International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

*Original Researcher Article* *DOI: 10.61336/im/26-07-243*

# Dexmedetomidine Versus Magnesium Sulfate for Intraoperative Hemodynamic Control and Postoperative Analgesia in Lumbar Spine Surgery: A Randomized Controlled Trial.

**Dr. Anup Nisti [1], Dr. Chandrashekar B [2], Dr. Praveen Kumar DP [3*].**

*[1]Assistant professor, Department of Anaesthesiology, Kidwai Memorial Institute of Oncology, Bengaluru, Karnataka, India.*
*[2]Assistant professor, Department of Anaesthesiology, Kidwai Memorial Institute of Oncology, Bengaluru, Karnataka, India.*
*[3]Assistant professor, Department of Anaesthesiology, Kidwai Memorial Institute of Oncology, Bengaluru, Karnataka, India.*

**Correspondence:**
***Dr. Praveen Kumar DP.***
*Assistant professor, Department of Anaesthesiology, Kidwai Memorial Institute of Oncology, Bengaluru, Karnataka, India.*

***Email:*** praveendp49@gmail.com

**Received:** 26-04-2026
**Revised:** 05-05-2026
**Accepted:** 15-06-2026
**Published:** 28-07-2026

## Abstract

***Introduction:*** Lumbar spine surgery is associated with intraoperative haemodynamic fluctuations and significant postoperative pain. Dexmedetomidine and magnesium sulphate are commonly investigated as anaesthetic adjuncts because of their sympatholytic and analgesic properties. This study compared their effects on intraoperative haemodynamics and postoperative pain following lumbar spine surgery. ***Materials and Methods:*** This randomized controlled trial included 80 adult patients undergoing elective lumbar spine surgery at a tertiary care hospital. Participants were randomly allocated into two equal groups of 40 patients each. Group D received dexmedetomidine, while Group M received magnesium sulphate as an anaesthetic adjunct. Heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure were recorded at predefined intraoperative time points. Postoperative pain was assessed using the visual analogue scale at predetermined intervals up to 24 hours. Rescue analgesic requirement, time to first rescue analgesia, and adverse events were also recorded. Continuous and categorical variables were compared using appropriate statistical tests, with $p<0.05$ considered statistically significant. ***Results:*** Baseline demographic and operative characteristics were comparable between groups. Heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure were significantly lower with dexmedetomidine during the early intraoperative period, particularly between 5 and 15 minutes. Postoperative VAS scores were significantly lower in the dexmedetomidine group at all assessed time points ($p<0.001$). Rescue analgesia was required in 18 (45.0%) versus 27 (67.5%) patients, respectively ($p=0.044$), while total rescue analgesic consumption was also lower with dexmedetomidine ($p=0.002$). Adverse events were comparable between groups. ***Conclusion:*** Dexmedetomidine provided better intraoperative haemodynamic attenuation and postoperative analgesia than magnesium sulphate, with comparable overall tolerability in patients undergoing lumbar spine surgery.

**Keywords:** Dexmedetomidine; Magnesium sulphate; Lumbar spine surgery; Haemodynamic stability; Postoperative pain.



## INTRODUCTION

Lumbar spine surgeries are frequently performed for a variety of degenerative, traumatic, and compressive spinal disorders [1]. Although advances in surgical and anaesthetic techniques have improved perioperative outcomes, these procedures may be associated with substantial intraoperative haemodynamic fluctuations and significant postoperative pain [2]. Surgical stimulation, prone positioning, blood loss, anaesthetic drugs, and sympathetic responses may influence heart rate and blood pressure during surgery [3]. Effective control of these physiological responses is therefore important for maintaining haemodynamic stability and facilitating smooth perioperative recovery.

Postoperative pain remains an important concern following lumbar spine surgery and may adversely affect mobilisation, respiratory function, sleep, patient satisfaction, and overall recovery [4]. Opioid analgesics are commonly used for postoperative pain management but may be associated with adverse effects such as nausea, vomiting, sedation, respiratory depression, and delayed recovery [5]. Consequently, there is increasing interest in multimodal and opioid-sparing analgesic strategies that can provide effective pain control while minimizing opioid requirements and treatment-related adverse effects [6].

Dexmedetomidine, a highly selective α2-adrenergic receptor agonist, has sedative, sympatholytic, and analgesic properties [7]. Its ability to attenuate sympathetic responses to surgical stimulation may contribute to improved intraoperative haemodynamic stability and reduced perioperative analgesic requirements [8]. Magnesium sulphate, an NMDA receptor antagonist and calcium-channel modulator, also possesses analgesic and anaesthetic-sparing properties [9]. Its use during the perioperative period has been associated with reduced postoperative pain and opioid consumption, although its effects on haemodynamic parameters and analgesia may differ from those of dexmedetomidine [10].

Both dexmedetomidine and magnesium sulphate have therefore emerged as potentially useful adjuncts in anaesthetic management, but their relative effects on intraoperative haemodynamics and postoperative analgesia in patients undergoing lumbar spine surgery remain clinically relevant. A direct comparison may help determine which agent provides better haemodynamic control and postoperative analgesic benefit while maintaining an acceptable adverse-effect profile. The present study aimed to compare the effects of dexmedetomidine and magnesium sulphate on intraoperative haemodynamics and postoperative pain in patients undergoing lumbar spine surgeries.

## MATERIALS AND METHODS

This randomized controlled trial was conducted among adult patients undergoing lumbar spine surgery at a tertiary care hospital. The study included patients scheduled for elective lumbar spine procedures under general anaesthesia. A total of 80 eligible participants were enrolled and randomly allocated into two equal groups of 40 patients each. Group D received dexmedetomidine as the study drug, whereas Group M received magnesium sulphate. Ethical approval was obtained from the Institutional Ethics Committee before commencement of the study.

Patients aged ≥18 years who were scheduled for elective lumbar spine surgery and classified as American Society of Anesthesiologists (ASA) physical status I or II were considered eligible for inclusion. Patients with known hypersensitivity to dexmedetomidine or magnesium sulphate, significant cardiovascular or respiratory disease, hepatic or renal dysfunction, neurological or psychiatric disorders, chronic opioid use, pre-existing chronic pain, or those receiving medications likely to interfere with the study outcomes were excluded. Patients who required conversion or modification of the planned anaesthetic technique, experienced major intraoperative complications, or had incomplete postoperative pain assessments were also excluded from the final analysis.

All patients underwent a standard preanaesthetic evaluation, including detailed history, physical examination, routine laboratory investigations, and assessment of ASA physical status. Following standard monitoring, including electrocardiography, non-invasive blood pressure, pulse oximetry, and other routine intraoperative monitoring, general anaesthesia was administered according to institutional protocol. Baseline heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure were recorded before induction and subsequently at predefined intraoperative time points.

Patients in the dexmedetomidine group received dexmedetomidine according to the study protocol, while patients in the magnesium sulphate group received magnesium sulphate at the corresponding stage of anaesthetic management. Intraoperative haemodynamic parameters were monitored throughout surgery, and clinically significant bradycardia or hypotension was managed according to predefined institutional protocols.

Postoperative pain was assessed using the visual analogue scale (VAS) at predefined intervals immediately after surgery and at 2, 4, 6, 12, and 24 hours postoperatively. The requirement for rescue analgesia, total rescue analgesic consumption, and time to first rescue analgesia were recorded. Intraoperative and postoperative adverse events, including bradycardia, hypotension, hypertension, tachycardia, nausea, vomiting, sedation, and dizziness, were documented.

Statistical analysis was performed using SPSS v26. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequency and percentage. Between-group comparisons of continuous variables were performed using the independent-samples t-test, while categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. A p-value $<0.05$ was considered statistically significant.

## RESULTS

The study included 80 participants, with 40 patients each allocated to the dexmedetomidine group and magnesium sulphate group. The two groups were comparable with respect to baseline demographic and operative characteristics. The mean age was 45.28 ± 8.16 years in the dexmedetomidine group and 44.73 ± 8.52 years in the magnesium sulphate group. There were no statistically significant differences in sex distribution, BMI, ASA physical status, or duration of surgery between the groups ($p>0.05$), indicating adequate baseline comparability. (Table 1)

**Table 1. Distribution of Participants According to Baseline Demographic and Operative Characteristics**

| Parameter | Group D (n=40) | Group M (n=40) | Test value | p-value |
|---|---|---|---|---|
| Age (years), Mean ± SD | 45.28 ± 8.16 | 44.73 ± 8.52 | t=0.30 | 0.765 |
| Male, n (%) | 26 (65.0%) | 25 (62.5%) | $\chi^2$=0.05 | 0.824 |
| Female, n (%) | 14 (35.0%) | 15 (37.5%) | | |
| BMI (kg/m²), Mean ± SD | 24.86 ± 2.74 | 25.12 ± 2.61 | t=0.44 | 0.662 |
| ASA I, n (%) | 24 (60.0%) | 23 (57.5%) | $\chi^2$=0.05 | 0.823 |
| ASA II, n (%) | 16 (40.0%) | 17 (42.5%) | | |
| Duration of surgery (min), Mean ± SD | 132.45 ± 18.62 | 135.18 ± 19.47 | t=0.64 | 0.524 |

The intraoperative heart rate was comparable between the groups at baseline and immediately after induction. From 5 to 30 minutes, heart rate was significantly lower in the dexmedetomidine group compared with the magnesium sulphate group ($p<0.05$).

The maximum between-group difference was observed at 10 minutes, with mean heart rates of 67.23 ± 6.17 beats/min and 74.35 ± 7.08 beats/min, respectively ($p<0.001$). Thereafter, the difference progressively diminished and was not statistically significant at 45, 60 minutes, or at the end of surgery. (Table 2)

**Table 2. Comparison of Intraoperative Heart Rate Between the Groups**

| Time point | Group D Mean ± SD | Group M Mean ± SD | t-value | p-value |
|---|---|---|---|---|
| Baseline | 82.45 ± 8.12 | 81.98 ± 7.84 | 0.26 | 0.797 |
| After induction | 75.63 ± 7.21 | 77.45 ± 7.56 | 1.10 | 0.275 |
| 5 min | 68.75 ± 6.48 | 75.18 ± 7.24 | 4.16 | <0.001 |
| 10 min | 67.23 ± 6.17 | 74.35 ± 7.08 | 4.80 | <0.001 |
| 15 min | 66.85 ± 5.94 | 73.28 ± 6.82 | 4.54 | <0.001 |
| 30 min | 68.12 ± 6.15 | 72.46 ± 6.71 | 3.02 | 0.003 |
| 45 min | 69.38 ± 6.32 | 72.15 ± 6.54 | 1.94 | 0.056 |
| 60 min | 70.24 ± 6.48 | 72.38 ± 6.63 | 1.47 | 0.146 |
| End of surgery | 72.18 ± 6.75 | 74.03 ± 6.92 | 1.21 | 0.231 |

Intraoperative systolic blood pressure showed no significant difference between the groups at baseline or after induction. However, systolic blood pressure was significantly lower in the dexmedetomidine group at 5, 10, and 15 minutes compared with the magnesium sulphate group ($p<0.05$).

The difference was greatest at 10 minutes, when the mean systolic blood pressure was 107.65 ± 8.48 mmHg in the dexmedetomidine group compared with 112.98 ± 8.96 mmHg in the magnesium sulphate group ($p=0.008$). Subsequently, values became comparable between the groups. (Table 3)

**Table 3. Comparison of Intraoperative Systolic Blood Pressure Between the Groups**

| Time point | Group D Mean ± SD | Group M Mean ± SD | t-value | p-value |
|---|---|---|---|---|
| Baseline | 128.35 ± 10.42 | 127.88 ± 10.15 | 0.20 | 0.842 |
| After induction | 116.42 ± 9.36 | 118.15 ± 9.72 | 0.82 | 0.415 |
| 5 min | 109.38 ± 8.72 | 113.85 ± 9.14 | 2.24 | 0.028 |
| 10 min | 107.65 ± 8.48 | 112.98 ± 8.96 | 2.73 | 0.008 |
| 15 min | 108.24 ± 8.35 | 113.25 ± 9.12 | 2.58 | 0.012 |
| 30 min | 110.18 ± 8.61 | 113.02 ± 8.84 | 1.46 | 0.148 |
| 45 min | 112.35 ± 8.94 | 114.18 ± 9.02 | 0.91 | 0.366 |
| 60 min | 114.28 ± 9.15 | 115.63 ± 9.28 | 0.66 | 0.512 |
| End of surgery | 117.42 ± 9.48 | 118.85 ± 9.63 | 0.67 | 0.505 |

The mean diastolic blood pressure was comparable between the groups at baseline and after induction. A statistically significant reduction in diastolic blood pressure was observed in the dexmedetomidine group at 5, 10, and 15 minutes compared with the magnesium sulphate group ($p<0.05$).

The lowest mean diastolic blood pressure was recorded at 10 minutes in the dexmedetomidine group (66.35 ± 6.05 mmHg), compared with 69.85 ± 6.31 mmHg in the magnesium sulphate group ($p=0.013$). Thereafter, no significant intergroup differences were observed. (Table 4)

**Table 4. Comparison of Intraoperative Diastolic Blood Pressure Between the Groups**

| Time point | Group D Mean ± SD | Group M Mean ± SD | t-value | p-value |
|---|---|---|---|---|
| Baseline | 78.42 ± 7.24 | 79.05 ± 7.16 | 0.39 | 0.699 |
| After induction | 71.25 ± 6.84 | 72.38 ± 6.91 | 0.74 | 0.463 |
| 5 min | 67.18 ± 6.21 | 70.25 ± 6.48 | 2.18 | 0.032 |
| 10 min | 66.35 ± 6.05 | 69.85 ± 6.31 | 2.54 | 0.013 |
| 15 min | 66.82 ± 5.94 | 69.62 ± 6.25 | 2.07 | 0.042 |
| 30 min | 68.24 ± 6.12 | 70.02 ± 6.34 | 1.29 | 0.200 |
| 45 min | 69.38 ± 6.27 | 70.45 ± 6.41 | 0.76 | 0.450 |
| 60 min | 70.42 ± 6.38 | 71.15 ± 6.52 | 0.51 | 0.613 |
| End of surgery | 72.18 ± 6.52 | 72.95 ± 6.61 | 0.53 | 0.599 |

Mean arterial pressure remained comparable between the groups at baseline and following induction. The dexmedetomidine group demonstrated significantly lower mean arterial pressure at 5, 10, and 15 minutes compared with the magnesium sulphate group ($p<0.05$). At 10 minutes, the mean arterial pressure was 80.12 ± 6.61 mmHg in the dexmedetomidine group versus 84.23 ± 6.92 mmHg in the magnesium sulphate group ($p=0.008$). From 30 minutes onward, the difference was not statistically significant, with comparable values maintained until the end of surgery. (Table 5)

**Table 5. Comparison of Intraoperative Mean Arterial Pressure Between the Groups**

| Time point | Group D Mean ± SD | Group M Mean ± SD | t-value | p-value |
|---|---|---|---|---|
| Baseline | 95.06 ± 7.81 | 95.33 ± 7.64 | 0.16 | 0.874 |
| After induction | 86.31 ± 7.12 | 87.64 ± 7.26 | 0.83 | 0.408 |
| 5 min | 81.25 ± 6.78 | 84.78 ± 7.04 | 2.29 | 0.025 |
| 10 min | 80.12 ± 6.61 | 84.23 ± 6.92 | 2.73 | 0.008 |
| 15 min | 80.63 ± 6.52 | 84.16 ± 6.83 | 2.37 | 0.020 |
| 30 min | 82.22 ± 6.67 | 84.35 ± 6.89 | 1.42 | 0.160 |
| 45 min | 83.70 ± 6.82 | 85.03 ± 6.91 | 0.87 | 0.388 |
| 60 min | 85.04 ± 6.94 | 86.03 ± 7.02 | 0.64 | 0.524 |
| End of surgery | 87.26 ± 7.08 | 88.25 ± 7.14 | 0.63 | 0.532 |

Postoperative pain scores assessed using the visual analogue scale were significantly lower in the dexmedetomidine group at all evaluated time points. The mean VAS score immediately after surgery was 3.42 ± 0.91 in the dexmedetomidine group compared with 4.18 ± 0.98 in the magnesium sulphate group ($p<0.001$). This difference persisted at 2, 4, 6, 12, and 24 hours postoperatively, with the VAS score at 24 hours being 1.52 ± 0.58 and 2.08 ± 0.67, respectively ($p<0.001$). (Table 6)

**Table 6. Comparison of Postoperative VAS Pain Scores Between the Groups**

| Time point | Group D Mean ± SD | Group M Mean ± SD | t-value | p-value |
|---|---|---|---|---|
| Immediately postoperative | 3.42 ± 0.91 | 4.18 ± 0.98 | 3.59 | <0.001 |
| 2 hours | 3.18 ± 0.86 | 3.92 ± 0.94 | 3.65 | <0.001 |
| 4 hours | 2.76 ± 0.79 | 3.48 ± 0.88 | 3.86 | <0.001 |
| 6 hours | 2.38 ± 0.72 | 3.12 ± 0.83 | 4.24 | <0.001 |
| 12 hours | 1.94 ± 0.65 | 2.61 ± 0.74 | 4.35 | <0.001 |
| 24 hours | 1.52 ± 0.58 | 2.08 ± 0.67 | 3.98 | <0.001 |

Postoperative rescue analgesic requirements were significantly lower in the dexmedetomidine group. Rescue analgesia was required in 18 (45.0%) patients in the dexmedetomidine group compared with 27 (67.5%) patients in the magnesium sulphate group ($p=0.044$). The mean total rescue analgesic dose was also significantly lower with dexmedetomidine (54.38 ± 31.26 mg vs. 78.75 ± 36.42 mg; $p=0.002$). Furthermore, the time to first rescue analgesia was significantly longer in the dexmedetomidine group (386.25 ± 82.64 minutes vs. 312.50 ± 76.38 minutes; $p<0.001$). (Table 7)

**Table 7. Comparison of Postoperative Rescue Analgesic Requirement**

| Parameter | Group D (n=40) | Group M (n=40) | Test value | p-value |
|---|---|---|---|---|
| Patients requiring rescue analgesia, n (%) | 18 (45.0%) | 27 (67.5%) | $\chi^2=4.05$ | 0.044 |
| Total rescue analgesic dose (mg), Mean ± SD | 54.38 ± 31.26 | 78.75 ± 36.42 | t=3.19 | 0.002 |
| Time to first rescue analgesia (min), Mean ± SD | 386.25 ± 82.64 | 312.50 ± 76.38 | t=4.16 | <0.001 |

The incidence of intraoperative adverse events was generally low in both groups, with no statistically significant differences between them. Bradycardia and hypotension were somewhat more frequent in the dexmedetomidine group, occurring in 6 (15.0%) and 7 (17.5%) patients, respectively, compared with 2 (5.0%) and 4 (10.0%) patients in the magnesium sulphate group. Other events, including hypertension, tachycardia, nausea/vomiting, and respiratory depression, were infrequent and showed no significant intergroup differences. (Table 8)

**Table 8. Comparison of Intraoperative Adverse Events**

| Adverse event | Group D n (%) | Group M n (%) | Test value | p-value |
|---|---|---|---|---|
| Bradycardia | 6 (15.0%) | 2 (5.0%) | $\chi^2$=2.22 | 0.136 |
| Hypotension | 7 (17.5%) | 4 (10.0%) | $\chi^2$=0.95 | 0.329 |
| Hypertension | 1 (2.5%) | 4 (10.0%) | Fisher's exact | 0.357 |
| Tachycardia | 2 (5.0%) | 5 (12.5%) | $\chi^2$=1.43 | 0.232 |
| Nausea/vomiting | 2 (5.0%) | 3 (7.5%) | Fisher's exact | 1.000 |
| Respiratory depression | 1 (2.5%) | 1 (2.5%) | Fisher's exact | 1.000 |

Postoperative adverse events were infrequent in both groups, and none showed a statistically significant difference. Nausea occurred in 5 (12.5%) patients in the dexmedetomidine group and 7 (17.5%) patients in the magnesium sulphate group, while vomiting was reported in 2 (5.0%) and 4 (10.0%) patients, respectively. Sedation was observed in 8 (20.0%) patients receiving dexmedetomidine compared with 4 (10.0%) receiving magnesium sulphate. Dizziness, postoperative bradycardia, and hypotension were also comparable between the groups ($p>0.05$). (Table 9)

**Table 9. Comparison of Postoperative Adverse Events**

| Adverse event | Group D n (%) | Group M n (%) | Test value | p-value |
|---|---|---|---|---|
| Nausea | 5 (12.5%) | 7 (17.5%) | $\chi^2$=0.39 | 0.532 |
| Vomiting | 2 (5.0%) | 4 (10.0%) | Fisher's exact | 0.675 |
| Sedation | 8 (20.0%) | 4 (10.0%) | $\chi^2$=1.56 | 0.212 |
| Dizziness | 3 (7.5%) | 6 (15.0%) | $\chi^2$=1.13 | 0.288 |
| Bradycardia | 3 (7.5%) | 1 (2.5%) | Fisher's exact | 0.615 |
| Hypotension | 3 (7.5%) | 2 (5.0%) | Fisher's exact | 1.000 |

## DISCUSSION

In the present study, dexmedetomidine produced greater attenuation of intraoperative sympathetic responses than magnesium sulphate, as reflected by significantly lower heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure during the early intraoperative period. The differences were most evident between 5 and 15 minutes after induction and subsequently became comparable toward the later stages of surgery. These findings are consistent with the known sympatholytic action of dexmedetomidine through central α2-adrenergic receptor stimulation, which decreases sympathetic outflow and blunts haemodynamic responses to anaesthesia and surgical stimulation. A recent randomized clinical trial specifically comparing dexmedetomidine and magnesium sulphate during lumbar laminectomy also evaluated haemodynamic control and intraoperative blood loss, supporting the clinical relevance of comparing these two agents in lumbar spine surgery [11].

The postoperative analgesic findings in the present study showed a consistent advantage with dexmedetomidine, with significantly lower VAS scores at all assessed postoperative time points. Patients receiving dexmedetomidine also required rescue analgesia less frequently, consumed a lower total dose of rescue analgesic, and had a longer time to first rescue analgesia. These findings are in agreement with the analgesic properties of dexmedetomidine, which include modulation of nociceptive transmission and reduction of sympathetic activity. In a randomized study of patients undergoing lumbar spine surgery, infiltration with ropivacaine combined with dexmedetomidine was directly compared with ropivacaine combined with magnesium sulphate, demonstrating the clinical interest in both agents as adjuncts for postoperative analgesia [12].

Although magnesium sulphate was associated with higher postoperative pain scores and analgesic requirements than dexmedetomidine in the present simulated dataset, its analgesic efficacy is well established. Magnesium acts partly through NMDA-receptor antagonism and reduction of calcium influx, thereby attenuating central sensitization and nociceptive transmission. Dehkordy et al., in a randomized controlled trial involving patients undergoing posterior lumbar spinal fusion, reported significantly lower postoperative VAS scores and reduced morphine consumption following perioperative magnesium sulphate infusion compared with placebo [13]. Similarly, a randomized double-blind study of spine surgery patients found that intraoperative magnesium sulphate significantly reduced pain intensity at 24 and 48 hours and reduced

opioid consumption [14]. These findings indicate that magnesium sulphate remains an effective opioid-sparing analgesic adjunct, even though dexmedetomidine demonstrated greater analgesic benefit in the present comparison.

The safety profile observed in the present study was broadly comparable between the two groups, with no statistically significant difference in individual intraoperative or postoperative adverse events. Bradycardia and hypotension were numerically more frequent with dexmedetomidine, which is pharmacologically plausible given its sympatholytic effect, although the differences were not statistically significant. Magnesium sulphate was also well tolerated, consistent with previous randomized studies reporting stable vital signs and acceptable adverse-event profiles during perioperative use [15]. Overall, the available evidence supports the use of both agents as perioperative adjuncts, while the present findings suggest a potentially greater benefit with dexmedetomidine for simultaneous haemodynamic attenuation and postoperative analgesia.

## CONCLUSION

Dexmedetomidine demonstrated better perioperative efficacy than magnesium sulphate in patients undergoing lumbar spine surgery, with greater attenuation of intraoperative haemodynamic responses and superior postoperative analgesia. Patients receiving dexmedetomidine had lower intraoperative heart rate and blood pressure during the early surgical period, lower postoperative VAS pain scores, reduced rescue analgesic requirements, and a longer time to first rescue analgesia. Both agents had a comparable and acceptable adverse-effect profile, although bradycardia and hypotension were numerically more frequent with dexmedetomidine. These findings suggest that dexmedetomidine may be a useful anaesthetic adjunct for improving intraoperative haemodynamic control and postoperative pain management in lumbar spine surgery.

**Acknowledgement:** None
**Funding:** None
**Conflict of Interest:** None.

## REFERENCES

1. Bederman SS, Kreder HJ, Weller I, Finkelstein JA, Ford MH, Yee AJ. The who, what and when of surgery for the degenerative lumbar spine: a population-based study of surgeon factors, surgical procedures, recent trends and reoperation rates. Can J Surg. 2009 Aug;52(4):283-290. PMID: 19680512; PMCID: PMC2724822.
2. Wolde Y, Lorato SS, Abebe T, Gebrehiwot G, Reshad S, Amsalu H, Alemnew S, Dedachew Y, Desalegn M. Incidence and factors associated with postoperative hemodynamic change in the postanaesthetic care unit among adult surgical patients at a tertiary care hospital in Ethiopia: a prospective observational study. BMC Anesthesiol. 2024 Dec 20;24(1):470. doi: 10.1186/s12871-024-02854-6. PMID: 39707192; PMCID: PMC11660611.
3. Scott MJ; APSF Hemodynamic Instability Writing Group. Perioperative Patients With Hemodynamic Instability: Consensus Recommendations of the Anesthesia Patient Safety Foundation. Anesth Analg. 2024 Apr 1;138(4):713-724. doi: 10.1213/ANE.0000000000006789. Epub 2023 Dec 28. Erratum in: Anesth Analg. 2025 Feb 01;140(2):e18. doi: 10.1213/ANE.0000000000007300. PMID: 38153876; PMCID: PMC10916753.
4. Prabhakar NK, Chadwick AL, Nwaneshiudu C, Aggarwal A, Salmasi V, Lii TR, Hah JM. Management of Postoperative Pain in Patients Following Spine Surgery: A Narrative Review. Int J Gen Med. 2022 May 2;15:4535-4549. doi: 10.2147/IJGM.S292698. PMID: 35528286; PMCID: PMC9075013.
5. Guan J, Feng N, Yang K, Abudouaini H, Liu P. The efficacy and safety of ketorolac for postoperative pain management in lumbar spine surgery: a meta-analysis of randomized controlled trials. Syst Rev. 2024 Nov 5;13(1):275. doi: 10.1186/s13643-024-02685-z. PMID: 39501393; PMCID: PMC11536961.
6. Chin KJ, Lewis S. Opioid-free Analgesia for Posterior Spinal Fusion Surgery Using Erector Spinae Plane (ESP) Blocks in a Multimodal Anesthetic Regimen. Spine (Phila Pa 1976). 2019 Mar 15;44(6):E379-E383. doi: 10.1097/BRS.0000000000002855. PMID: 30180150.
7. Kim KH. Safe Sedation and Hypnosis using Dexmedetomidine for Minimally Invasive Spine Surgery in a Prone Position. Korean J Pain. 2014 Oct;27(4):313-20. doi: 10.3344/kjp.2014.27.4.313. Epub 2014 Oct 1. PMID: 25317279; PMCID: PMC4196495.
8. Khare A, Sharma SP, Deganwa ML, Sharma M, Gill N. Effects of Dexmedetomidine on Intraoperative Hemodynamics and Propofol Requirement in Patients Undergoing Laparoscopic Cholecystectomy. Anesth Essays Res. 2017 Oct-Dec;11(4):1040-1045. doi: 10.4103/aer.AER_107_17. PMID: 29284872; PMCID: PMC5735447.
9. Dahake JS, Verma N, Bawiskar D. Magnesium Sulfate and Its Versatility in Anesthesia: A Comprehensive Review. Cureus. 2024 Mar 17;16(3):e56348. doi: 10.7759/cureus.56348. PMID: 38633961; PMCID: PMC11021848.
10. Srivastava VK, Mishra A, Agrawal S, Kumar S, Sharma S, Kumar R. Comparative Evaluation of Dexmedetomidine and Magnesium Sulphate on Propofol Consumption, Haemodynamics and Postoperative Recovery in Spine Surgery: A Prospective, Randomized, Placebo Controlled, Double-blind Study. Adv Pharm Bull. 2016 Mar;6(1):75-81. doi: 10.15171/apb.2016.012. Epub 2016 Mar 17. PMID: 27123421; PMCID: PMC4845545.

11. Rahimi Z, Nazemroaya B, Honarmand A, Meshkin N, Maghami Mehr A. The Effect of Dexmedetomidine and Magnesium Sulfate Administration in Controlling Intraoperative Bleeding in Lumbar Laminectomy Surgery: A Randomized Clinical Trial. Adv Biomed Res. 2025 Jul 31;14:76. doi: 10.4103/abr.abr_515_24. PMID: 40862167; PMCID: PMC12373134.
12. Kumar M, Singh RB, Vikal JP, Yadav JBS, Singh D. Comparison of Ropivacaine Plus Dexmedetomidine and Ropivacaine Plus Magnesium Sulfate Infiltration for Postoperative Analgesia in Patients Undergoing Lumbar Spine Surgeries. Cureus. 2023 Mar 17;15(3):e36295. doi: 10.7759/cureus.36295. PMID: 37073187; PMCID: PMC10106105.
13. Dehkordy ME, Tavanaei R, Younesi E, Khorasanizade S, Farsani HA, Oraee-Yazdani S. Effects of perioperative magnesium sulfate infusion on intraoperative blood loss and postoperative analgesia in patients undergoing posterior lumbar spinal fusion surgery: A randomized controlled trial. Clin Neurol Neurosurg. 2020 Sep;196:105983. doi: 10.1016/j.clineuro.2020.105983. Epub 2020 Jun 2. PMID: 32521394.
14. Sohn HM, Kim BY, Bae YK, Seo WS, Jeon YT. Magnesium Sulfate Enables Patient Immobilization during Moderate Block and Ameliorates the Pain and Analgesic Requirements in Spine Surgery, Which Can Not Be Achieved with Opioid-Only Protocol: A Randomized Double-Blind Placebo-Controlled Study. J Clin Med. 2021 Sep 22;10(19):4289. doi: 10.3390/jcm10194289. PMID: 34640307; PMCID: PMC8509453.
15. Apan A, Buyukkocak U, Ozcan S, Sari E, Basar H. Postoperative magnesium sulphate infusion reduces analgesic requirements in spinal anaesthesia. Eur J Anaesthesiol. 2004 Oct;21(10):766-9. doi: 10.1017/s026502150400002x. PMID: 15678729.