that may be required to observe its anti-nociceptive modulations.

Table 6: Duration of post-operative analgesia VAS score at the point of onset of post-operative pain

Time (min)	Group M	Group D	p-value
Duration of Post-operative analgesia	219.94±6.68	394.36±5.43	<0.0001
VAS score at start of post-op pain	3.9±0.86	3.5±0.74	0.016

Post-operative analgesia and VAS score expressed as mean±SD. Student *t*-test was used to compare continuous data. p<0.05 statistically significant.
SD: Standard deviation, VAS: Visual Analog Scale

Table 7: Peri-operative complications

Parameters	Group M (%)	Group D (%)	p-value	Results
Nausea	12	6	0.296	NS
Vomiting	6	4	0.648	NS
Resp. depression	0	0		NS
Bradycardia	6	8	0.696	NS
Hypotension	8	10	0.72	NS
Itching	4	2	0.559	NS
Shivering	4	16	0.046	SS

Peri-operative complications expressed as percentage proportions

Intrathecal dexmedetomidine has been used at various doses (2.5 μg–20 μg) in various studies [7] and has been found it to prolong the sensory blockade, motor blockade, and post-operative analgesia. When combined with spinal bupivacaine it prolongs the sensory block by depressing the release of C-fiber transmitters and by hyperpolarization of post-synaptic dorsal horn neurons. Motor block prolongation by a-2 adrenoreceptor agonists may result from binding these agonists to motor neurons in the dorsal horn of the spinal cord. Intrathecal a-2-receptor agonists have antinociceptive action for both somatic and visceral pain [8].

This study compared the effect of adding intrathecal magnesium sulfate and dexmedetomidine to bupivacaine hydrochloride in subarachnoid block in infra-umbilical surgeries and found that at the dose of 5 μg dexmedetomidine is more effective than 50 mg magnesium sulfate in prolonging the duration of subarachnoid block and post-operative analgesia.

The dose of magnesium used in this study was derived on data from Özalevli *et al*. [9], where 50 mg of intrathecal $MgSO_4$ potentiated antinociception in perioperative period during spinal anesthesia.

Many authors have compared intrathecal magnesium at different doses with other adjuvants. A summary of those studies is shown in Table 8.

In this study, the onset of sensory block, time taken to achieve the highest dermatomal level of sensory blockade, and time to Achieve Bromage score 3 was delayed in Group M. The possible explanation for this effect

Table 8: Different studies comparing intrathecal magnesium with different adjuvants

Author	Study	Conclusion
Katiyaret al. [10]	2 intrathecal doses of Magnesium sulfate (50 mg and 100 mg) with intrathecal fentanyl (25 μg)	Magnesium sulfate at 100 mg dosage provides better hemodynamic stability than magnesium sulfate at 50 mg which was further better than fentanyl with fewer side effects.
Arora *et al*. [11]	Intrathecal magnesium 50 mg and fentanyl 12.5 μg as adjuvants to 2 mL 0.5% hyperbaric bupivacaine in preeclamptic parturients undergoing elective cesarean sections	$MgSO_4$ 50 mg to bupivacaine for sub-arachnoid block in patients with mild preeclampsia undergoing elective cesarean section prolongs the duration of analgesia and reduces postoperative analgesic requirements without additional side effects
Talaat *et al*. [12]	Intrathecal hyperbaric bupivacaine 2.5 mL with Dexmedetomidine 5 μcg versus Intrathecal hyperbaric bupivacaine 2.5 mL with $MgSO_4$ 50 mg in caesarean section	Dexmedetomidine (5 μg) intrathecally during CS has no significant adverse effects on the maternal hemodynamics when compared with magnesium sulfate
Joshi-Khadke *et al*. [13]	Neostigmine 25 μg with 17.5 mg hyperbaric bupivacaine versus $MgSO_4$ 50 mg with 17.5 mg hyperbaric bupivacaine	Intrathecal Neostigmine and $MgSO_4$ does not affect characteristics of SA. Postoperative analgesia of neostigmine was better than $MgSO_4$. Neostigmine provides some protection against hypotension of SA whereas $MgSO_4$ protects against bradycardia.
Attia *et al*. [14]	2.5 mL Hyperbaric bupivacaine with 0.5 mg midazolam versus 2.5 mL Hyperbaric bupivacaine with 0.5 mL magnesium sulfate versus 2.5 mL Hyperbaric bupivacaine alone.	Intrathecal midazolam as an adjuvant for bupivacaine increases the duration of both sensory and motor blockade more than that of magnesium sulfate.
Vasure *et al*. [15]	Hyperbaric bupivacaine (0.5%) 2.5 mL with $MgSO_4$ (50%) 0.1 mL versus Hyperbaric bupivacaine (0.5%) 2.5 mL with fentanyl (50 mg/mL) 0.5 mL versus Hyperbaric bupivacaine (0.5%) 2.5 mL with $MgSO_4$ (50%) 0.1 mL and fentanyl (50 mg/mL) 0.5 mL	The addition of 50 mg $MgSO_4$ as adjuvant to intrathecal bupivacaine significantly prolongs the duration of analgesia with a lesser side effect. It is suggested that magnesium may be a useful adjuvant to opioids for spinal anesthesia.
Shukla *et al*. [16]	15 mg hyperbaric bupivacaine plus 10 μg dexmedetomidine versus 15 mg hyperbaric bupivacaine plus 50 mg $MgSO_4$ versus 15 mg hyperbaric bupivacaine alone	Onset of anesthesia was rapid and of prolonged duration in the dexmedetomidine group. However, in the $MgSO_4$ group, although onset of block was delayed, the duration was significantly prolonged as compared with the control group, but to a lesser degree than in the dexmedetomidine
Pathak and Doshi [17]	Hyperbaric bupivacaine with dexmedetomidine10 μg versus received Bupivacaine+$MgSO_4$ 50 mg in lower limb orthopedic surgeries	Dexmedetomidine, as an adjuvant to Inj. Bupivacaine intra-thecally in sub-arachnoid block, has faster onset, longer duration of action, prolonged analgesia in comparison with Magnesium Sulfate.

$MgSO_4$: Magnesium sulfate

is the change in pH and baricity after the addition of magnesium sulfate to bupivacaine. Furthermore, a possible mechanism can be, increase in the metabolism of bupivacaine caused by the activation of Cytochrome P450 by magnesium may be responsible for the delayed onset [4].

The total duration of the sensory blockade and motor block was longer in Group D in comparison to Group M.

Because of this delay in the onset of sensory and motor blockade of spinal anesthesia magnesium sulfate is not recommended in patients undergoing cesarean section and in emergency situations where faster induction of cases is required [18].

Magnesium sulfate has also been used as an adjunct to bupivacaine for post-operative pain in epidural anesthesia. Ghatak *et al*. [19], conducted a study and found that the onset of anesthesia was more rapid in magnesium group than clonidine. Shahi *et al*. [20] also compared Magnesium sulfate 50 mg versus dexmedetomidine 0.5 μg/kg with bupivacaine in epidural analgesia and found that the addition of dexmedetomidine to epidural bupivacaine can be advantageous with respect to the increased duration of motor and sensory blockade and arousable sedation.

Regarding post-operative complications, the incidence of nausea and vomiting was slightly higher in Group M compared to Group D. However, the difference between the two was not significant. The incidence of bradycardia and hypotension was lower in Group M, but the difference was not statistically significant. Incidence of Itching was statistically insignificantly higher in Group M in comparison to Group D.

Incidence of Shivering was higher in Group D in comparison with Group M which was statistically significant. $MgSO_4$ use can cause peripheral vasodilatation, which potentially improves cutaneous circulation, thus decreasing the incidence of shivering. Similar to our finding was noted by Omar *et al*., [21] they concluded that the use of magnesium sulfate, as it is more physiologically available, more readily available in most operating theatres, and much less expensive than dexmedetomidine to control post-spinal shivering.

Our prospective randomized trial stands out as a reliable source of scientific evidence thanks to its design that effectively minimizes confounding and selection bias. All participants completed the study, and there were no dropouts, which ensured comprehensive data collection. The intervention was well-tolerated, and there were no major side effects.

However, we acknowledge some limitations that we selected focused patient population and included only ASA I and II patients, which might limit its applicability to broader populations. We monitored patients only during their recovery room stay, leaving long-term effects and potential complications unexplored. Despite our double-blinded design, some observer bias might still be present. These limitations highlight areas for future research and improvement. By recognizing these constraints, we aim to contribute to ongoing investigations and enhance our understanding of the topic.

CONCLUSION

Both dexmedetomidine and magnesium sulfate enhance the duration of spinal anesthesia. Notably, intrathecal dexmedetomidine demonstrates a significant advantage in prolonging sensory and motor blockade. Dexmedetomidine provides superior pain relief without increasing side effects. This suggests that intrathecal dexmedetomidine may be a preferable option for patients undergoing spinal anesthesia, offering improved outcomes and patient comfort. Both dexmedetomidine and magnesium sulfate improves the duration of spinal anesthesia, but intrathecal dexmedetomidine significantly prolongs sensory and motor blockade with better post-operative analgesia without any significant side effects.

AUTHOR CONTRIBUTION

Author 1: Conceptualization, Methodology, Data collection, Data analysis. Writing original draft, – review and editing; Author 2: Methodology, writing – review and editing, supervision; Author 3: Methodology, writing – review and editing, supervision.

CONFLICTS OF INTEREST

None.

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