ORIGINAL RESEARCH

Comparative Analysis of Standard versus High Dose Dexmedetomidine for Sedation in ICU Settings: A Study Conducted at a Tertiary Care Hospital of Central India

Sukrati Jain[1], Jambu Jain[2], Aditya Singhai[3], Sudeep Jain[4]

[1]MBBS MD (Anesthesiology), Government Officer PGMO, Chhatarpur, Madhya Pradesh, India
[2]Assistant Professor, Department of Pharmacology, L. N. Medical College & Research Centre, Bhopal, Madhya Pradesh, India
[3]PG Resident (I[st] Year), Department of Medicine, RKDF Medical College Hospital & Research Center, Bhopal, Madhya Pradesh, India
[4]PG Resident (I[st] Year), Department of Pharmacology, RKDF Medical College Hospital & Research Center, Bhopal, Madhya Pradesh, India.

Corresponding Author
Jambu Jain
Assistant Professor, Department of Pharmacology, L. N. Medical College & Research Centre, Bhopal, Madhya Pradesh, India
Email: jimmi07@gmail.com

Received: 12 March, 2024 Accepted: 26 April, 2024

ABSTRACT
Background: Dexmedetomidine is a valuable sedative choice in the ICU setting, demonstrating benefits such as reducing delirium incidence and duration, delaying delirium onset, and potentially decreasing the need for other medications. The study aimed to provide valuable insights into the potential effects of dexmedetomidine dosing on sedation quality and clinical outcomes in critically ill patients receiving mechanical ventilation in the ICU. **Materials and Methods:** The primary aim was to compare the percentage of time spent within the target sedation range (RASS score of -2 to 0) between standard-dose and high-dose dexmedetomidine groups. Additionally, the study examined secondary efficacy outcomes including lengths of hospital and ICU stay, duration of mechanical ventilation, and the requirement for adjunctive sedation. The safety outcomes encompassed monitoring for bradycardia, hypotension, and the use of vasopressor agents. **Results:** Patients of the high dose didn't show any significant difference in terms of occurrence of adverse events, hospital stay, and ICU stay. **Conclusion:** This study indicates that high doses of dexmedetomidine in the ICU did not show superior sedation efficacy and were associated with a higher need for additional sedation and prolonged mechanical ventilation.
Keywords: Dexmedetomidine, Anesthesia, Dose.

INTRODUCTION

Dexmedetomidine is a valuable sedative choice in the ICU setting, demonstrating benefits such as reducing delirium incidence and duration, delaying delirium onset, and potentially decreasing the need for other medications. These advantages can lead to outcomes like shorter ventilation time and improved patient comfort, particularly beneficial for elderly post-cardiac surgery patients. Additionally, dexmedetomidine may aid in promoting better sleep quality in the ICU environment.[1,2]

In anesthesia practice, dexmedetomidine is commonly used for procedural sedation, awake intubation, and as an adjunct during general anesthesia. It has been associated with decreased postoperative pain, reduced opioid usage, and lower rates of nausea.[3] While studies have supported its benefits in various settings, such as procedures under spinal anesthesia, there have been some conflicting findings, like the opioid-sparing effect in certain patient populations undergoing major spine surgery.[4,5]

Dexmedetomidine has also been explored for preventing emergence agitation, postoperative delirium, and cognitive dysfunction with varying degrees of success.[6] While it has shown promise in preventing emergence agitation in both children and adults, its effectiveness in preventing postoperative delirium after intraoperative infusion has not been

consistently demonstrated in trials. The study aimed to provide valuable insights into the potential effects of dexmedetomidine dosing on sedation quality and clinical outcomes in critically ill patients receiving mechanical ventilation in the ICU.

MATERIALS AND METHODS

The study focused on assessing the impact of dexmedetomidine dosing on sedation depth and various clinical outcomes in critically ill patients. Out of the patients who met the inclusion criteria, 60 were included in the study, with 40 in the standard-dose (SD) group and 20 in the high-dose (HD) group. The primary aim was to compare the percentage of time spent within the target sedation range (RASS score of -2 to 0) between standard-dose and high-dose dexmedetomidine groups. Additionally, the study examined secondary efficacy outcomes including lengths of hospital and ICU stay, duration of mechanical ventilation, and the requirement for adjunctive sedation. The safety outcomes encompassed monitoring for bradycardia, hypotension, and the use of vasopressor agents. The study design involved categorizing patients based on their received dexmedetomidine dose and included a post hoc analysis excluding patients with a history of alcohol and drug abuse. Data analysis was done using SSPS software.

RESULTS

Out of the patients who met the inclusion criteria, 60 were included in the study, with 40 in the standard-dose (SD) group and 20 in the high-dose (HD) group.Patients of the high dose didn't show any significant difference in terms of occurrence of adverse events, hospital stay and ICU stay.

Table 1: Dose distribution wise parameters among study subjects

Parameter	Standard dose(n=40)	High dose(n=20)
Highest dose(mcg/kg/h)	0.71	1.3
Median dose(mcg/kg/h)	0.40	0.63
Infusion duration (h)	43.7	121.0
Required additional sedation (%)	37	17
Time within goal RASS (%)	82.1	45.2
Time below goal RASS (%)	0	10
Time above goal RASS (%)	2.9	23.1

Table 2: Outcome wise distribution

Outcomes	Standard dose(n=40)	High dose(n=20)
ICU length of stay (days)	9	7
Hospital length of stay (days)	10	14
Hypotension (n)	5	2
Bradycardia (n)	10	4

DISCUSSION

In the intensive care unit (ICU), dexmedetomidine is commonly used for sedation in critically ill patients on mechanical ventilation. Studies have compared standard and high doses of dexmedetomidine to determine their impact on sedation depth, duration of mechanical ventilation, length of ICU and hospital stays, and the need for additional sedatives. Safety outcomes such as hypotension, bradycardia, and vasopressor use have also been evaluated. The optimal dosing of dexmedetomidine continues to be an area of interest, with ongoing research influencing clinical practice in ICU sedation management.[7- 10]In the present study, patients of the high dose didn't show any significant difference in terms of occurrence of adverse events, hospital stay, and ICU stay.Van Berkel Patel M, et al evaluated time spent within goal Richmond Agitation Sedation Scale (RASS) range with standard-dosing of dexmedetomidine ≤1 mcg/kg/hour (SD group) compared to high-dose >1 mcg/kg/hour (HD group). Secondary outcomes included days requiring mechanical ventilation, concomitant sedation, and incidence of hypotension or bradycardia. Methods: This retrospective chart review of adult ICU patients at a single academic medical center included patients who required at least 24 hours of mechanical ventilation and received dexmedetomidine monotherapy for at least 4 hours. Patients were excluded for intubations at an outside hospital, continuous neuromuscular blocking infusions, or Glasgow Coma Score ≤4. Results: A total of 144 patients met inclusion criteria (n = 121 SD group and n = 23 HD group). The SD group spent a greater time within goal RASS range compared to the HD group (84.5% [IQR 47–100] vs 45.5% [IQR 30.1–85.4], P = .013). The SD group also had shorter durations of both dexmedetomidine infusion and mechanical ventilation and required less concomitant sedation. There was no difference in hypotension or bradycardia.[11]Zarfoss EL et al compared safety and efficacy of dexmedetomidine at standard versus high doses in ECMO. A retrospective analysis of adult ECMO patients was performed. Patients were compared as receiving either standard-dose (≤1.5 µg/kg/h) or high-dose (>1.5 µg/kg/h) dexmedetomidine. Safety outcomes included new onset bradycardia or hypotension. Efficacy was compared by the addition of concomitant sedative and

analgesic agents.One hundred five patients were evaluated, with 20% of patients in the high-dose group. Comparing standard and high dosing, no significant differences were seen in primary safety outcomes including bradycardia (49% vs 38%, P = 0.46), hypotension (79% vs 71%, P = 0.56), or addition of vasopressors (75% vs 71%, P = 0.78). Need for concomitant analgesic agents and propofol was similar between groups.This represented the first evaluation of use of high-dose dexmedetomidine in ECMO.[12]

CONCLUSION

This study indicates that high doses of dexmedetomidine in the ICU did not show superior sedation efficacy and were associated with a higher need for additional sedation and prolonged mechanical ventilation.

REFERENCES

1. Djaiani G, Silverton N, Fedorko L, Carroll J, Styra R, Rao V, Katznelson R. Dexmedetomidine versus Propofol Sedation Reduces Delirium after Cardiac Surgery: A Randomized Controlled Trial. Anesthesiology. 2016 Feb;124(2):362-8.
2. Reade MC, Eastwood GM, Bellomo R, Bailey M, Bersten A, Cheung B et al. Australian and New Zealand Intensive Care Society Clinical Trials Group. Effect of Dexmedetomidine Added to Standard Care on Ventilator-Free Time in Patients with Agitated Delirium: A Randomized Clinical Trial. JAMA. 2016 Apr 12;315(14):1460-8.
3. Zhang DF, Su X, Meng ZT, Li HL, Wang DX, Xue-Ying Li, Maze M, Ma D. Impact of Dexmedetomidine on Long-term Outcomes After Noncardiac Surgery in Elderly: 3-Year Follow-up of a Randomized Controlled Trial. Ann Surg. 2019 Aug;270(2):356-363.
4. Alexopoulou C, Kondili E, Diamantaki E, Psarologakis C, Kokkini S, Bolaki M, Georgopoulos D. Effects of dexmedetomidine on sleep quality in critically ill patients: a pilot study. Anesthesiology. 2014 Oct;121(4):801-7.
5. Goucher Miranda H, Krystal AD, Fierro MA. Nocturnal Dexmedetomidine in Nonintubated, Critically Ill Patients: Sleep or Sedation? Anesthesiology. 2017 Aug;127(2):397-398.
6. Blaudszun G, Lysakowski C, Elia N, Tramèr MR. Effect of perioperative systemic α2 agonists on postoperative morphine consumption and pain intensity: systematic review and meta-analysis of randomized controlled trials. Anesthesiology. 2012 Jun;116(6):1312-22.
7. Riker RR, Shehabi Y, Bokesch PM, et al. Dexmedetomidine vs midazolam for sedation of critically ill patients: a randomized trial. JAMA. 2009;301(5):489-499.
8. Devlin JW, Skrobik Y, Gelinas C, et al. Clinical practice guidelines for the prevention and management of pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. Crit Care Med. 2018;46:e825-e873.
9. Gerlach AT, Dasta JF, Steinberg S, Martin LC, Cook CH. A new dosing protocol reduces dexmedetomidine-associated hypotension in critically ill surgical patients. J Crit Care. 2009; 24(4):568-574.
10. Rodriguez K, Anderson R, Keriazes G, Meyers B. A retrospective review of high versus standard dose dexmedetomidine for sedation in critically ill patients. J Intensive Crit Care. 2016;2(2):1-5.
11. Van Berkel Patel M, Bolton S, Hamilton C. Standard- versus High-Dose Dexmedetomidine for Sedation in the Intensive Care Unit. Hosp Pharm. 2022;57(2):281-286.
12. Zarfoss EL, Garavaglia J, Hayanga JWA, Kabulski G. Comparison of Standard-Dose Versus High-Dose Dexmedetomidine in Extracorporeal Membrane Oxygenation. Annals of Pharmacotherapy. 2023;57(2):121-126.